

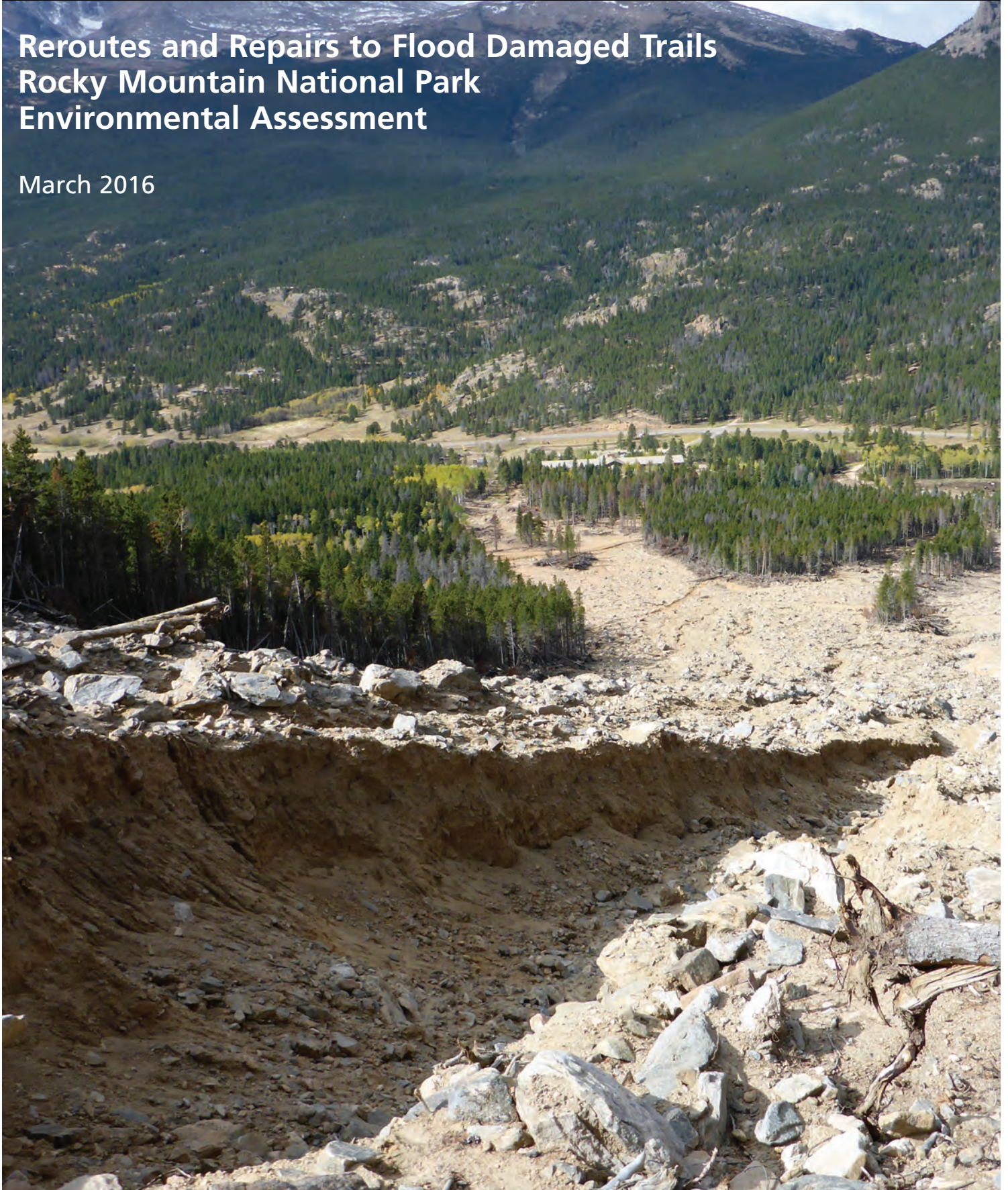
National Park Service
U.S. Department of the Interior

Rocky Mountain National Park
Colorado



Reroutes and Repairs to Flood Damaged Trails Rocky Mountain National Park Environmental Assessment

March 2016



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Rocky Mountain National Park
1000 Highway 36
Estes Park, CO 80517-8397

Reroutes and Repairs to Flood Damaged Trails Rocky Mountain National Park

Environmental Assessment

SUMMARY

Rocky Mountain National Park (park) is proposing to improve or reroute the following five trails that were heavily damaged or lost during the September 2013 flood: Lawn Lake, Ypsilon Lake, Alluvial Fan, Aspen Brook, and Twin Sisters. The purpose of this proposed project is to address damaged portions of these trails, while protecting natural and cultural resources and preserving wilderness character.

This Environmental Assessment (EA) evaluates two possible alternatives: establishing and maintaining a travel route and a no action alternative. Establishing and maintaining a travel route could include limited improvements, such as using existing social trails around damaged trail sections, stabilizing a damaged trail in place, or constructing a new rerouted trail around damaged trail segments. Trail segments abandoned due to reroutes or closure would be restored to natural conditions through active replanting or natural revegetation. Under the no action alternative, damaged trails would not be substantially repaired and the park would continue the present level of trail management and maintenance.

This EA 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 on the resources and values, and 3) identifies mitigation measures to lessen the degree or extent of these impacts.

This EA analyzes the following resource topics in detail because the resultant impacts would be noticeably measurable: soils; vegetation, including noxious weeds; wildlife including special status species; wilderness; and visitor use and experience. Other resource topics were dismissed because the proposed project would have less than minor effects. Public scoping was conducted to assist with the development of this document. During the 30-day scoping period, 14 written comments were received generally in support of the proposed project.

Compliance with section 106 of the National Historic Preservation Act (NHPA) is being conducted separately from the NEPA process.

Public Comment

If you wish to comment on the EA, you may post comments online at: <http://parkplanning.nps.gov/romo> or mail or hand deliver comments to: Superintendent, Rocky Mountain National Park, Estes Park, Colorado 80517. This EA will be on public review for 30 days.

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. Although you can ask us in your comment to withhold your personal identifying information from public review, we

cannot guarantee that we will be able to do so. Comments will not be accepted by fax, email, or in any other way than those specified above. Bulk comments in any format (hard copy or electronic) submitted on behalf of others will not be accepted.

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PURPOSE AND NEED

Rocky Mountain National Park (park) is proposing to improve or reroute the following five trails that were heavily damaged or lost during the September 2013 flood: Lawn Lake, Ypsilon Lake, Alluvial Fan, Aspen Brook, and Twin Sisters (Figure 1).

Rocky Mountain National Park was established in 1915. The purpose of the 265,761-acre park according to the *Foundation Document for Rocky Mountain National Park* (National Park Service (NPS) 2013a) “is to preserve the high-elevation ecosystems and wilderness character of the southern Rocky Mountains within its borders and to provide the freest recreational use of and access to the park’s scenic beauties, wildlife, natural features and processes, and cultural objects.” The NPS administers the historic, natural, and scenic values that contribute to the public’s enjoyment of the park.

The purpose of this Environmental Assessment (EA) is to examine the environmental effects associated with the alternative actions to reroute and repair damaged trails. A no action alternative that does not restore or reroute trails damaged by flooding is also evaluated. This EA was prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, regulations of the Council on Environmental Quality (CEQ) (40 Code of Federal Regulations (CFR) §1508.9), and NPS Director’s Order (DO)-12: *Conservation Planning, Environmental Impact Analysis, and Decision-Making*. The EA will determine whether significant impacts would occur as a result of the proposed action and if an environmental impact statement or finding of no significant impact would be required.

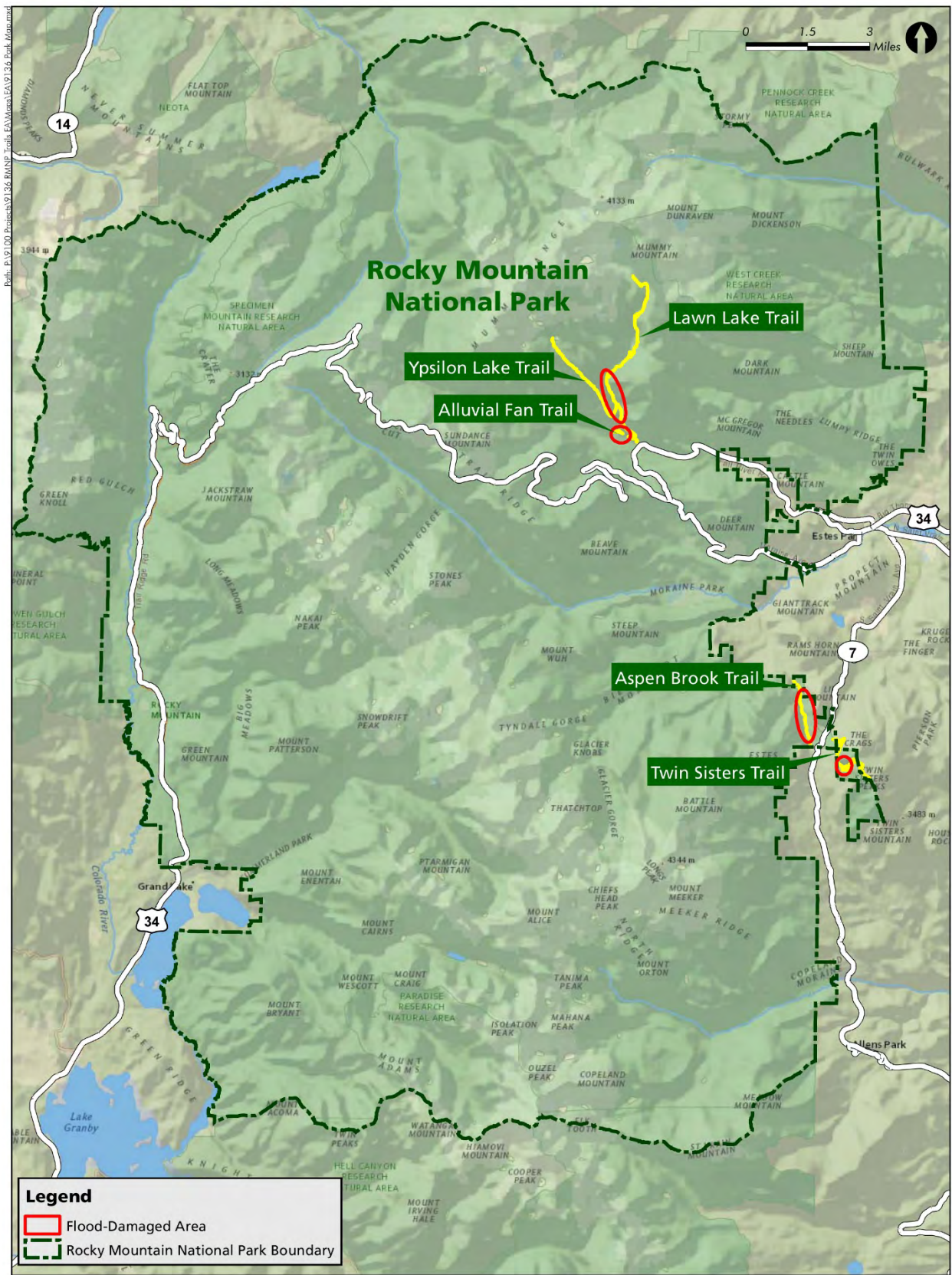
Compliance with section 106 of the National Historic Preservation Act (NHPA) is being conducted separately from the NEPA process through ongoing consultation with the Colorado State Historic Preservation Office (SHPO), park-affiliated American Indian tribes, and the Advisory Council on Historic Preservation (ACHP).

PURPOSE AND NEED

The purpose of this proposed project is to address damaged portions of the Lawn Lake, Ypsilon Lake, Alluvial Fan, Aspen Brook, and Twin Sisters Trails, while protecting natural and cultural resources and preserving wilderness character. These five trails were substantially damaged by heavy precipitation and the resulting flooding, landslides, and erosion that occurred in 2013. The park and nearby Colorado Front Range communities received up to 12 inches of rain from September 11 to 13, 2013, which caused catastrophic flooding across the northern Front Range and downstream areas in northeastern Colorado. Damage in the park included the loss of two road bridges, washed-out and damaged roads, damage to or complete loss of 16 trail bridges, and heavy damage to several trails, including the five trails included in this EA.

These five damaged trails currently remain open to the public. However portions of the trails and bridges have been washed out by flooding and landslides or are badly damaged. Social trails have developed in some locations around the damaged or missing trails, which can lead to soil erosion and vegetation damage over time. The damage to each trail is discussed in the *Alternatives* chapter.

Figure 1. Project Area.



Summary of Project Objectives

- Allow for nonmotorized recreational uses of trails damaged by flooding.
- Protect and preserve natural, cultural, and scenic values along all rerouted or repaired trails.
- Preserve wilderness character for the trails located in designated wilderness, supporting visitor access, safety, and resource protection.
- Efficiently implement construction and repair work while minimizing impacts on visitors.
- Use trail design and construction methods that minimize impacts on park resources in accordance with NPS regulations and policies and consistent with park regulations and policies.

PUBLIC SCOPING

Scoping is an early and open process to determine the breadth of issues and alternatives to be addressed in the EA. On November 4, 2014, the park initiated public scoping with a press release to provide the public and interested parties an opportunity to comment on the proposed project. A public scoping meeting was held on November 18, 2014 at the Estes Valley Library in Estes Park, Colorado to provide information to the public on the proposed project and solicit comments on the alternative actions. During the 30-day scoping period, which ended December 8, 2014, the park received 14 comments. The public expressed several comments including:

- Concern about the environmental impacts and safety of social trails developing around damaged trails.
- Support for restoration of damaged trails and restoring access.
- Consideration and support for connecting the Aspen Brook Trail to an existing trail on private land to the north. Also, concern about the park's consideration of the historic use of the Aspen Brook Trail and connections to private land.
- Suggestions on rerouting the Lawn Lake and Ypsilon Lake Trails to reduce erosion and protect aquatic resources.
- Support for constructing a new defined Alluvial Fan Trail, with consideration for possible future damage from flooding.
- Support for designing trails for long-term sustainability and resource protection.
- Suggestion for routing trails near scenic features or with scenic views.
- Consider community impact and input on trails work, along with historical interest and environmental factors.

Public scoping comments were considered in the choice of impact topics and the development and evaluation of alternatives discussed in this EA.

IMPACT TOPICS RETAINED FOR FURTHER ANALYSIS

Based on issues identified by the park's interdisciplinary team and by the public during the scoping process, the following impact topics were identified for further detailed analysis in this EA:

- Soils
- Vegetation, including Noxious Weeds
- Wildlife, including Special Status Species
- Wilderness
- Visitor Use and Experience

IMPACT TOPICS DISMISSED FROM FURTHER ANALYSIS

The NPS dismissed impact topics from further analysis in this EA for those resources where there would be no effects or the effects would be slight. Prime farmlands, wild and scenic rivers, lightscape, archeology and historic structures, museum collections, cultural landscapes, and ethnographic resources (based on government-to-government tribal consultation that was conducted on June 2, 2015) were dismissed because there would be no effects from the alternative actions. No Indian trust resources are in the park; therefore, Indian trust resources also was dismissed as an impact topic in this EA.

Geology, water quality, floodplains, wetlands, special status plant species, soundscapes, socioeconomics, environmental justice, archeology and historic structures, air quality, and climate change were dismissed because effects would be minimal and primarily temporary. Table 1 briefly discusses those impact topics with minor effects that were dismissed from further analysis along with a brief explanation of the reasons for dismissal.

Table 1. Impact Topics Dismissed from Further Analysis.

Topic	Reason Dismissed
Geology	Limited rock blasting associated with construction of some of the new trail segments would have a localized minor impact on geology. However this would not create a long-term adverse impact on geology and this topic was dismissed.
Water Quality	Trail improvement or rerouting would result in ground disturbances and excavation that removes vegetation and litter that protect the soil surface. Exposed soil could increase the potential for erosion and sedimentation of nearby water sources. However, most of the work would be done by hand and erosion-control best management practices (BMPs) would be implemented during trail work to capture sediment and minimize these impacts. Once trail work has been completed and permanent erosion and drainage control structures are installed, the potential for water quality impacts would diminish and are expected to be negligible. Restoration and revegetation of damaged or abandoned trail sections would have a long-term minor benefit to water quality by stabilizing soils and providing vegetation cover, which would reduce concentrated runoff. For these reasons, there would be no long-term adverse impacts on water quality and this topic was dismissed. Bridges would be installed in a manner to span wetlands and waters of the US, thus water quality would not be impacted.
Floodplains	The Alluvial Fan Trail, where the trail crosses the Roaring River, is the only trail in the project area located within a Federal Emergency Management Agency mapped floodplain. In addition, the proposed bridge replacement on the Ypsilon Lake Trail also would cross the Roaring River upstream from the Alluvial Fan Trail. Construction of a new Alluvial Fan Trail and bridge would not impede flow or adversely impact floodplain functions or increase the risk of flooding. A new timber bridge on the Alluvial Fan Trail and the Ypsilon Lake Trail would be designed to break away during flood events so as not to catch debris or increase the potential for flood damage. Because future flooding along the Roaring River is likely, no structures would be installed that would adversely impact the floodplain. Rerouting the Aspen Brook Trail would require construction of a bridge across the drainage. This structure would be designed to not impede flows or impact floodplain functions. Because trail work and bridges would be constructed and installed in such a manner to maintain floodplain functions, floodplains were dismissed as an impact topic. The proposed work in floodplains are considered an "excepted action" according to the NPS <i>Procedural Manual 77-2 Floodplain Management</i> because there is no overnight occupation and foot trails would have minimal impacts on floodplain values. Therefore, a Floodplain Statement of Findings is not needed.
Wetlands	Trail locations were chosen to avoid impacts to wetlands. Bridges would be installed in a manner to span wetlands and waters of the US. For these reasons, wetlands were dismissed as an impact topic. Trails and bridges that span waters of the US and wetlands are excepted from preparing a Wetland Statement of Findings per NPS DO 77-1: Wetland Protection.

Topic	Reason Dismissed
Special Status Plant Species	Plant special status species are plants that have been identified as vulnerable, imperiled, or critically imperiled in the state by the Colorado Natural Heritage Program. Fifty-five plant special status species have potential habitat in the park, including two that have also been listed as threatened under the Endangered Species Act (ESA): Colorado butterfly plant (<i>Gaura neomexicana</i> ssp. <i>coloradensis</i>) and Ute ladies'-tresses (<i>Spiranthes diluvialis</i>). Neither of these two species, nor their critical habitat, is in the project area and neither would be directly or indirectly impacted by the project. In a letter dated September 8, 2015, the NPS relayed this determination of no effect to the U.S. Fish and Wildlife Service (USFWS). The USFWS replied to the NPS on October 9, 2015. Since the two federally threatened plant species do not occur in the project area, they were not mentioned in the response letter. Surveys for plant special status species for each potential reroute area were conducted in 2014 (NPS 2014a) and 2015 (ERO 2015a). None of the alternatives is expected to result in impacts on plant special status species because none was identified in surveys of the project area (NPS 2014a and ERO 2015a). If plant special status species are encountered during construction of new trails, the NPS would make efforts to avoid the plants or they would be relocated as feasible. The Impacts on plant special status species are therefore dismissed from further analysis.
Soundscapes	Noise levels would temporarily increase for four to five months at a time over a one- to three-year period depending on the trail section during trail repairs and construction. Because most trail work in wilderness would be conducted with hand tools, noise levels would be low. Exceptions include possible rock blasting operations, use of helicopters for material delivery, and other mechanized use, including chainsaw use. Use of construction equipment on the Alluvial Fan Trail outside of designated wilderness would introduce noise levels above background conditions for four to five months at a time over two to three years. There would be no long-term changes to the soundscape following completion of trail work, thus this topic was dismissed. Impacts on the wilderness soundscape from trail construction are discussed in the <i>Wilderness</i> section.
Socioeconomics	Implementation of trail reroutes and repairs would result in construction-related expenditures for labor, supplies, equipment, and material. Construction spending would have a minor beneficial effect on the regional economy during the one to three years of construction depending on the trail segment. Repairing trails to support equestrian use on the Aspen Brook and Twin Sisters Trails would benefit commercial equestrian operations. Extension of the Aspen Brook Trail with connections outside of the park would also enhance commercial equestrian operations. Construction-related spending would have a minor effect on the local and regional economy. Native materials would be used for most trail work and park staff may do the majority of the work. Repair and improvement of trails would continue to support visitor and equestrian use, much as it has in the past. Because socioeconomic effects would have a minor effect on the local and regional economy, this topic was dismissed.
Environmental Justice	Estes Park and other communities near the park contain both minority and low-income populations; however, environmental justice was dismissed as an impact topic because the alternative actions would not result in any identifiable adverse human health effects and would not disproportionately affect any minority or low-income population or community. Thus, this topic was dismissed.
Archeological Resources and Historic Properties	Several cultural resource surveys have been conducted in the park and within the project area (Brunswick 2005; Butler 2005, ERO 2015b) and a multiple property documentation for the trail system was completed in 2006 (Standish 2006a, 2006b). Based on the results of this work, it was determined that trail improvements and reroutes would avoid or otherwise not impact these resources, so this topic was dismissed. Should construction unearth previously undiscovered cultural resources, work would be stopped in the area of any discovery and the NPS archeologist would consult with the Colorado State Historic Preservation Office and the Advisory Council on Historic Preservation, as necessary, according to 36 CFR 800.13, <i>Post Review Discoveries</i>. In the unlikely event that human remains are discovered during construction, provisions outlined in the Native American Graves Protection and Repatriation Act (1990) would be followed.

Topic	Reason Dismissed
Air Quality	Trail repairs and construction would be done primarily with hand tools with minimal use of machinery or equipment. Possible emissions may include vehicles or helicopters used to transport materials to the trailhead or construction site, rock blasting, use of chainsaws for vegetation clearing, and use of earthmoving equipment for work on the Alluvial Fan Trail, which is located outside of designated wilderness. Dust and vehicle emissions from trail work would be localized within approximately 100 feet of the project site for 15 to 30 minutes. Vehicle emissions would dissipate quickly and dust-control BMPs would reduce the potential for fugitive dust. There would be no long-term impacts on air quality or impacts on the park's Class I airshed designation and, thus, this topic was dismissed.
Climate Change	Vehicle or equipment emissions from construction activities would contribute slightly to increased greenhouse gas (GHG) emissions, but such emissions would be for perhaps 15 minutes at a time for use of generators, chainsaws, and heavy equipment. This use would end with the cessation of construction. Any effects of construction-related GHG emissions on climate change would not be discernible at a regional scale as it is not possible to meaningfully link the GHG emissions of such individual project actions to quantitative effects on regional or global climatic patterns.

ALTERNATIVES

INTRODUCTION

A range of alternatives was considered during the NEPA process to identify different actions for meeting the project purpose and need. This chapter describes a no action alternative and the park's preferred alternative for treatment of flood-damaged trails.

Included in this chapter are other alternatives that were considered, but dismissed from detailed analysis. Also included in this chapter is a summary comparison of the alternative actions and environmental effects of each of the alternatives.

LAWN LAKE TRAIL

This 6.2-mile (one-way) hike to Lawn Lake has an elevation gain of 2,249 feet. Lawn Lake was the site of a dam failure in 1982 that caused extensive erosion and scouring of the Roaring River channel that destroyed a portion of the original trail. Following the dam failure, the dam was removed and the trail was rebuilt. The park maintains a backcountry patrol cabin at Lawn Lake. Flood flow from 2013 storms resulted in significant flooding along the Roaring River that caused the steep riverbank to collapse and take part of the trail with it. Social trails formed by hikers bypassing missing or damaged portions of the trail have developed adjacent to the steep unstable riverbank along four sections of the trail.

Alternative A – No Action

Informal social routes around the four damaged or missing sections of the trail would receive minimal trail maintenance, such as digging dip drains to shed water from the trail and brushing out the trail corridor to provide clearance for hikers. Initially there would be no constructed structures and minimal drainage swales would be installed to prevent erosion. Where trail braiding is occurring, some restoration would take place such as raking in duff and placing branches and trees across the paths that are redundant. Only pedestrian use would be allowed; other modes of transportation, including equestrian use, would not be permitted.

There would be no attempt to implement NPS trail sustainability concepts (see section on *Trail Sustainability* for information on this topic), and only minimal actions would be taken to prevent resource damage.

Alternative B – Establish and Maintain a Travel Route (NPS Preferred Alternative)

Under this alternative, park staff would address the informal social routes around the four damaged or missing sections either by rerouting these trails or applying limited improvements (Figure 2). All four trail sections would be open to pedestrian and equestrian use and maintained similarly to other trail segments; no other modes of transportation would be permitted. Section-by-section details are provided below.

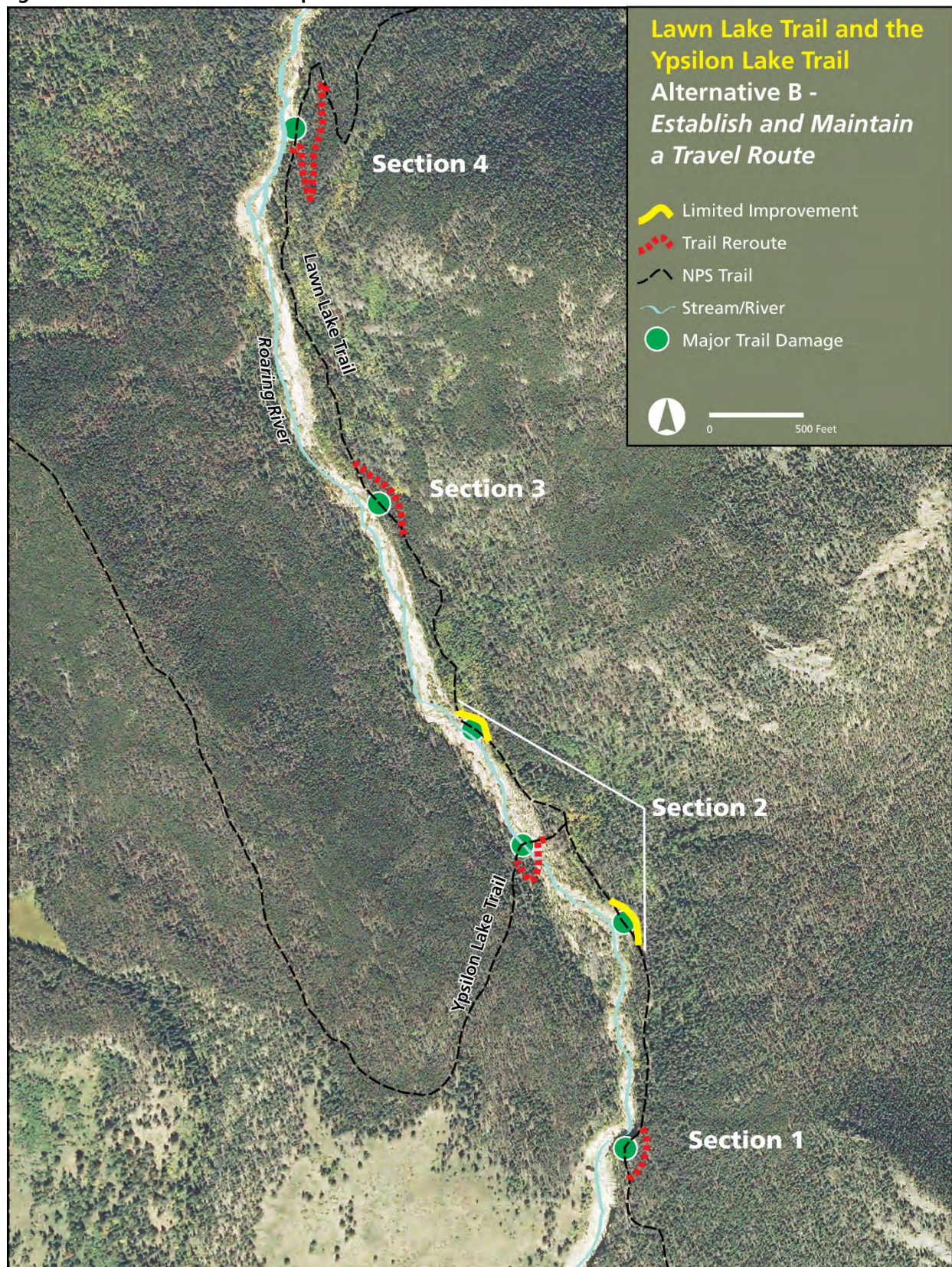
Section 1 (Reroute) – A new, approximately 280-foot trail section would be constructed east of the original trail away from the steep riverbank and on more favorable cross slopes. NPS trail sustainability concepts would be fully implemented in the trail reroute design and construction (see section on *Trail Sustainability* for more information). Trail tread would be about 3 feet wide, with trail clearing limits 6 feet wide by 10 feet high. The abandoned section of the existing trail (about 290 feet) would be stabilized and revegetated.

Section 2 (Limited Improvements) – The approximately 220-foot and 175-foot informal trails that have developed following damage to two segments of the original route would be improved in-place, creating trail tread about 3 feet wide and trail clearing limits 6 feet wide by 10 feet high. Actions would be taken to reduce impacts on park resources from these informal trails developed by public use, but NPS trail sustainability concepts would not be fully implemented. Mitigating actions to slow down or reduce the impacts from informal social routes would be implemented. The remaining portions of the existing trail would be restored to natural conditions to the extent practicable.

Section 3 (Reroute) – A new, approximately 460-foot trail section would be constructed east of the original trail on more favorable cross slopes and away from the steep riverbank. NPS trail sustainability concepts would be fully implemented in the trail reroute design and construction. Trail tread would be about 3 feet wide, with trail clearing limits 6 feet wide by 10 feet high. The abandoned section of the existing trail (about 440 feet) would be stabilized and revegetated.

Section 4 (Reroute) – The park would construct a longer reroute away from the steep riverbank. About 950 feet of new trail would be constructed with connections to the existing trail before and after the damaged trail segment. NPS trail sustainability concepts would be fully implemented in the trail reroute design and construction. Trail tread would be about 3 feet wide, with trail clearing limits 6 feet wide by 10 feet high. The abandoned sections of the existing trail (about 575 feet) would be stabilized and revegetated.

Figure 2. Lawn Lake Trail and Ypsilon Lake Trail.



YPSILON LAKE TRAIL

The Ypsilon Lake Trail starts 1.4 miles up the Lawn Lake Trail (Figure 2) at an elevation of 9,200 feet. The Ypsilon Lake Trail branches to the west, crossing the Roaring River. The trail steadily climbs in a northwest direction up a large blunt ridge below Mount Chiquita and Ypsilon Mountain. The portion of the trail and bridge that crosses the Roaring River washed out during the flood. In addition, a ramped causeway along the western bank washed out. The Ypsilon Lake Trail is on the National Register of Historic Places (NRHP) for its association with the early resort industry and tourism in the Estes Park region.

Alternative A – No Action

The washed-out bridge across the Roaring River would not be replaced. Hikers would have to ford the stream or use logs that span the river. At high flows, the river may not be passable. The washed-out segments of the trail on the east and west sides of the river would not be replaced. Trail users would use informal routes on each side of the riverbank to reach undamaged trail sections.

There would be no attempt to implement NPS trail sustainability concepts (see section on *Trail Sustainability* for information on this topic), and only minimal actions would be taken to prevent resource damage. Informal social routes around damaged or missing portions of trail created by hikers would receive minimal trail maintenance, such as digging dip drains to shed water from the trail and brushing out the trail corridor to provide clearance for hikers. There would be no constructed structures and minimal drainage swales would be installed to prevent erosion. Where trail braiding is occurring, some restoration would take place such as raking in duff and placing branches and trees across the paths that are redundant. Only pedestrian use would be allowed; other modes of transportation, including equestrian use, would not be permitted.

Alternative B – Establish and Maintain a Travel Route (NPS Preferred Alternative)

A new timber foot traffic bridge 30 feet in length would be constructed about 30 feet south of the original bridge location from local materials. The previous bridge location is no longer suitable because of erosion of the riverbank. The footbridge would be a minimum of 12 inches wide and would include a handrail if the walking surface is 3 feet or more above the river, similar to the example in Figure 3. Relocation of the bridge downstream would better fit the current terrain and trail approaches.

About 350 feet of new trail approaches would be added to the new bridge on each side of the river. NPS trail sustainability concepts would be fully implemented in the trail reroute design and construction (see section on *Trail Sustainability* for more information). The trail tread would be about 3 feet wide, with trail clearing limits approximately 6 feet wide by 10 feet high. Abandoned trail sections would be restored to natural conditions to the extent possible. Pedestrian and equestrian use would be allowed and a horse stream crossing would be established; other modes of transportation would not be permitted.

Figure 3. Example of Bridge Design Proposed for Roaring River on Ypsilon Lake Trail.



ALLUVIAL FAN TRAIL

This 0.3-mile accessible asphalt trail runs between two parking lots located on the east and west sides of the Roaring River alluvial fan (Figure 4). The alluvial fan is the product of the Lawn Lake Dam failure in 1982 that deposited flood debris at the mouth of the Roaring River. Recent flooding washed out most of the trail including the bridge across the Roaring River. Asphalt trail remnants are cracked, heaved, or buried under sediment. The concrete foundation of the bridge still remains, but is buried under rock and sediment.

Alternative A – No Action

The park would allow continued informal access to the alluvial fan area. Remaining portions of the damaged asphalt trail and bridge would be removed for safety. Visitors would be allowed to hike through the alluvial fan from either the existing east or west parking area. Over time, defined trails may develop, but they would not be maintained. Pedestrian crossing of the river would require fording at low flow. The river may not be passable during high flows.

There would be no attempt to implement NPS trail sustainability concepts (see section on *Trail Sustainability* for information on this topic), and only minimal actions would be taken to prevent resource damage. Informal social routes around damaged or missing portions of trail created by hikers would receive minimal trail maintenance such as digging dip drains to shed water from the trail and brushing out the trail corridor to provide clearance for hikers. There would be no constructed structures and minimal drainage swales would be installed to prevent erosion. Where

trail braiding is occurring, some restoration would take place such as raking in duff and placing branches and trees across the paths that are redundant. Pedestrian use would be allowed; other modes of transportation, including equestrian use, would not be permitted.

Alternative B – Establish and Maintain a Travel Route (NPS Preferred Alternative)

Remnants of the old bridge would be removed and a new bridge constructed at a suitable location downstream, similar to the one shown below in Figure 5.

A new approximately 1,950-foot trail route through the alluvial fan would be constructed, connecting the east and west parking lots. Because the main portion of the Alluvial Fan Trail is a frontcountry trail, it would be constructed to Architectural Barriers Act (ABA) accessibility standards to allow use by all visitors. The trail surface would be constructed to ABA grade requirements using finely crushed granite installed at a minimum 2-inch depth. NPS trail sustainability concepts would be fully implemented in the trail design and construction (see section on *Trail Sustainability* for more information). The trail tread would be about 5 to 6 feet wide, with trail clearing limits approximately 8 feet wide by 8 feet high. Abandoned trail sections would be restored to natural conditions to the extent possible. ABA accessible use would be provided for. Equestrian use would not be permitted.

The accessible trail would include a spur trail that terminates at a new 200 square foot overlook providing a view of the Horseshoe Falls of Roaring River. About 150 feet of the 350-foot spur trail to the overlook, and the overlook itself, would be in designated wilderness. While the park is not required to meet accessibility standards for facilities within designated wilderness, the park is proposing to make the entire spur trail and overlook ABA accessible. Limited use of mechanized equipment in wilderness would be required to create a smooth surface that meets accessibility standards.

Figure 4. Alluvial Fan Trail

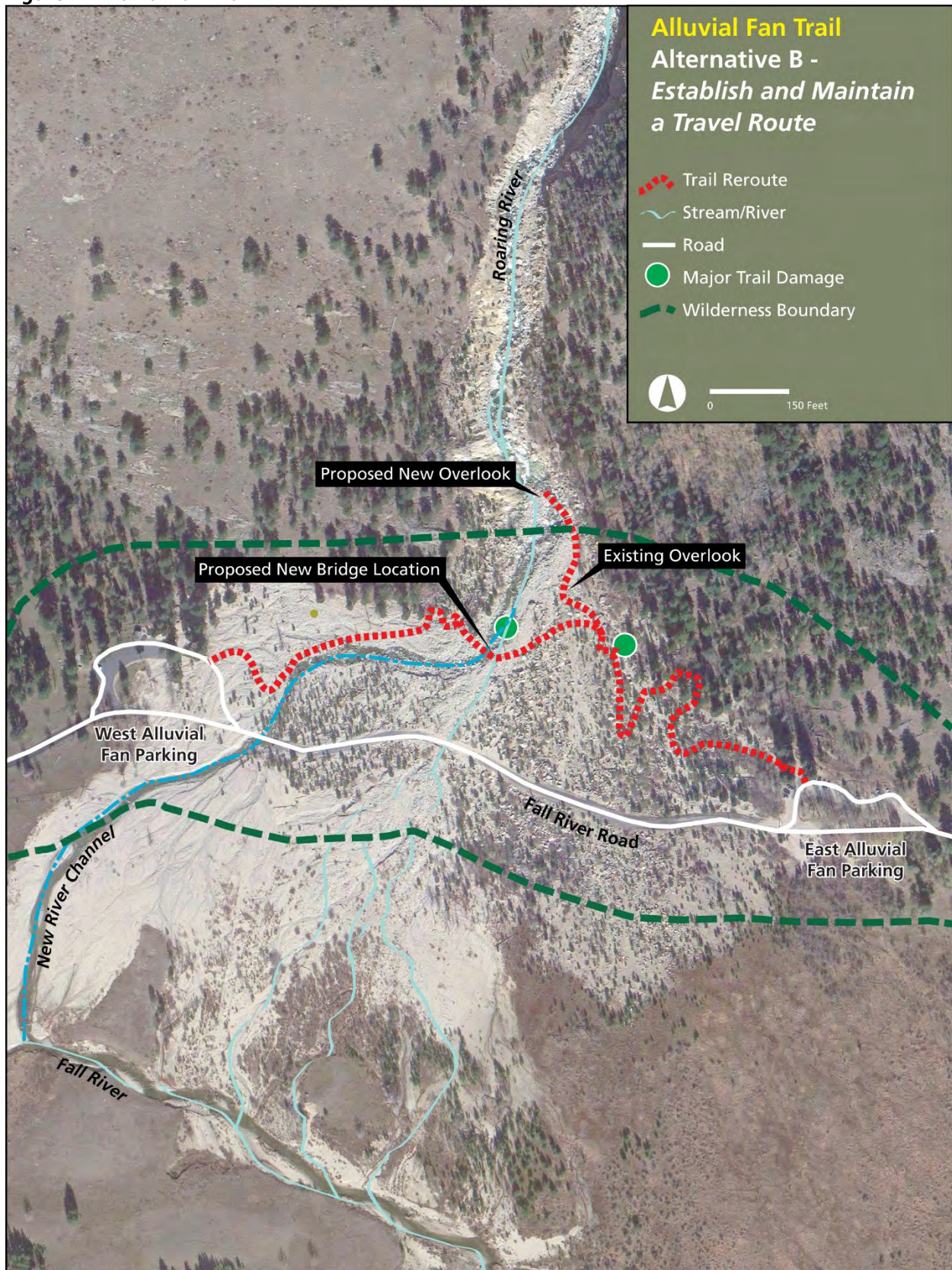


Figure 5. Example of Bridge Design Proposed for Roaring River Crossing on Alluvial Fan Trail and Aspen Brook Crossing on the Aspen Brook Trail Extension.



ASPEN BROOK TRAIL

The Aspen Brook Trail is accessed from the Lily Lake parking lot by hiking 0.6 mile on the Storm Pass Trail (Figure 6). The 1.8-mile Aspen Brook Trail continues north and descends along Aspen Brook to the park boundary near the historic Wigwam Teahouse. Currently, the trail ends at the park boundary as further travel across private property to the north is prohibited. This trail experienced significant erosion, gullies, and slope failure from heavy rains in 2013.

Alternative A – No Action

No new trails would be constructed and no improvements would be made to the existing damaged trail. The existing trail is passable in most locations, although it is deeply incised and eroded in some areas. Social trails are likely to develop around damaged sections as the trail erodes further. Pedestrian use would be allowed; equestrian use would not be permitted because damaged trail sections present safety concerns for horseback riding. Similarly, no other modes of transportation would be permitted.

There would be no attempt to implement NPS trail sustainability concepts (see section on *Trail Sustainability* for information on this topic), and only minimal actions would be taken to prevent resource damage. Informal social routes around damaged or missing portions of trail created by hikers would receive minimal trail maintenance such as digging dip drains to shed water from the

trail and brushing out the trail corridor to provide clearance for hikers or equestrians. There would be no constructed structures and minimal drainage swales would be installed to prevent erosion. Where trail braiding is occurring, some restoration would take place such as raking in duff and placing branches and trees across the paths that are redundant.

Alternative B – Establish and Maintain a Travel Route (NPS Preferred Alternative)

The Aspen Brook Trail currently ends at the park boundary near the Wigwam Teahouse. Under this alternative, a new, approximately 4,200-foot trail would extend off of the existing trail northwest to the park boundary. The trail would partially follow an existing social trail through private property where it would cross in and out of park lands and then continue through land owned by the YMCA of the Rockies and private property to Spur Highway 66 and an existing trailhead on Bureau of Reclamation property. NPS trail sustainability concepts would be fully implemented in the trail design and construction for portions of the trail on NPS land (see section on *Trail Sustainability* for more information). The trail tread would be about 3 feet wide, with trail clearing limits approximately 6 feet wide by 10 feet high.

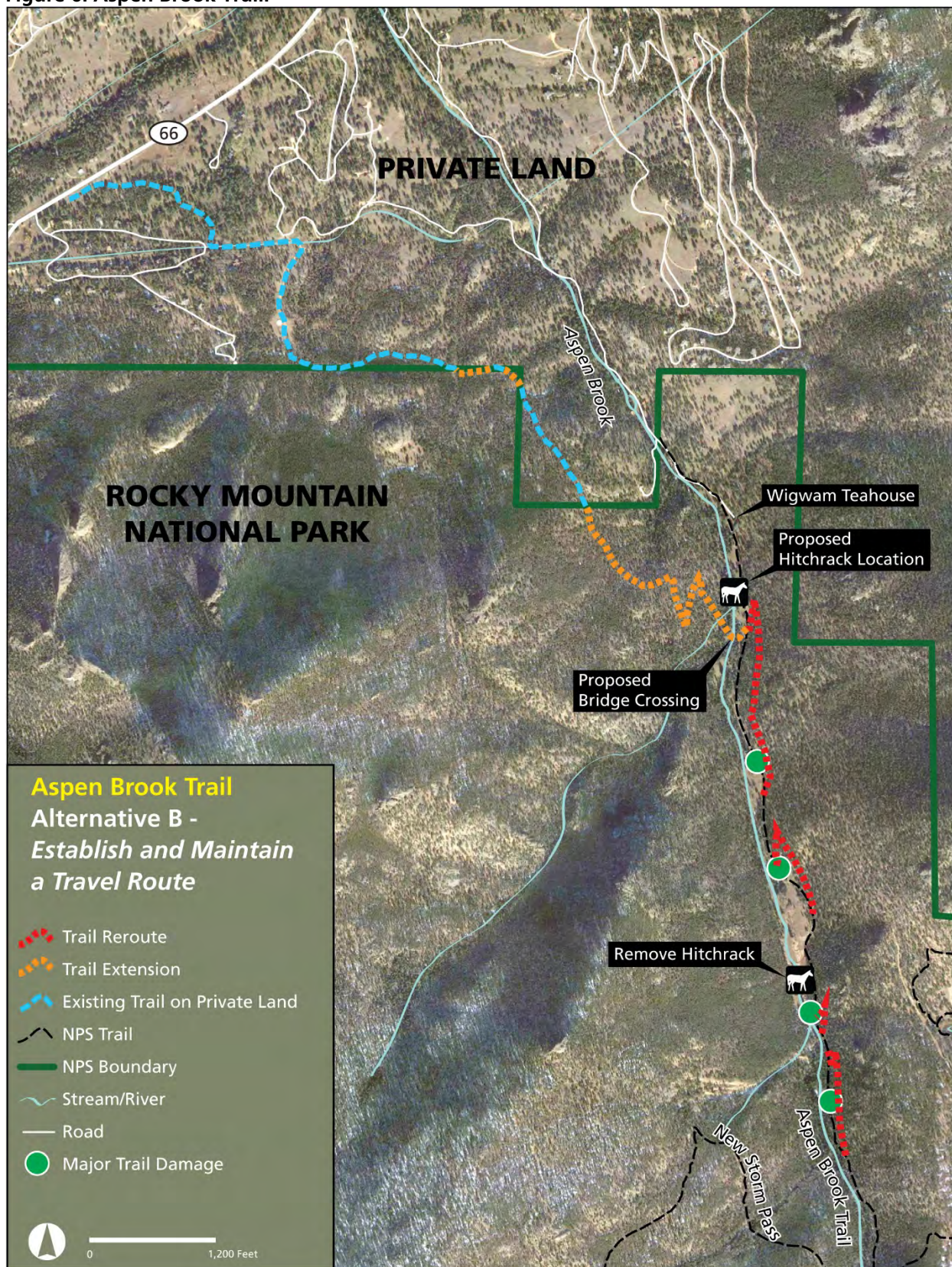
The existing hitchrack on the west side of Aspen Brook would be removed and a new hitchrack would be installed closer to the Wigwam Teahouse where the new trail extension intersects the existing trail. A log bridge with steel girder stringers would be used to cross Aspen Brook (Figure 6).

In addition to the new trail extension described above, up to four sections of the existing trail would be rerouted. These sections would be rerouted east and upslope of the existing trail, bypassing the most damaged trail sections. Rerouted sections range from about 430 feet to 2,200 feet in length and total about 5,160 feet. NPS trail sustainability concepts would be fully implemented in the trail reroute design and construction. The trail tread would be about 3 feet wide, with trail clearing limits approximately 6 feet wide by 10 feet high. Abandoned sections of the existing trail (about 3,360 feet) would be stabilized and revegetated. Pedestrian and equestrian use would be allowed. No other modes of transportation would be allowed.

Because establishing and maintaining a travel route is not necessary for administration of designated wilderness in the park and has been requested by outside entities, the NPS will not fully fund construction or ongoing maintenance of the new 4,200 foot trail extension. Construction and ongoing maintenance will require funding by others, recorded trail easements or rights-of-way across all private lands between Spur Highway 66 and the park boundary, and a written agreement between the NPS and all partners prior to implementation.

Adaptive Management – If funding, recorded easements or rights-of-way, and a written agreement to extend the Aspen Brook Trail do not occur within five years of the approval date of a FONSI, the trail extension will not be built, and informal trails in that area of the park will be obliterated, and the area will be restored to natural conditions to the extent practicable.

Figure 6. Aspen Brook Trail.



TWIN SISTERS TRAIL

The Twin Sisters Trail is a 7.4-mile (one-way) moderate to strenuous hike to Twin Sisters Peaks. The trailhead is about 6 miles south of Estes Park off Highway 7 (Figure 7). The trail climbs a west-facing slope on long, steep switchbacks with views to the west of Longs Peak, Mt. Meeker, Powell Peak, Taylor Peak, Lily Mountain and Estes Cone. The trail leads to a saddle, where it splits to the two summits. The western summit is the site of a former fire lookout tower. The park maintains a radio repeater in the saddle between the two summits. A massive landslide, as a result of heavy rains in 2013, removed five switchbacks and about 2,000 feet of trail on the lower portion of the trail. Hikers have created social trails on both sides of the landslide to get around the section of trail removed by the landslide. The trail is currently closed to equestrians because of the landslide and safety concerns.

Alternative A – No Action

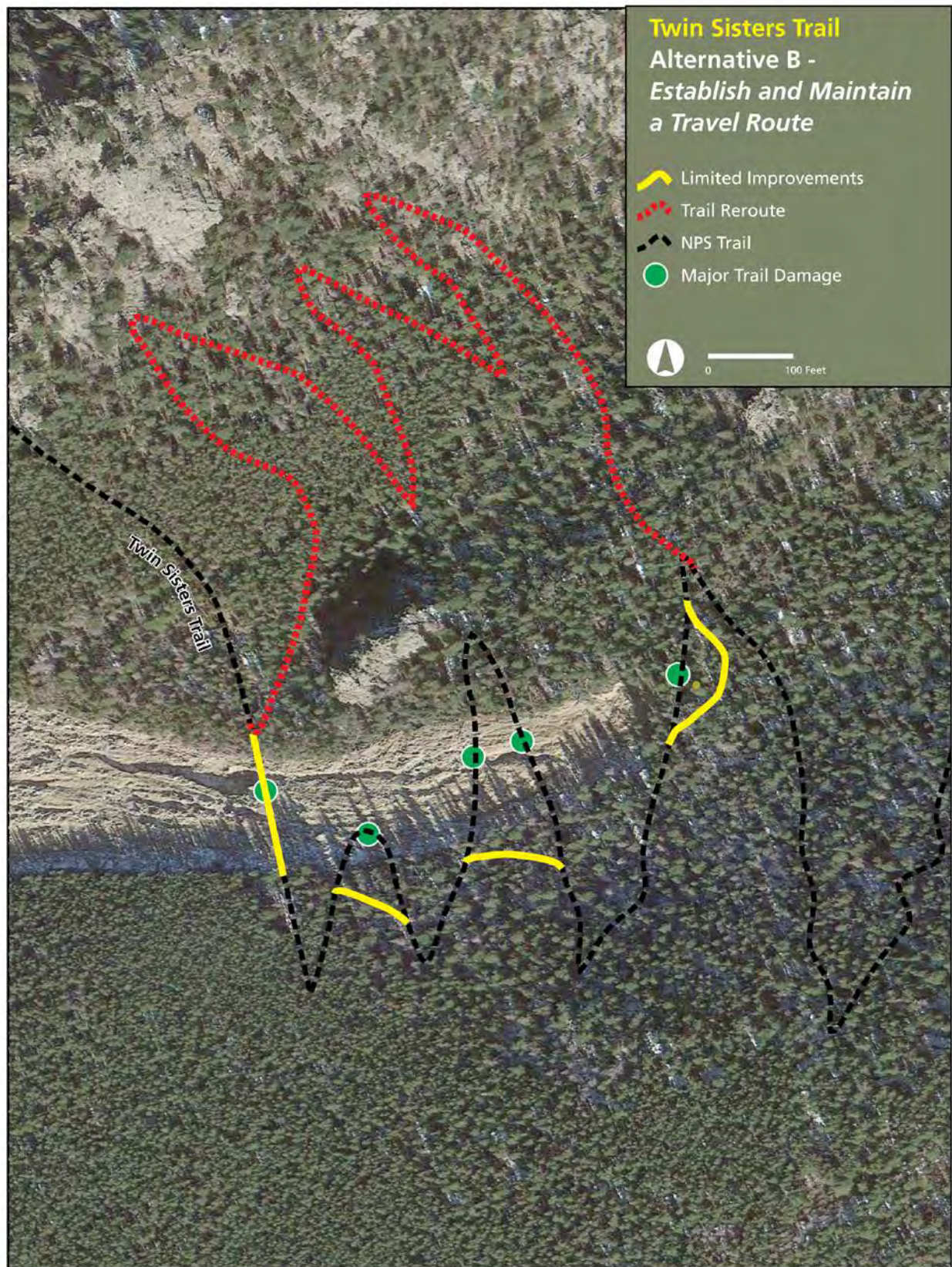
Hikers would continue to have access to the undamaged sections of trail and informal social trails that provide linkage around segments of the trail lost due to the landslide. The park would continue normal trail management practices on undamaged trail sections, but would only conduct minimal trail maintenance on social trails.

There would be no attempt to implement NPS trail sustainability concepts (see section on *Trail Sustainability* for information on this topic), and only minimal actions would be taken to prevent resource damage. Informal social routes around damaged or missing portions of trail created by hikers would receive minimal trail maintenance such as digging dip drains to shed water from the trail and brushing out the trail corridor to provide clearance for hikers or equestrians. There would be no constructed structures and minimal drainage swales would be installed to prevent erosion. Where trail braiding is occurring, some restoration would take place such as raking in duff and placing branches and trees across the paths that are redundant. Pedestrian use would be allowed; however, no other modes of transportation, including equestrian use, would be permitted.

Alternative B – Establish and Maintain a Travel Route (NPS Preferred Alternative)

Actions would be taken to reduce impacts on park resources on informal trails developed by public use, but NPS trail sustainability concepts would not be fully implemented. Social trails that have developed south of the landslide would be established and incorporated into the regular trail maintenance program with repairs and erosion-control measures implemented as necessary. In addition to erosion-control measures, mitigating actions to slow down or reduce the impacts from informal social routes would be implemented. Existing trail segments or informal routes that are redundant would be restored to natural conditions to the extent practicable. Drainage and trail clearing would occur on an annual basis. Erosion control structures and drainage would be constructed as needed. Trail width of the 7.4 mile (one-way) trail would be maintained at 2 to 3 feet with clearing limits of 4 feet by 7 feet. An assessment of informal trails once the improvements have been completed will document the current conditions of the trails to be retained and their associated impacts. The data from the study will be used to help inform the decision process for the adaptive management alternative.

Figure 7. Twin Sisters Trail.



Social trails that have developed south of the landslide would be established and managed as a Class 3 trail to the extent practical (for more information on trail classes, see “Construction Methods” below). Mitigating actions to reduce resource impacts from erosion and visitor use would be implemented on a limited basis based on maintenance resources available. Existing trail segments or informal routes that are redundant or obsolete would be restored to natural conditions. Pedestrian use would be allowed; however, no other modes of transportation, including equestrian use, would be permitted.

Adaptive Management – Upon completion of the trail repairs and installation of the erosion-control measures, the park will obtain baseline trail metrics for the repaired trails, such as the width of the trail tread, extent of current erosion, and current area of ground disturbance. The same trail metrics will be collected during routine trail maintenance going forward, and compared to the baseline data. If substantial change is evident at routine five-year maintenance intervals (e.g., the trail is substantially wider, erosion and ground disturbance are substantially greater), and cannot be repaired or stabilized with proven trail construction and maintenance techniques, the park may seek federal funding to construct a trail reroute. If federal funding is obtained, the reroute will be approximately 2,730 feet in length. The new trail alignment will not cross the landslide path and will be located north of the landslide on a stable side slope with multiple switchbacks connecting undamaged portions of the original Twin Sisters Trail. The new trail will be constructed according to park trail design standards. The trail tread will be about 3 feet wide, with trail clearing limits approximately 6 feet wide by 10 feet high. With this new trail section in place, equestrian use may be allowed on the Twin Sisters Trail. For commercial liveries, use of the Twin Sisters Trail will be governed by the Concessions Contracts in place at the time. Abandoned sections of the existing trail (about 2,200 feet) will be obliterated, stabilized, and revegetated.

ACTIONS COMMON TO THE PREFERRED ALTERNATIVE

Trail repairs, restoration of abandoned trail sections, and construction would be implemented to varying degrees under the preferred alternative. The park would evaluate the level of work needed for each of the trail sections based on the current conditions, intended use, and other factors described in more detail below.

Trail Sustainability

The NPS has adopted the concept of sustainable design as a guiding principle in the design of trails and other park infrastructure. As defined by the NPS Natural Resource Management Reference Manual #77:

“Sustainability of backcountry trail corridors is defined as the ability of the travel surface to support current and anticipated appropriate uses with minimal impact on the adjoining natural systems and cultural resources. Sustainable trails have negligible soil loss or movement and allow the naturally occurring plant systems to inhabit the area, while allowing for the occasional pruning and removal of plants necessary to build and maintain the trail. If well designed, built, and maintained, a sustainable trail minimizes braiding, seasonal muddiness and erosion. It should not normally affect natural fauna adversely nor require re-routing and major maintenance over long periods of time.”

Sustainability in trail design considers whether the trail supports current and anticipated uses, the degree to which it protects natural systems, cultural resources, and the long-term maintenance requirements.

Construction Methods

New and Rerouted Trails – Construction of new trails would follow long-term sustainability design concepts. The park uses a number of tools and guidance documents in the design, management, and maintenance of the trail system. Trail maintenance and reconstruction is currently managed under the 2000 Trail System Maintenance and Construction Plan (NPS 2000). The park adopted Federal Trail Data Standards (Federal Geographic Data Committee 2011) for trail design and maintenance in 2012. Federal Trail Data Standards identify a common set of standardized trail classes ranging from minimally developed to fully developed. Each trail class has defined levels of tread and traffic flow, obstacles present, types of constructed features, and trail elements. Trail design standards consider a number of factors including key components about trail location, length, use, condition, and management. A primary resource used in the design and construction of trails in the park is the Sustainable Mountain Trails Sketchbook (Duffy et al. 2006). The sketchbook provides detailed guidance for sustainable trail design, restoration, and maintenance.

Successful trail design considers a number of variables including slope, landscape features, available surface material, rock content, erosion potential, drainage, level of use, and user type - pedestrian and/or equestrian. In anticipation of trail restoration or construction, NPS staff has developed specific alignments for each trail segment following sustainable guidelines and standard construction techniques.”

Trails are typically constructed using hand tools with native material available on-site, particularly in wilderness areas where access by mechanized equipment is restricted. However, mechanized equipment (motorized and nonmotorized) may be needed to facilitate construction and repair of trails and bridges including, but not limited to, chainsaws, gas or electric drills, rock drills, rock dollies, a grip hoist, a motorized flat plate compactor, and a gas-powered generator. Blasting also may be necessary in some locations where large rocks are present. The park prepared a Minimum Requirements Decision Guide (MRDG) (NPS 2016) to evaluate alternative methods and tools for constructing and repairing trails in wilderness (Appendix B). The MRDG is a process to identify, analyze, and select management actions that are the minimum necessary for wilderness administration and applies direction found in the Wilderness Act. The MRDG analysis resulted in the following minimum tools decisions:

- Trail construction on Lawn Lake, Ypsilon Lake, Aspen Brook, and Twin Sisters Trails would be done with the use of limited mechanized equipment and the use of pack stock and helicopter support. Grip hoists and rock dollies would be used to move rocks greater than 10 pounds and use gas or battery powered drills to drive in lags.
- The 150-foot section of trail in the wilderness for the ABA accessible Alluvial Fan Spur Trail would include trail reconstruction with the use of mechanized equipment use and without the use of pack stock or helicopter support. Grip hoists and rock dollies would be used to move rock greater than 10 pounds and use gas or battery powered drills to drive in lags. Due to the large amount of large boulders and other flood debris in the Alluvial Fan Spur trail corridor, crews would also use gas powered generators and electric drills to drill holes for quarrying and blasting of rock. Also, to finish the final tread layer of the ABA accessible Alluvial Fan Spur trail, the final tread layer would be compacted by using a motorized flat plate compactor.

In general, the following design guidelines and types of structures would be used to stabilize and restore existing trails and construct new trail reroutes.

- Trail design would be guided by the specific trail class. All backcountry trails considered in this document are considered Class 3 (Developed) (Developed/Improved Trails). The Alluvial Fan Trail, which would have a widened hard wide surface for accessibility, would be a Class 5 trail (Fully Developed). The US Forest Service Trail Fundamentals website provides an explanation of these trail classes and design parameters. See Appendix C for a summary of the trail classes and design parameters.
- Trail alignment would be selected to minimize vegetation and tree removal to the extent feasible; however, in some locations, tree clearing or pruning would be necessary. A preliminary trail alignment has been identified using Global Positioning System (GPS) equipment. A final refined trail alignment would be identified in the field prior to beginning trail work.
- Optimum trail grade would be achieved by adhering to the quarter guideline, where trail profile grade is one-fourth of the prevailing cross slope, while incorporating periodic grade dips to facilitate natural drainage. Fluctuations in grade and the use of structures may be necessary where drainage is poor, soils are loose, visitor use is high, and/or topographic constraints exist.
- Trails would generally be outsloped and compacted to facilitate drainage, or crowned when slopes are shallow.
- A variety of drainage features may be used including rolling swales, rock or log water bars, stone, or French drains.

Trails Undergoing Limited Improvement – Park staff would incorporate the informally developed trail into a regular maintenance schedule. This would allow a higher level of trail maintenance with the possible use of drainage or other structures to protect the trail and adjacent resources. This treatment could include digging dip drains and/or constructing log/rock water bars to shed water from the trail. Open rock culverts, rock causeways, and/or log turnpikes could be constructed to promote adequate drainage, and sustainable trail tread surfaces would be developed. Rock/log retaining bars could be installed along the trail to help retain tread material and prevent erosion.

Abandoned Trails

Abandoned trail sections, as a result of trail closure, would be reclaimed and revegetated. The extent of reclamation and revegetation efforts would depend on the specific conditions for each trail. Trails that are currently stable with minimal erosion and with no man-made drainage structures could be revegetated with limited seedbed preparation.

Unstable eroding trails would require implementation of measures to improve drainage and reduce erosion. Erosion control could involve reestablishing the natural contours and drainage patterns and installing erosion-control measures, such as small check dams made of straw bales or temporary silt fences. Revegetation could be passive or active. Passive revegetation would allow natural regeneration to occur from surrounding vegetation. Active revegetation would involve seeding or plantings of native vegetation in accordance with the park's Vegetation Restoration Management Plan (NPS 2006). Monitoring would be conducted to determine revegetation success and to determine the need for implementing weed-control measures per the park's Invasive Exotic Plant Management Plan (NPS 2003).

ARCHEOLOGICAL RESOURCES AND HISTORIC PROPERTIES

Compliance with section 106 of the NHPA is being conducted through ongoing consultation with the Colorado SHPO, Rocky Mountain National Park-affiliated American Indian tribes, and the ACHP.

In accordance with section 106 of the NHPA, the NPS provided the Colorado SHPO an opportunity to comment on the effects of this project with regard to historic properties. The NPS submitted the results of cultural survey of the project area to the SHPO on March 26, 2015. In a letter dated April 23, 2015, the SHPO concurred with the park's determination on the eligibility status for several resources discovered in the project area. The SHPO also concurred that the proposed undertaking would have no adverse effects on historic properties with implementation of management recommendations. Subsequent to the original cultural survey of the project area, the park added an extension of the Aspen Brook Trail to the proposed project and submitted a cultural resource survey of the additional area of potential effect to the SHPO on September 9, 2015. The SHPO responded in a letter dated September 18, 2015 that one cultural resource found in the Aspen Brook Trail extension is not eligible for the NRHP and the proposed action would not have an adverse effect on historic properties.

CONSTRUCTION STAGING

Temporary staging and stockpiling areas would be needed for equipment and material storage during trail repairs and construction. Staging and stockpiling areas would be located within existing disturbed areas, where feasible or in sites devoid of vegetation, typically at the construction site and at the trailhead or nearby parking area. The east and west parking lots would be used for staging when constructing the Alluvial Fan Trail.

Native timber, rock, and soil from on-site locations within areas surveyed for biological and cultural resources would be used to the extent possible to minimize the transport of material on backcountry trails. Native soil would be gathered from areas inside the trail corridor, and no borrow pits would be established. Timber could be transported to the site by pack mule/helicopter or harvested on-site. If harvested on-site, the preferred timber would be dead standing, out of sight from the trail, and without cavity nests. Rock would be gathered from nearby areas in the defined project area where they can easily be carried, rolled, or highlined to the project site.

VISITOR ACCESS DURING TRAILS WORK

Trail repairs and construction may require temporary closure of trail sections for several weeks, particularly when the trail is being stabilized in place. Construction of trail reroutes may allow hiker passage along existing routes. The park would advertise in advance any trail closures or detours.

SCHEDULE

Implementation of the action alternatives for the five trails is expected to take 3 to 10 years, depending on available funding and which alternative is selected. The priority for trail construction would be determined in the future, but it is anticipated that trail work would be conducted in the following sequence: Ypsilon Lake Trail, Lawn Lake Trail, Alluvial Fan Trail, Twin Sisters Trail, and Aspen Brook Trail. Repair and trail construction work would be conducted for four to five months

from late spring through fall depending on weather conditions and snow cover. Work on the Lawn Lake Trail and Aspen Brook Trail, including the adaptive management option, is anticipated to take two years. Trail repairs and rerouting of the Ypsilon Lake Trail and the preferred alternative for the Twin Sisters Trail could be completed in one year. Construction of a new Alluvial Fan Trail and a new Twin Sisters Trail under the adaptive management option would take two to three years. Trail work is anticipated to occur in daylight hours Monday through Friday, but weekend work could occur as needed.

BEST MANAGEMENT PRACTICES

To minimize impacts related to the action alternatives, the NPS would implement BMPs and resource protection measures.

BMPs are primarily focused on hand construction because most of the trail work would occur in wilderness areas with limited use of mechanized equipment. However, construction of the Alluvial Fan Trail, except for a short spur, is located outside of wilderness, where mechanized equipment would be used to facilitate trail work. Thus, some of the BMPs are directed at minimizing impacts associated with construction equipment.

General Measures

- The construction area limits would be clearly defined, fenced, flagged, and delineated to keep ground disturbance to a minimum. No disturbance would occur beyond these limits other than protection measures for erosion/sediment control.
- All contractor employees and subcontractors shall attend an orientation session(s) regarding park regulations focused on minimizing impacts on resources, human health and safety, and appropriate housekeeping.
- All tools, equipment, barricades, signs, surplus materials, and rubbish would be removed from the project area upon project completion. Construction debris would be hauled from the park to an appropriate disposal location.
- The park has developed a comprehensive list titled, “Construction Stipulations for Native Plant Conservation and Restoration,” to help minimize impacts on natural resources (Appendix A). These measures cover all aspects of trail construction, including implementation, construction limits, equipment, clearing and grubbing, excavation, topsoil salvage, vegetation salvage, rough grading, finish grading, imported aggregate and soil, placement of topsoil, erosion control, seeding, and mulching and would be incorporated into contract documents. The park will also apply the 2006 Vegetation Restoration Management Plan (NPS 2006) to guide revegetation activities.

Floodplains

- Staging, materials and equipment would be located outside of the floodplain to the extent possible.
- Sustainable design principles, such as the use of stepping stones in streams or bogs or the use of foot logs to span small streams to minimize impacts on the natural environment, would also be used.

Water Resources

- During earthwork, standard erosion-control measures such as silt fencing would be used, following the direction of the 2006 Rocky Mountain National Park Vegetation Restoration Management Plan.
- BMPs would be used to minimize erosion and the introduction of sediments to aquatic habitat during and after construction.
- All vehicle and equipment fueling would occur more than 100 feet from any surface water in a location where a fuel spill would not be able to enter the water.
- A spill prevention and response plan that regulates the use of hazardous and toxic materials, such as fuels and lubricants for construction equipment, would be prepared.

Wildlife and Species of Concern

- Construction personnel would be instructed on appropriate behavior in the presence of wildlife and on proper storage and handling of food, garbage, and other attractants.
- Field surveys for migratory bird nests and cavities would be conducted prior to ground-disturbing activities and vegetation removal during the breeding and nesting season. Where active nests are present, vegetation removal would not occur until after the young have fledged, and ground-disturbing activities would not occur within 100 feet until the young have fledged.
- From April 15 to July 15 only hand tools will be used on the Alluvial Fan Trail to minimize impacts on bighorn sheep lambing. Exceptions to this limitation will be as follows: 1) if monitoring of bighorn is conducted prior to work commencing and no ewes and/or young lambs are identified in the area, use of mechanized equipment can commence, 2) If monitoring of bighorn is conducted prior to work and ewes and/or lambs are observed, use of equipment may commence in coordination with bighorn observations to assess disturbance; if no adverse impacts are observed mechanized equipment use can continue independent of bighorn monitoring, and 3) once ewes with lambs are being observed at Sheep Lakes use of mechanized equipment can commence.
- Construction activity in montane meadow habitat with elk rutting activity would be avoided from September 15 to October 31. If rutting elk are not observed near the project work area, work may proceed.
- Potential impacts on boreal toads and other amphibians, such as boreal chorus frogs and tiger salamanders, would be avoided by constructing the bridge crossing outside of the breeding season and spanning the drainage with a bridge. Also prior to starting work in the Aspen Brook drainage, biologists would conduct searches for boreal toad tadpoles upstream and downstream in the project area for the bridge crossing.

Vegetation

- Disturbance to vegetation would be avoided as much as possible and contained to as small a trail corridor as possible.
- All equipment entering the park would be cleaned and pressure washed to remove foreign soil, vegetation, and other materials that may contain nonnative seeds or vegetation.
- All disturbed areas would be revegetated with native species. Revegetation plantings, if necessary, would use native species from genetic stocks originating in the park. Revegetation efforts would focus on recreating the natural spacing, abundance, and diversity of native

plant species. All disturbed areas would be restored as nearly as possible to preconstruction conditions shortly after construction activities are completed.

- In an effort to avoid introduction of exotic plant species, no hay bales would be used. Hay often contains seed of undesirable or harmful invasive exotic plant species. Therefore, on a case-by-case basis, the following materials may be used for any erosion control that may be necessary: rice straw, straws determined by the NPS to be weed-free (e.g., Coors barley straw or Arizona winter wheat straw), cereal grain straw that has been fumigated to kill weed seed, and wood excelsior bales.
- Nonnative invasive plant infestations near disturbed areas would be treated on a yearly basis for a minimum of three years following project completion.

Soils

- Disturbance to soils would be 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.
- Topsoil would be salvaged, stored in approved areas, and used to restore temporarily disturbed areas following construction or to restore abandoned trail alignments.
- To minimize the amount of ground disturbance, staging and stockpiling areas would be placed on previously disturbed land where feasible.

Wilderness

- For trail improvement activities in wilderness where motorized equipment or mechanical transport are approved, the activities would be timed to minimize impacts on park users and resources. Time of day, day of week, and season would be considered.

Cultural Resources

- Known historic sites and isolated occurrences would be avoided during construction.
- Should construction unearth previously undiscovered cultural resources, work would be stopped in the area of any discovery and the NPS archeologist would consult with the Colorado State Historic Preservation Office and the Advisory Council on Historic Preservation, as necessary, according to 36 CFR 800.13, *Post Review Discoveries*. In the unlikely event that human remains are discovered during construction, provisions outlined in the Native American Graves Protection and Repatriation Act (1990) would be followed.
- The park would ensure that all personnel who work on the trail are informed of the penalties for illegally collecting artifacts or intentionally damaging archeological sites or historic properties. Personnel would also be instructed on procedures to follow in case previously unknown archeological resources are uncovered during construction. Equipment traffic would be minimized in the area of the site. Equipment and materials staging areas would also avoid known archeological resources.

Visitor Use and Experience

- Signs, press releases, and other communication methods would be used to inform visitors about construction, trail access, and any trail closures or detours during construction.
- Barriers or signs would be used to deter visitor travel on abandoned trail segments to allow restoration of these areas.

Air Quality and Soundscapes

- Fugitive dust generated by construction would be controlled as necessary by spraying water on the construction site.
- Any blasting would conform to NPS-65, Explosives Use and Blasting Program (1991), specifications. All blasting charges would use the minimum amount necessary to accomplish the task. All blasting would be used to shatter, not distribute, any material.
- All construction motor vehicles and equipment would have mufflers conforming to original manufacturer specifications that are in good working order to prevent excessive or unusual noise, fumes, or smoke.
- To reduce noise and emissions, construction equipment would not be permitted to idle for longer than two minutes when not in use.

Public Health, Safety, and Park Operations

- Appropriate barriers and barricades would be used to clearly delineate work areas and provide for safe visitor travel near construction areas.
- Construction workers would wear appropriate attire such as hard hats, gloves, and goggles to protect themselves from natural hazards. Visitors would not be allowed into construction zones.
- Trucks hauling debris and other loose materials would be covered to maintain adequate freeboard to prevent spillage to paved surfaces.
- Emergency response protocols would be developed for implementation during construction. Construction activities would be conducted in accordance with established safety protocols.
- Employees and construction crews would be required to park their vehicles in designated locations.
- Construction workers and supervisors would be informed about the special sensitivity of park values, regulations, and appropriate housekeeping.

ALTERNATIVES CONSIDERED AND DISMISSED

The following actions were considered during the planning process but were rejected based on their inability to meet the purpose and need and/or the objectives of the project.

Wilderness Minimum Requirement Alternatives

The NPS considered a variety of wilderness minimum requirement alternatives for conducting trail work in the wilderness portion of this proposed project, including alternatives that would not include the use of any prohibited activities (mechanized tools and equipment and helicopter support) as well as other alternatives that would include various mixes of this equipment as well as non-mechanized tools and pack mules. However, these alternatives, including a no action alternative, were not selected because they did not accomplish the determined necessary trail work in a way that would minimize overall wilderness character impacts and provide for staff and visitor safety. See the Minimum Requirements Decision Guide in Appendix B for additional details.

Alternative Trail Repairs and Reroutes

A number of alternative trail reroutes were considered in addition to those presented in the description of the alternatives for each trail. Trail reroutes were dismissed from further consideration where it was determined that the environmental effects of a new location would be too great. Thus, routes through wetlands or near populations of sensitive plant species or wildlife habitat were eliminated from consideration. Steep terrain and rock outcrops were avoided because of the difficulty in constructing a sustainable trail. Trail alignments near cultural resources of concern were also eliminated from consideration. Alternatives that were dismissed for specific trail segments are described below.

Lawn Lake Trail

Stabilize in Place/Restore Original Trail: Stabilizing the old trail in place was not considered a feasible alternative because in many locations the trail no longer exists due to bank erosion along the Roaring River.

Alternative Reroutes: Several alternative reroutes were evaluated for each of the damaged trail sections. Potential longer reroutes away from the bank of the Roaring River were eliminated because of identified adverse environmental and cultural resource effects.

Resource Restoration and Abandon: Abandoning the Lawn Lake Trail was not considered feasible because it provides access to popular destinations and backcountry campsites in the park, and maintaining a trail to Lawn Lake is important for managing wilderness within the park. The park maintains a backcountry patrol cabin at Lawn Lake that is critical to park management. This alternative was considered but dismissed from further consideration.

Ypsilon Lake Trail

Stabilize in Place/Restore Original Trail: Replacement of the bridge across the Roaring River at the location of the previous bridge was eliminated from consideration because flood changes in the channel geometry and riverbanks made this location unsuitable for bridge construction. Thus, a location downstream from the previous bridge was chosen.

Resource Restoration and Abandon: Abandoning the Ypsilon Lake Trail is not feasible because it provides access to popular destinations and backcountry campsites in the park. This alternative was considered but dismissed from further consideration.

Alluvial Fan Trail

Stabilize in Place/Restore Original Trail: The previous bridge location across the Roaring River is no longer a suitable crossing because of sediment deposition and changes in the river channel following flooding. The location of the previous bridge was abandoned in favor of a downstream location that would provide a better crossing for a new trail alignment. Stabilizing in place and restoring the original trail is not considered feasible because very little of the original trail remains following the

flood, and the previous trail did not meet current accessibility requirements. For these reasons, this alternative has been dismissed from further consideration.

Resource Restoration and Abandon: Abandoning the Alluvial Fan Trail was not considered feasible because it provides access to one of the most popular frontcountry destinations in the park. Without a trail, visitors would continue to scramble over loose alluvium to reach the Roaring River, giving rise to visitor safety concerns. This alternative was considered but dismissed from further consideration.

Aspen Brook Trail

Stabilize in Place/Restore Original Trail: Stabilizing the old trail in place was not considered feasible because large quantities of fill material would be needed to bring the trail surface back to the original ground level. Importing such large quantities of fill would require use of mechanized equipment in designated wilderness and would compromise wilderness values. Maintaining the trail in its original alignment once stabilization was complete would require significant ongoing maintenance because of the unstable soils in the Aspen Brook drainage. For these reasons, this alternative was dismissed from further consideration.

Alternative Reroutes: Trail alignments to the north and farther from the drainage than those proposed in the Alternative B reroute were eliminated from consideration because of the steep side slopes, greater potential for resource damage, and the difficulty of constructing a sustainable trail.

Twin Sisters Trail

Stabilize in Place/Restore Original Trail: Stabilizing the old trail in place across the landslide was not considered a feasible alternative. The landslide material is unstable and is likely to continue moving in the future. Because of the difficulty in maintaining a trail across an active landslide and visitor safety concerns, this alternative was dismissed from further consideration.

Alternative Reroutes: Several alternative routes were also evaluated north of the landslide in the same general location as proposed in Alternative B. While these routes are feasible, the selected route best fits the terrain and sustainable design considerations.

Resource Restoration and Abandon: Abandoning the Twin Sisters Trail was not considered feasible because it provides access to one of the most iconic peaks in the park, and maintaining a trail to the summit is important for managing wilderness within the park. The park maintains a radio repeater near the summit of Twin Sisters that is critical to park management. This alternative was considered but dismissed from further consideration.

Allow Equestrian Use: To allow for equestrian use, the park would need to move forward with the option listed in Alternative B as adaptive management. This alternative would allow the grades and switchback design preferable for stock operational safety. The preferred alternative does not provide sustainable grades allowable for stock use.

ALTERNATIVE SUMMARIES

Table 2 summarizes the major components of Alternatives A and B. Alternative B (NPS preferred alternative) achieves the project objectives while Alternative A (no action) does not.

Table 2. Summary of Alternatives.

Trail	Alternative A No Action	Alternative B Establish and Maintain a Travel Route NPS Preferred Alternative
Lawn Lake Trail	No new trails would be constructed. Informal social trails would receive minimal maintenance for pedestrian-only travel. NPS trail sustainability design concepts would not be implemented.	Sections 1, 3, and 4 of the damaged trail would be rerouted to new locations using trail sustainability design concepts. Limited improvements to an existing social trail would be conducted for Section 2. Pedestrian and equestrian use would be allowed.
Ypsilon Lake Trail	The washed-out bridge across the Roaring River would not be replaced and informal social trails would receive minimal maintenance for pedestrian-only travel. NPS trail sustainability design concepts would not be implemented.	A new bridge across the Roaring River would be constructed and new trail approaches to the bridge would be constructed using trail sustainability design concepts. Pedestrian and equestrian use would be allowed.
Alluvial Fan Trail	Visitors would be allowed to access the area via multiple social trails. The bridge across the Roaring River would not be replaced. NPS trail sustainability design concepts would not be implemented. Only pedestrian use would be allowed.	A new trail would be constructed between the east and west parking lots according to accessibility standards to allow use by all visitors. A new bridge across the Roaring River would be constructed. A new short trail segment into the wilderness to an overlook would be constructed to accessibility standards. Only pedestrian use would be allowed.
Aspen Brook Trail	No new trails would be constructed and no improvements would be made to the existing damaged trail. Informal social trails would receive minimal maintenance for pedestrian-only travel. NPS trail sustainability design concepts would not be implemented.	New trail segments around damaged trail would be constructed using trail sustainability design concepts. A new trail extension would be constructed to the park boundary to connect to an existing trail on private land. A new hitchrack for equestrian use would be installed. Pedestrian and equestrian use would be allowed. An adaptive management option includes abandonment and restoration of the trail if funding and easements and agreements for the trail extension on private land are not secured.
Twin Sisters Trail	No new trails would be constructed. Informal social trails would receive minimal maintenance for pedestrian-only travel. NPS trail sustainability design concepts would not be implemented.	Existing social trails would be incorporated into the trail maintenance program. Abandoned trail segments or informal routes that are redundant would be restored to natural conditions to the extent practicable. Only pedestrian use would be allowed on this trail. An adaptive management option includes construction of a new realigned trail if use of social trails results in resource damage or presents visitor safety concerns. Pedestrian and equestrian use would be allowed under this option.

Impact Summary

Table 3 through Table 7 provide a summary of potential environmental effects for each of the alternative trail locations.

Table 3. Lawn Lake Trail – Impact Summary.

Impact Topic	Alternative A No Action Sections 1-4	Alternative B – Establish and Maintain a Travel Route NPS Preferred Alternative			
		Reroute	Limited Improvements	Reroute	Reroute
		Section 1	Section 2	Section 3	Section 4
Soils	Accelerated erosion on multiple social trails would adversely impact soils.	A 280-foot trail reroute would adversely impact soils, but would eliminate soil disturbance on social trails and further streambank erosion. Soils would be stabilized on 290 feet of abandon trail.	Limited improvements on 395 feet of trail would adversely impact soils. Revegetation of 390 feet of damaged trails would have a beneficial effect on soils.	A 460-foot trail reroute would adversely impact soils. Restoration of a similar amount of abandoned trail would protect soils.	A 950-foot trail reroute would adversely impact soils. Revegetation of about 575 feet of abandoned trail would have a beneficial effect on soils.
Vegetation, including Noxious Weeds	Vegetation disturbance along social trails would adversely impact native vegetation. The introduction of noxious weeds is possible.	A 280-foot trail reroute would adversely impact native vegetation, but would be offset by revegetation along 290 feet of abandoned trail. Vegetation damage along social trails would be reduced. The introduction of noxious weeds is possible.	Limited improvements on 395 feet of trail would adversely impact native vegetation. Revegetation of 390 feet of abandoned trail would offset new disturbance. Vegetation damage along social trails would be reduced. The introduction of noxious weeds is possible.	A 460-foot trail reroute would adversely impact native vegetation. Revegetation of a similar amount of abandoned trail would reduce the net impacts. Vegetation damage along social trails would be reduced. The introduction of noxious weeds is possible.	A 950-foot trail reroute would adversely impact native vegetation. Revegetation along 575 feet of abandoned trail and reduced vegetation damage along social trails would benefit vegetation. The introduction of noxious weeds is possible.
Wildlife, Aquatics, and Special Status Species	Minor trail work would have minimal impacts on wildlife, aquatics, and special status species. There would be no effect on federally listed threatened or endangered species.	Wildlife would be displaced during construction. Habitat loss for trail clearing would have a negligible adverse impact offset with restoration of abandoned trail sections. The action may affect, but is not likely to adversely affect greenback cutthroat trout or Canada lynx. There would be no effect on Mexican spotted owl.	Impacts would be similar to those for Section 1.	Impacts would be similar to those for Section 1.	Impacts would be similar to those for Section 1.

Impact Topic	Alternative A No Action Sections 1-4	Alternative B – Establish and Maintain a Travel Route NPS Preferred Alternative			
		Reroute	Limited Improvements	Reroute	Reroute
		Section 1	Section 2	Section 3	Section 4
Wilderness	An adverse effect may result if continued human use results in greater trail damage to fundamentally unstable trails.	The trail reroute would adversely impact wilderness characteristics during construction and impact wilderness from new ground disturbance and human manipulation.	Trail improvements would result in a beneficial effect on wilderness character from protecting and restoring the natural quality of the wilderness area. Adverse impacts on wilderness characteristics could occur during trails work.	Impacts would be similar to those for Section 1.	Impacts would be similar to those for Section 1.
Visitor Use and Experience	An adverse impact on trail users and safety concerns from social trails near an eroding streambank may occur. Closure of the trail to equestrian use would adversely impact some trail users.	Trail reroutes would have a beneficial effect with improved safety, access, and equestrian use. Adverse impacts on trail use are possible during trail construction and restoration work.	Visitors would benefit from trail improvements that allow equestrian use and improved safety. Adverse impacts on trail use are possible during improvements and restoration work.	Impacts would be similar to those for Section 1.	Impacts would be similar to those for Section 1.

Table 4. Ypsilon Lake Trail – Impact Summary.

Impact Topic	Alternative A No Action	Alternative B – Establish and Maintain a Travel Route Reroute NPS Preferred Alternative
Soils	Adverse impacts on soil resources are likely from braided social trails crossing the stream.	Bridge replacement and construction of new trail would result in minor adverse impacts on soil resources.
Vegetation, Including Noxious Weeds	In the absence of a bridge, multiple social trails across the Roaring River could impact streambank vegetation. The introduction of noxious weeds is possible.	Vegetation removal for trail construction would result in a minor loss of vegetation, since most of the vegetation was removed by channel scouring. The introduction of noxious weeds is possible.
Wildlife, Aquatics, and Special Status Species	Minor trail work would have minimal impacts on wildlife. There would be no effect on federally listed threatened or endangered species.	Construction-related noise and disturbance would have an adverse impact on wildlife. Habitat loss would be minor because of the lack of vegetation. The action may affect, but is not likely to adversely affect, greenback cutthroat trout or Canada lynx. There would be no effect on Mexican spotted owl.
Wilderness	There would be no impact on wilderness character.	Bridge replacement and construction of new trail would result in localized adverse impacts on all qualities of wilderness character during construction. Improvements would result in adverse impacts on the untrammeled, undeveloped, and natural qualities of wilderness character.
Visitor Use and Experience	In the absence of a bridge over the Roaring River, there would be an adverse impact on visitor use. The stream may be impassable at high flows. Because equestrian use would not be allowed, this user group would be adversely impacted.	A new bridge and trail improvements would provide increased safety at the river crossing and a more stable trail that would have a beneficial effect on visitor use and experience.

Table 5. Alluvial Fan Trail – Impact Summary.

Impact Topic	Alternative A No Action	Alternative B – Establish and Maintain a Travel Route Reroute NPS Preferred Alternative
Soils	Adverse impacts on soil resources from multiple social trails would be negligible in this active floodplain.	No adverse impacts on soils are anticipated because of the absence of soil material in the alluvial floodplain.
Vegetation, Including Noxious Weeds	Vegetation impacts would be minimal from minor trail improvements because of the lack of vegetation. The introduction of noxious weeds is possible.	New trail construction would have minor effects on vegetation because much of the vegetation was scoured by flooding. The introduction of noxious weeds is possible.
Wildlife, Aquatics, and Special Status Species	Minor adverse impacts on wildlife would occur from removal of remnants of the existing trail. There would be no effect on federally listed threatened or endangered species.	Minor adverse impacts on wildlife would occur from construction activity and habitat loss To minimize impacts on bighorn sheep, only hand tools would be used for trails work between April 15 and July 15. Exceptions to this limitation will be as follows: 1) if monitoring of bighorn is conducted prior to work commencing and no ewes and/or young lambs are identified in the area, use of mechanized equipment can commence, 2) If monitoring of bighorn is conducted prior to work and ewes and/or lambs are observed, use of equipment may commence in coordination with bighorn observations to assess disturbance; if no adverse impacts are observed mechanized equipment use can continue independent of bighorn monitoring, and 3) once ewes with lambs are being observed at Sheep Lakes use of mechanized equipment can commence. The action may affect, but is unlikely to adversely affect, Canada lynx and greenback cutthroat trout and would have no effect on wolverine or Mexican spotted owl.
Wilderness	There would be no impact on wilderness since the trail is located outside of designated wilderness	New trails would be constructed outside of the wilderness, with the exception of a 350-foot overlook spur that would extend into the wilderness area. Adverse impacts on all qualities of wilderness character would occur with new trail construction.
Visitor Use and Experience	An adverse impact on visitor use would occur if the trail and bridge are not replaced and visitor access is limited to social trails. The absence of an accessible trail would adversely impact trail users with disabilities.	A new accessible trail and bridge would enhance visitors' enjoyment while using the trail.

Table 6. Aspen Brook Trail – Impact Summary.

Impact Topic	Alternative A No Action	Alternative B – Establish and Maintain a Travel Route	
		Reroute (NPS Preferred Alternative)	Resource Restoration and Abandon (Adaptive Management)
Soils	Adverse impacts on soil resources would occur from active erosion of damaged trails and social trails.	Impacts on soil resources would occur from about 8,760 feet of trail reroutes and new construction. Restoration of 3,360 feet of abandoned trail would protect soil resources from erosion.	Reclamation of the trail would have a beneficial effect on soil resources, although social trails could continue to impact soils.
Vegetation, Including Noxious Weeds	Vegetation disturbance along social trails would have an adverse impact. The introduction of noxious weeds is possible.	An adverse impact on vegetation would occur along about 8,760 feet of trail reroutes and new trail. Revegetation along 3,360 feet of abandoned trail and reduced vegetation damage along social trails would occur. The introduction of noxious weeds is possible.	Restoration of vegetation on the trail would have a beneficial effect on vegetation, although some vegetation disturbance along social trails is likely.
Wildlife, Aquatics, and Special Status Species	Minor trail work would have negligible impacts on wildlife. There would be no effect on federally listed threatened or endangered species.	Trails work would have an adverse impact by displacing wildlife during construction. Construction activity in montane meadow habitat with elk rutting activity would be avoided from September 15 to October 31. If rutting elk are not observed near the project work area, work may proceed. Habitat loss for trail clearing would have a minor adverse impact. Effects would be negligible with restoration of abandoned trail sections. The action may affect, but is not likely to adversely affect, Canada lynx or Mexican spotted owl. There would be no effect on greenback cutthroat trout or wolverine.	Closure of the trail would have a beneficial effect on all wildlife species.
Wilderness	Social trails could lead to an adverse impact on untrammeled qualities of wilderness character. Closure to equestrian use would have an adverse impact on opportunities for unconfined recreation.	The trail reroute would have adverse impacts on wilderness characteristics during construction and impacts on wilderness from new ground disturbance and human manipulation.	Trail closure and reclamation would have adverse impacts on opportunities for unconfined recreation and beneficial effects on untrammeled, undeveloped, and natural qualities of wilderness.
Visitor Use and Experience	An adverse impact on trail use would occur as a result of flood-damaged trail impacting access and continued erosion of the trail. Closure of the trail to equestrian use would adversely impact some trail users.	Beneficial effects on visitor use would occur by reestablishing access and extending the trail to the north to allow access from Highway 66. New hitchracks would benefit equestrian use. Adverse impacts on trail use are possible during trail construction and repair work.	Reclamation and closure of the trail would have an adverse impact on visitor use. Continued social trail development is likely.

Table 7. Twin Sisters Trail – Impact Summary.

Impact Topic	Alternative A No Action	Alternative B - Establish and Maintain a Travel Route	
		Limited Improvement (NPS Preferred Alternative)	Reroute (Adaptive Management)
Soils	Adverse impacts on soil resources would occur from erosion of damaged trails and social trails.	Impacts on soil resources would occur from improvements of about 575 feet of trail. Restoration of 1,110 feet of abandoned trail would protect soil resources from erosion.	Impacts on soil resources would occur from construction of about 2,730 feet of new trail. Restoration of 2,200 feet of abandoned trail would protect soil resources from erosion.
Vegetation, including Noxious Weeds	Vegetation disturbance along social trails would have an adverse impact. The introduction of noxious weeds is possible.	An adverse impact on vegetation would occur along about 575 feet of improvements to social trails. Revegetation along 1,100 feet of abandoned trail and reduced vegetation damage would occur along multiple social trails. The introduction of noxious weeds is possible.	An adverse impact on vegetation would occur along about 2,730 feet of improvements to social trails. Revegetation along 2,200 feet of abandoned trail and reduced vegetation damage would occur along multiple social trails. The introduction of noxious weeds is possible.
Wildlife, Aquatics, and Special Status Species	Minor trail work would have negligible impacts on wildlife and aquatic species. There would be no effect on federally listed threatened or endangered species.	Trails work would have an adverse impact by displacing wildlife during construction. Habitat loss for trail clearing would have a minor adverse impact. Effects would be negligible with restoration of abandoned trail sections. The action may affect, but is not likely to adversely affect, the Canada lynx. There would be no effect on greenback cutthroat trout or Mexican spotted owl.	Impacts would be similar to Alternative B Limited Improvements, but with a greater disturbance of wildlife habitat with the longer trail reroute.
Wilderness	Social trails could lead to adverse impacts on untrammeled wilderness. The lack of equestrian access would adversely impact opportunities for unconfined recreation.	Adverse impacts on wilderness character would be minor, with beneficial effects from restoration of multiple social trails.	Impacts would be similar to Alternative B Limited Improvement, but with new longer disturbances in the wilderness with a rerouted trail.
Visitor Use and Experience	An adverse impact on trail use would occur from a lack of a well-defined trail. Closure of the trail to equestrian use would adversely impact some trail users.	Beneficial effects on visitor use would occur by reestablishing pedestrian and equestrian access along a social trail. Adverse impacts on trail use are possible during trail construction and repairs work.	Effects would be similar to Alternative B Limited Improvements, but with a less steep longer trail constructed to sustainability standards.

AFFECTED ENVIRONMENT

INTRODUCTION

The park's mountains support a diversity of ecosystems, including montane, subalpine, and alpine biological communities, ranging in elevation from 7,600 to 14,259 feet. The park also includes lush riparian and aquatic ecosystems based in 147 lakes and 450 miles of streams that speckle and divide the other ecosystems. Stands of ponderosa pine, Douglas-fir, lodgepole pine, aspen, subalpine fir, and Engelmann spruce adorn the mountainsides. The forests are interspersed with mountain meadows. The park ranks as one of America's premier wildlife watching destinations, showcasing elk, bighorn sheep, mule deer, black bears, coyotes, cougars, eagles, hawks, ptarmigans, and scores of smaller animals. The landscape now known as Rocky Mountain National Park has been home to humans for at least 10,000 years. Human evidence surfaces in a wide range of places within the current park boundaries. In 1977, United Nations Educational, Scientific and Cultural Organization included the park in the international system of biosphere reserves. In 2009, Congress designated 95% of the park as wilderness.

More than 355 miles of trails (266 miles within designated wilderness) offer opportunities to hikers and backpackers. Many park trails are open to equestrians, and during the winter many trails are used for snowshoeing or cross-country skiing. The park trails provide opportunities for visitors to access wild places in the park. Such access is identified as a fundamental resource or value in the 2013 *Foundation Document* (NPS 2013a). Technical rock climbing, bouldering, angling, and bird watching are also popular activities that are accessed from trails. Trail conditions range between highly maintained frontcountry trails, such as the accessible trail around Lily Lake, and lesser-maintained foot trails, such as the climbers' trails on Lumpy Ridge.

SOILS

The soils in the park developed as the result of weathering of the parent rock material. Park soils vary by the composition of parent rock and environmental conditions influenced by different vegetation types, climate, and elevation. The soils exhibit a wide range of characteristics in texture, depth, organic matter content, and physical and chemical properties. The majority of the trails in the project area are located in the montane life zone at elevations from 8,000 to 10,000 feet, although upper portions of the Twin Sisters Trail are located in the lower subalpine zone. The soils of the montane life zone have approximately 40 to 75 frost-free days and receive about 16 to 24 inches of precipitation annually. In general, the soils in the montane life zone formed in sandy and gravelly till and in gravelly slope alluvium derived from granite, gneiss, and schist. These soils range in depth from deep to shallow depending on the depth to rock and are somewhat excessively drained (Natural Resource Conservation Service (NRCS) 2007). The soils in the subalpine life zone formed in gravelly slope alluvium, residuum, colluvium, or till derived from granite, gneiss, or schist and vary in depth. Characteristics of soil conditions for each of the trail locations in the project area are described below.

Lawn Lake Trail and Ypsilon Lake Trail

The Lawn Lake flood in 1982 occurred from the failure of the Lawn Lake Dam and resulted in significant erosion of the Roaring River and deposition of a large alluvial fan at the mouth of the

drainage. All of the eroded sections of these trails occur in glacial till of Pinedale age (upper Pleistocene). Glaciation occurring between approximately 35,000 and 10,000 years ago deposited this material consisting of boulders, cobbles, and gravels in a sandy silt to silty sand matrix. Many of the boulders are extremely large, greater than 12 feet in diameter. The failure of the Lawn Lake Dam in 1982 caused significant erosion and redistribution of the materials in the Roaring River drainage.

The existing trail surface consists of silty sand with some fine gravels and occasional cobbles to small boulders. However, sections of the trail were completely washed out from flooding along the Roaring River and collapse of the streambank where the trail was located (Figure 8). The Soil Survey of the park (NRCS 2007) indicates much of the Lawn Lake Trail is in the Nanita-Rock outcrop soil map unit. This soil is described as an excessively drained gravelly sandy loam near the surface to an extremely gravelly sand at depths derived from schist, granite, and gneiss. The Ypsilon Lake Trail is also located in the Nanita extremely gravelly loamy coarse sand. Where this trail crosses the Roaring River, the soils are mostly alluvial deposits of coarse sandy material.

Figure 8. Lawn Lake Trail Damage from Eroding Roaring River Streambank.



Alluvial Fan Trail

The Alluvial Fan Trail was heavily damaged by flooding in 2013. This trail was originally constructed on alluvial deposits resulting from the failure of the Lawn Lake Dam in 1982. The dam failure caused a flash flood, which deposited sediment at the mouth of the Roaring River. This very recent Holocene aged deposit consists of sediment ranging from very large boulders to silt and varies in thickness from approximately 46 feet at the deepest point to several inches at the edges (Yeh 2015a). The September 2013 flooding of the Roaring River once again deposited large amounts of alluvial material at the mouth of the Roaring River. Up to approximately 15 feet of sediment was deposited

below Horseshoe Falls, causing the river channel to shift to the west. This material and the new river alignment completely buried the western leg of the trail. The eastern leg of the trail was partially covered with sediment, and the flooding inflicted heavy damage to the remaining trail sections.

Because most of the material in the Alluvial Fan Trail area consists of recent alluvial deposition, there is no soil development. The soil in the area consists of pockets of unconsolidated layers of sand, silt, and clay within a matrix of large to medium boulders, stones, and cobble.

Aspen Brook Trail

The Aspen Brook Trail is constructed on soils derived from slope alluvium and gravelly residuum weathered from granite, gneiss, and schist. The material is a silty sand with cobbles and boulders. The composition and ratio of fine to coarse material varies throughout the length of the trail. Based on field observations, this material appears to be readily erodible and weakened when exposed to flowing water (Yeh 2015a, 2015b).

This trail falls within the Galauche-Rock outcrop soil map unit (NRCS 2007). The soils are typically less than 19 inches deep with very gravelly sandy loam textures near the surface and unweathered bedrock at depth. Portions of the trail along Aspen Brook may be located within the Lumpyridge gravelly coarse sandy loam map unit. These soils are derived from alluvium and are typically greater than 39 inches deep. Portions of the Aspen Brook Trail experienced erosion from the 2013 flooding (Figure 9).

Figure 9. Erosion Along the Aspen Brook Trail.



Twin Sisters Trail

The existing trail is constructed on colluvial material consisting of gravels, cobbles, and boulders in a matrix of silty sand, with the majority of the material, at and near the surface, being cobbles and boulders. The recent debris flow occurred in the colluvial material, in a slight topographic draw, flanked to the north by outcropping bedrock (Figure 10). Observations of the headscarp indicate the colluvium at the slide location is at least 20 feet thick.

Much of the trail reroute option on the north side of the debris flow is located in the Hiamovi-Rock outcrop map unit (NRCS 2007). This soil is derived from gravelly slope alluvium and residuum weathered from granite, gneiss, and schist with extremely gravelly loam textures and shallow depths. The south side of the debris flow is located in the Fallriver gravelly sandy loam map unit, which is also composed of gravelly sandy loam surface soils, but with soil depths greater than 35 inches.

Figure 10. Debris Flow Across Twin Sisters Trail.



VEGETATION, INCLUDING NOXIOUS WEEDS

The vegetation in the trail reroute areas is generally composed of mixed-coniferous forest. Vegetation surveys were conducted by park staff in summer 2014 to identify dominant plant species for each of the proposed trail reroute areas (NPS 2014a). Common plant species for each of the trail reroute sections, including invasive species, are described below.

Lawn Lake Trail

The vegetation communities of the four trail reroute sections along the Lawn Lake Trail are described individually below. Several populations of Canada thistle (*Cirsium arevense*), an invasive species, were found during the surveys, but the closest population is more than 100 feet from the trail reroute.

Section 1

The trail in this section crosses mixed coniferous woodland dominated by lodgepole pine (*Pinus contorta*) and Douglas-fir (*Pseudotsuga menziesii*). Other plant species in the understory include bearberry (*Arctostaphylos uva-ursi*), pussytoes (*Antennaria pulcherrima*), common juniper (*Juniperus communis*), western golden ragwort (*Senecio eremophilus*), narrowleaf sedge (*Carex stenophylla*), and wild strawberry (*Fragaria virginiana*).

Section 2

This section consists primarily of spruce-fir woodland. Tree species in this section include Douglas-fir, subalpine fir (*Abies lasiocarpa*), Engelmann spruce (*Picea engelmannii*), and quaking aspen (*Populus tremuloides*). Common plant species in the understory include bearberry, Woods' rose (*Rosa woodsii*), common juniper, western golden ragwort, Parry goldenrod (*Oreochrysum paryii*), broom huckleberry (*Vaccinium scoparium*), and heartleaf arnica (*Arnica cordifolia*).

Section 3

Lodgepole pine woodlands dominate this trail section, along with several stands of aspen. Common plant species in the understory include bearberry, Woods' rose, Oregon grape (*Berberis repens*), western golden ragwort, broom huckleberry (*Vaccinium scoparium*), and sidebells wintergreen (*Orthilia secunda*).

Section 4

This trail section consists of coniferous woodland dominated by subalpine fir and Douglas-fir. Other plant species include lodgepole pine, broom huckleberry, heartleaf arnica, and common juniper.

Ypsilon Lake Trail

The proposed trail reroute for the Ypsilon Lake Trail crosses the floodplain of the Roaring River. Much of this area was affected by flooding in September 2013, resulting in channel scouring and loss of vegetation (Figure 11). Most of the herbaceous vegetation in the floodplain was removed during the flooding, with woody species such as trees and shrubs primarily remaining. Tree and shrub species in this area include Engelmann spruce, lodgepole pine, quaking aspen, mountain willow (*Salix monticola*), and shining willow (*Salix lucida*). Common species in the understory, in areas not affected by flooding, include fireweed (*Chamerion angustifolium*), wild strawberry, prairie junegrass (*Koeleria macrantha*), five petal cliffbush (*Jamesia americana*), pearly everlasting (*Anaphalis margaritaceae*), common juniper, hairy rockcress (*Arabis hirsuta*), prairie goldenrod (*Solidago missouriensis*), golden banner (*Thermopsis divaricarpa*), and Woods' rose.

No invasive species were observed along the proposed Ypsilon Lake Trail reroute.

Figure 11. Ypsilon Lake Trail near Washed-Out Bridge Location.



Alluvial Fan Trail

The Alluvial Fan Trail crosses the floodplain of the Roaring River impacted by deposition from the 1982 Lawn Lake flood and subsequent additional flooding, deposition, and scouring from the September 2013 flood event. Erosion resulting from the flooding in 2013 removed most of the herbaceous vegetation from the Roaring River floodplain, leaving woody vegetation such as willows and trees. Common woody species along the Alluvial Fan Trail reroute include Ponderosa pine (*Pinus ponderosa*), quaking aspen, Rocky Mountain maple (*Acer glabrum*), mountain willow, and planeleaf willow (*Salix planifolia*).

Two invasive species, cheatgrass (*Bromus tectorum*) and Canada thistle, are found throughout the proposed reroute area. Cheatgrass is more common on the west side of the Roaring River and Canada thistle is more common on the east side of the river.

Aspen Brook Trail

The Aspen Brook Trail reroute crosses mixed coniferous woodland of mostly Douglas-fir and aspen. Common plant species in the understory include bearberry, common juniper, western golden ragwort, Parry's goldenrod (*Oreochrysum parryi*), leafy cinquefoil (*Drymocallis fissa*), mountain muhly (*Muhlenbergia montana*), and woolly brome (*Bromus lanatipes*). The northern portion of the trail reroute crosses a mixed coniferous forest dominated by lodgepole pine, Engelmann spruce, and subalpine fir, with scattered aspen.

Suitable habitat exists along the proposed reroute for several rare plant species including Colorado aletes, grassslope sedge (*Carex oreocharis*), rattlesnake plantain, yellow monkeyflower, whitevein pyrola (*Pyrola picta*), variegated rush, and autumn willow.

Several infestations of woolly mullein (*Verbascum thapsis*), an invasive species, occur in the lower half of the reroute.

Twin Sisters Trail

The vegetation along the potential Twin Sisters Trail reroute is primarily dry mixed-coniferous woodland. Common tree species include lodgepole pine, Engelmann spruce, Douglas-fir, and limber pine (*Pinus flexilis*). Plant species present in the understory include common juniper, bracted alumroot (*Heuchera bracteata*), and dotted saxifrage (*Cilinia austromontana*).

No invasive species were found in the Twin Sisters Trail project area during the surveys.

WILDLIFE, INCLUDING SPECIAL STATUS SPECIES

Wildlife found in the park includes 52 mammal species, 276 bird species, 4 amphibian species, 1 reptile species, and 11 fish species. The distribution of wildlife species within the park varies by season, elevation, and types of habitats.

Mammals

Large mammals potentially occurring in the trail reroute areas include elk (*Cervus canadensis*), mule deer (*Odocoileus hemionus*), bighorn sheep (*Ovis canadensis*), and moose (*Alces alces*). Elk are common throughout the park. Population estimates in the park and nearby Estes Valley peaked between 1997 and 2001, with annual estimates ranging from about 2,800 to 3,500 animals (NPS 2007). The elk population in the park and Estes Valley migrate seasonally between high-elevation summer ranges and low-elevation winter ranges. Summer range includes subalpine and alpine areas in the park and is used primarily during June, July, and August. In September, a portion of the elk herd migrates to winter range in the Estes Valley on the east side of the park and adjacent areas outside the park, as well as areas farther east. The elk population on the winter range in the park is estimated at 200 animals. Elk typically return to summer range in May (Zeigenfuss et al. 2011). Mule deer occupy many types of habitats in the park, including lodgepole pine and other forest types, forest edges, shrublands, and grasslands. Moose are present in the park as a result of releases conducted by the Colorado Division of Wildlife to an area northwest of the park in 1978 and 1979. Moose occupy a large range and forage in a variety of habitats in the park. They prefer a mosaic of second growth forest, openings, swamps, lakes, and wetlands.

By the 1950s, pressures from hunting, disease, and habitat alteration had reduced bighorn sheep numbers in the park and surrounding areas to as few as 150 animals in remote areas in the park and surrounding mountains (NPS 2015a). Bighorn populations have since increased. Wildlife managers reintroduced bighorn sheep to their historical range east of the park in 1978 and 1980 in an effort to increase population numbers. These new herds of bighorn sheep along the eastern boundary of the park and the surviving native herds have continued to grow. Today, approximately 350 bighorn sheep live in the park and surrounding areas. Bighorn sheep use habitat in and near the Alluvial Fan Trail reroute area. The Alluvial Fan Trail is located near an April 15 to August 31 seasonal public

closure to protect bighorn sheep. Bighorn sheep are also present in the Lawn Lake and Ypsilon Lake Trail areas, but the trail reroute areas are not heavily used. Bighorn sheep are not common in the Twin Sisters Trail or Aspen Brook Trail reroute areas.

Small mammals potentially occurring within the trail reroute areas include golden-mantled ground squirrel (*Spermophilus lateralis*), deer mouse (*Peromyscus maniculatus*), montane vole (*Microtus montanus*), least chipmunk (*Neotamias minimus*), Uinta chipmunk (*Neotamias umbrinus*), chickaree (*Tamiasciurus douglasii*), northern pocket gopher (*Thomomys talpoides*), Nuttall's cottontail (*Sylvilagus nuttallii*), and snowshoe hare (*Lepus americanus*).

Beavers (*Castor canadensis*) are not common in the park and are of concern to park managers because of their rarity. Beavers are known to occur at Lily Lake near the Aspen Brook Trail (Watry, pers. comm. 2015) and could potentially be present within Aspen Brook in or near the trail reroute area.

Other mammals potentially occurring within the trail reroute areas include predators that occur in a wide variety of habitats, including mountain lion (*Felis concolor*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), black bear (*Ursus americanus*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), and striped skunk (*Mephitis mephitis*).

Birds

The park provides habitat for a variety of bird species including Neotropical migrant songbirds, raptors, and waterfowl. Of the 276 bird species known to occur in the park, 26 are year-round inhabitants while the rest are seasonally present within the park. The diversity of songbirds in the park is greatest in aspen, riparian willow, and ponderosa pine habitat (Connor 1993; Turchi et al. 1995).

Bird species potentially occurring in the trail reroute areas based on species known to occur in the park (NPS 2013b) and suitable habitat include common raven (*Corvus corax*), gray jay (*Perisoreus canadensis*), Steller's jay (*Cyanocitta stelleri*), Clark's nutcracker (*Nucifraga columbiana*), ruby-throated hummingbird (*Archilochus colubris*), northern flicker (*Colaptes auratus*), mountain chickadee (*Poecile gambeli*), red-breasted nuthatch (*Sitta canadensis*), pygmy nuthatch (*Sitta pygmaea*), brown creeper (*Certhia americana*), house wren (*Troglodytes aedon*), mountain bluebird (*Sialia currucoides*), Townsend's solitaire (*Myadestes townsendi*), hermit thrush (*Catharus guttatus*), American robin (*Turdus migratorius*), yellow-rumped warbler (*Dendroica coronate*), and dark-eyed junco (*Junco hyemalis*). Three species of accipiters – northern goshawk (*Accipiter gentilis*), Cooper's hawk (*A. cooperii*), and sharp-shinned hawk (*A. striatus*) – are known to breed in the park and could occur near the trail reroute areas. Mallards (*Anas platyrhynchos*) and ring-necked ducks (*Aythya collaris*) occasionally nest along the banks of rivers and streams and could be present near the trail reroutes where water is present.

Amphibians and Reptiles

Four species of amphibians – boreal toad (*Anaxyrus boreas boreas*) boreal chorus frog (*Pseudacris maculata*), wood frog (*Rana sylvatica*), and tiger salamander (*Ambystoma tigrinum*) – are known to occur in the park. The boreal toad is state listed as endangered in Colorado and under consideration by the USFWS for federal listing. Chorus frogs and tiger salamanders occur in wet or riparian habitats. The Aspen Brook Trail is the only reroute area with potential habitat for amphibians. The only known reptile in the park is the western terrestrial garter snake (*Thamnophis elegans*), which occurs in riparian habitat.

Fish

Native fish species that occur in the park are greenback cutthroat trout (*Oncorhynchus clarki stomias*) and Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*). Exotic fish that occur in the park are brown trout (*Salmo trutta*), eastern brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), and Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*). Brown and brook trout occur in the Roaring River, including the area below Horseshoe Falls near the Alluvial Fan Trail (Watry, pers. comm. 2015). No fish are present in Aspen Brook, and no streams that could provide fish habitat are present in or near the Twin Sisters Trail reroute.

Special Status Species

Wildlife special status species include wildlife listed as threatened, endangered, or candidate under the ESA and species listed as threatened or endangered by the Colorado Division of Parks and Wildlife (CPW). Wildlife special status species potentially affected by the proposed trail reroutes, based on surveys, staff knowledge, US Fish and Wildlife Service (USFWS) data, available habitat, and known range are presented in Table 8.

The NPS first provided an overview of the Reroutes and Repairs to Flood Damaged Trails project to the USFWS during the Level 1 Team meeting on April 15, 2015. On September 8, 2015, the NPS sent a letter to the USFWS, seeking concurrence on NPS determinations of effect to endangered, threatened and rare species that could be affected by the proposed trail work. The NPS used the current Unit Specific Species List for Rocky Mountain National Park for this determination. On October 9, 2015 the USFWS concurred in writing with the NPS that the proposed project may affect but is not likely to adversely affect the greenback cutthroat trout, Mexican spotted owl, and Canada lynx. The proposed action would not occur in critical habitat for any of these species.

Since that time, two additional wildlife species that occur in the park have been placed under review by the USFWS under the Endangered Species Act: the **boreal toad** (*Anaxyrus boreas boreas*) and the **southern white-tailed ptarmigan** (*Lagopus leucura altipetens*). The boreal toad has the potential to occur in the park and is included in Table 8 and addressed in the EA. However, habitat for the southern white-tailed ptarmigan is not found with the project area of the five trails damaged by the 2013 flood. All of the trails in the project area are below treeline. The southern white-tailed ptarmigan lives at or above treeline. The southern white-tailed ptarmigan is a tier 1 species in the State Wildlife Action Plan. Tier 1 species in Colorado are of high conservation priority in the state.

The NPS submitted a Unit Specific Species List for Rocky Mountain National Park to the USFWS in February 2016 for review and consideration. The park is awaiting a response on this submission, which includes the boreal toad and the southern white-tailed ptarmigan.

Table 8. Special Status Wildlife Species with the Potential to Occur in the Project Area.

Species Common and Scientific Name	Status ¹	Potential to Occur	Rationale for Exclusion ²	Habitat Description and Range
FISHES				
Greenback cutthroat trout <i>Oncorhynchus clarki stomias</i>	FT, ST	Yes (Lawn Lake, Ypsilon Lake, and Alluvial Fan Trails)	—	Clear swift-flowing mountain streams with cover such as overhanging banks and vegetation. In the park, this species is found primarily on the east side of the Continental Divide, including the Roaring River.
AMPHIBIANS				
Boreal toad <i>Anaxyrus boreas boreas</i>	SE	Yes (Aspen Brook Trail)	—	Lodgepole pine or spruce-fir forest habitats between approximately 7,500 and 12,000 feet. Habitat includes breeding ponds, summer range, and overwinter refugia.
MAMMALS				
Canada lynx <i>Lynx canadensis</i>	FT, SE	Yes	—	Occurs in mature conifer forests that provide habitat for snowshoe hare (<i>Lepus americanus</i>). There have been confirmed sightings in the park in recent years.
Wolverine <i>Gulo gulo</i>	SE	Yes	—	Occurs in areas with deep persistent snow into the warm season. Habitat for this species is restricted to higher elevations in the park. Recent sightings of a wolverine in the park occurred in 2009 and 2014.
BIRDS				
Mexican spotted owl <i>Strix occidentalis lucida</i>	FT, ST	Yes	ODR	This species is found in steep-sided canyons with old-growth mixed conifer forests. Surveys in 2007 and 2008 did not find this owl in the park, although suitable habitat is present.

The USFWS species list was determined based on consultation with USFWS (2016) and species not having the potential to occur were excluded from further review with a no effect determination.

¹**Status Codes:** FE=federally listed endangered; FT=federally listed threatened; SE=state endangered; ST=state threatened; SC=state species of special concern.

²**Exclusion Rationale Codes:** ODR=outside known distributional range of the species; HAB=no habitat present in analysis area; and SEA=species not expected to occur during the season of use/impact.

Greenback cutthroat trout is the only native trout species present in the park east of the Continental Divide. The introduction of nonnative rainbow trout, brook trout, and brown trout in the early 1900s and overfishing resulted in a decline in the native cutthroat trout population. Nonnative trout species compete with greenback cutthroat trout and interbreeding results in hybridization and loss of genetic purity. The park ended nonnative species stocking in the early 1960s and is currently working to restore greenback cutthroat trout populations. In the park, greenback cutthroat trout occur primarily in the North Fork of the Big Thompson River, Roaring River, Fern Creek, Hidden Valley Creek, and the Wild Basin area—areas primarily east of the Continental Divide.

Greenback cutthroat trout occur in the Roaring River above Horseshoe Falls near the Lawn Lake and Ypsilon Lake Trails reroutes. Spawning occurs in the spring, but specific spawning areas have not been identified. The cutthroat trout populations in the Roaring River were greatly reduced by the flooding in September 2013, and are expected to recolonize the lower reaches of the Roaring River over time (Watry, pers. comm. 2015). The area below Horseshoe Falls, near the Alluvial Fan Trail, is a popular fishing spot because greenback cutthroat trout can occasionally be caught there in

addition to brook and brown trout. Greenback cutthroat trout and suitable habitat are not present near the Aspen Brook Trail or Twin Sisters Trail.

Canada lynx were reintroduced into southwestern Colorado by the CPW starting in 1999, with the purpose of establishing a viable population. During that first winter, the CPW had 19 records of four radio-collared Canada lynx moving north from their release site and spending some time in or near the park between October 8, 1999 and April 28, 2000. Subsequent documented occurrences of Canada lynx have occurred in the park, including a sighting near the Grand Ditch, located west of the Continental Divide in 2006, and a sighting of a Canada lynx near the park in 2009. The park provides prime habitat for the Canada lynx and future sightings are expected. Although extensive surveys have not documented a relict population of the Canada lynx or a permanent population within park boundaries, the NPS considers Canada lynx to be resident within the park.

Human presence can have a major impact on Canada lynx survival and behavior. Human activities, particularly in the winter, can cause Canada lynx to avoid prime habitats (Oliff et al. 1999). However, repeated and consistent human disturbance would not necessarily preclude Canada lynx from using an area, as they may adapt behaviorally or physiologically (Bowles 1995).

All of the project areas are considered overall range for Canada lynx according to broad CPW and US Forest Service mapping. The most suitable habitat is located at higher elevation lodgepole and spruce/fir habitat. Lower elevation ponderosa pine forest such as in the Alluvial Fan Trail area is less likely to support Canada lynx, although riparian habitat along the Roaring River provides potential movement corridors for Canada lynx.

The **wolverine** is a wide-ranging mammal found primarily in heavily forested habitat at high elevations. Wolverines are opportunistic feeders and consume a variety of foods, depending on availability. They primarily scavenge carrion but also prey on small animals and birds and eat fruits, berries, and insects. Wolverines have large home ranges and require a lot of space. The availability and distribution of food is likely the primary factor in determining wolverine movements and home range size (USFWS 2010). Historical records indicate the presence of the wolverine in Moraine Park in the late 1800s (Armstrong 1987). A wolverine was seen near the park in 2009 in the Never Summer Range located along the park's northwest boundary. Wolverine tracks were documented in the Kawuneeche Valley on the west side of the park in March 2014. Because wolverines can travel long distances, it is unknown where this wolverine is today. Because of the species' requirement for persistent cold and snow, the wolverine is likely restricted to high elevations in the park. Although they are likely restricted mostly to higher elevations in the park, wolverines could potentially forage in or move through the trail reroute areas.

Mexican spotted owl suitable habitat is present in the park, but at present, owls are not known to occur within the park based on previous surveys (Blakesley 2008). The park contains Forested Recovery Habitat, and suitable Forested Recovery Habitat exists near the Alluvial Fan and Aspen Brook Trails. Scott Rashid (Colorado Avian Research and Rehabilitation Institute) surveyed for the owl in the Alluvial Fan Trail area in 2014, but none were found.

WILDERNESS

In 2009, Congress designated the Rocky Mountain National Park Wilderness Area, covering about 252,085 acres, or 95% of the park. The Wilderness Act directs the NPS to protect and manage wilderness so that it "generally appears to have been affected primarily by the forces of nature, with

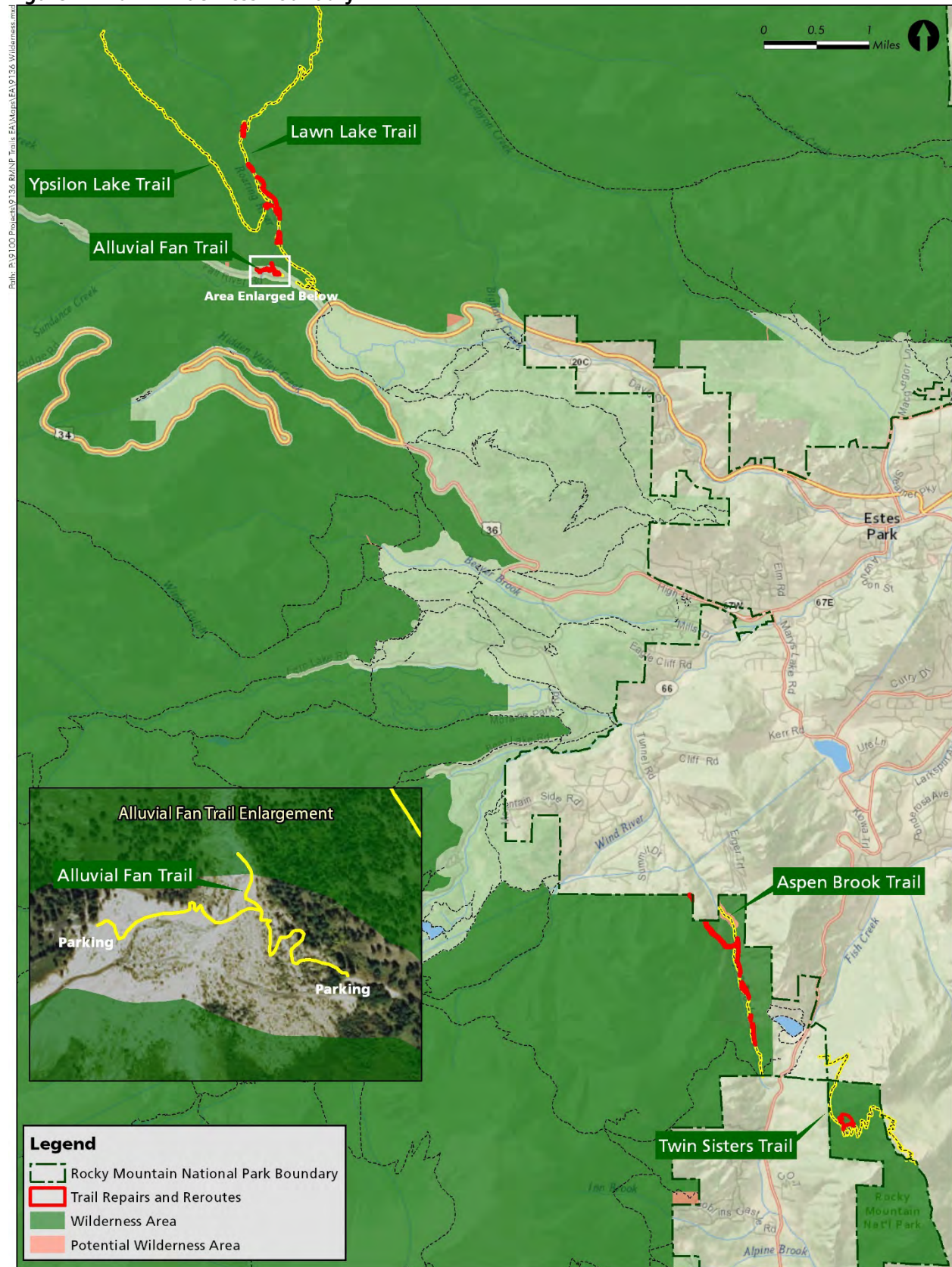
the imprint of man's work substantially unnoticeable," and so that it "has outstanding opportunities for solitude, or a primitive and unconfined type of recreation." Director's Order 41: *Wilderness Stewardship* (NPS 2013c) provides accountability, consistency, and continuity in the NPS wilderness stewardship program and guides NPS-wide efforts in meeting the letter and spirit of the Wilderness Act (16 U.S.C. 1133(b)). The Wilderness Act directs that "each agency administering any area designated as wilderness shall be responsible for preserving [its] wilderness character." The five qualities of wilderness character are (1) untrammeled, (2) undeveloped, (3) natural, (4) offers outstanding opportunities for solitude or primitive and unconfined recreation, and (5) other features of scientific, educational, scenic, or historical value.

One of the stated purposes of Rocky Mountain National Park is to preserve the high-elevation ecosystems and wilderness character of the southern Rocky Mountains within its borders. Maintaining wilderness values are key to many visitors' experiences and to park management. In addition to the natural features of the wilderness, such as animals, plants, waters, and geologic features, the park contains intangible qualities of wilderness such as natural quiet, solitude, space, light, night sky, and scenery. Both tangible and intangible resources are equally important in wilderness management decisions affecting park resources. The wilderness areas are free of most man-made noises from machinery and motor vehicles and light pollution in the night sky. Activities causing excessive or unnecessary unnatural sounds in and adjacent to the park are monitored, and actions are taken to prevent or minimize unnatural sounds that adversely affect park resources or values or visitors' enjoyment of them (NPS 1994).

The Backcountry/Wilderness Management Plan for Rocky Mountain National Park (NPS 2001) defines wilderness management policies and actions at the park. The plan identifies the park's wilderness vision, long-range management goals, intermediate objectives, and actions and options to meet those objectives. The Wilderness Management Plan is also used as a working guide for staff who manage the wilderness resource.

Within the project area, all of the Lawn Lake (5.3 miles), Ypsilon Lake (2.8 miles), Aspen Brook (1.74 miles), and Twin Sisters (3.46 miles) Trails are within designated wilderness. The Alluvial Fan Trail (0.34 mile) is a "frontcountry" trail with the exception of a portion of the trail near the falls, which lies within wilderness. Designated wilderness areas, including the flood-damaged trails within the park, are shown in Figure 12.

Figure 12. Park Wilderness Boundary.



VISITOR USE AND EXPERIENCE

The park's wide range of elevations and habitats offer a variety of opportunities for visitors. Common summer activities in the park include viewing scenery, wildlife viewing/bird watching, hiking, frontcountry and backcountry camping, technical rock climbing and bouldering, fishing, and photography. Visitors also drive Trail Ridge Road, which topping out at 12,183 feet is the highest continuous paved road in the United States. Although most visitors come in the summer, snowshoers and cross-country skiers also visit the park in the winter. More than 350 miles of trails offer opportunities to hikers and backpackers, and many trails are available to horseback riders. Trails within the park accommodate a range of user levels, from frontcountry trails with minimal inclines to high alpine backcountry trails with steep rocky terrain.

The park is easily accessible from the Denver metropolitan area, about 65 miles to the southeast. Because of the park's popularity and proximity to communities along the Colorado Front Range, visitation exceeds 3 million annually. Although visitation fluctuates from year to year, visitor numbers have hovered around 3 million annually since 1994 (NPS 2015b). Visitation dropped in 2013, which could be attributed to damage from flooding (3,229,617 in 2012 compared with 2,991,141 in 2013). Rocky Mountain National Park received its highest annual visitation in 2015. The park received more than 4,155,900 visitors for 2015, which was a 21% increase over 2014. All months in 2015 set visitation records except for February and April. Fall visitation, particularly on weekends, continues to increase at the park. The park began its Centennial Celebration in September of 2014, which continued through September of 2015. Additional contributing factors of the rise in park visitation include lower gas prices and increased population along the Front Range of Colorado.

An NPS visitor study conducted in the park in the summer of 2010 by the Park Studies Unit at the University of Idaho determined that the average length of stay in the park was 1.6 days. In addition, results of the survey determined that the most common visitor activities were viewing scenery, driving Trail Ridge Road, wildlife viewing/bird watching, and day hiking. Visitors gave ratings of "extremely important" and "very important" to protecting native wildlife, natural scenery/undeveloped vistas, clean water, and clean air. For 46% of visitor groups, crowding detracted from their experience. The most commonly preferred topic to learn about was wildlife.

The trails addressed in this EA are some of the oldest and most popular trails in the park. They are used by thousands of day hikers to access some of the most spectacular and unique wilderness areas in the park. The backcountry campsites accessed by these trails are some of the most popular in the park. Flood-damaged trails in this analysis and their uses by visitors to the park are described below.

Lawn Lake Trail

Lawn Lake was the site of a dam failure in 1982. Following the dam failure, the dam was removed and the trail rebuilt. The Lawn Lake Trail is 5.3 miles long with an elevation gain of 2,249 feet. Lawn Lake sits at the top of the trail at an elevation of 10,789 feet. Permitted uses on the trail are hiking and equestrian. More than 31,000 visitors use this trail from May through October each year.

The lower half of the Lawn Lake Trail closely follows the bank of the Roaring River, which suffered severe erosion and/or collapse during 2013 flooding. Social trails have developed near the edge of the eroded banks, which continue to slough off, creating a safety hazard for users.

Ypsilon Lake Trail

The Ypsilon Lake Trail starts 1.4 miles up the Lawn Lake Trail at an elevation of 9,200 feet. At the junction, the trail heads west and crosses the Roaring River. Prior to the 2013 flood, a 50-foot log stringer bridge crossed the Roaring River. The Ypsilon Lake Trail is 2.8 miles long. Permitted uses are hiking and equestrian. Visitor use numbers are not currently available for this trail.

Flood damage has caused several sections of the riverbank to fail and the pedestrian bridge to wash out. Trail users have created a temporary bridge with felled trees to cross the Roaring River and continue to access the Ypsilon Lake Trail.

Alluvial Fan Trail

The Alluvial Fan Trail is a short (0.34-mile) “frontcountry” partially paved trail with a waterfall overlook. The trail was built after the flood in 1982. The developed trail is located in a popular area with parking and picnic facilities on both the east and west sides of the alluvial fan. Trail use is permitted for hikers only. The west side of the trail previously met ABA accessibility standards, and the short distance and relatively easy incline of the trail made it popular with visitors looking to experience the views and waterfall at the top of the trail with minimal effort. Visitor use numbers are not currently available for this trail.

Flood damage destroyed several paved portions of the Alluvial Fan Trail (which had previously experienced significant deterioration) including the ABA accessible portion of the west side (Figure 13). The pedestrian bridge was buried by flood deposition and major sections of asphalt trail were destroyed on the eastern half of the trail. In addition, the Roaring River diverted its channel to the west, completely destroying the western half of the trail.

Figure 13. Damaged Section of Alluvial Fan Trail.



Aspen Brook Trail

The Aspen Brook Trail follows the Aspen Brook drainage starting at the junction with the Storm Pass Trail and ending at the historic Wigwam Teahouse at the park boundary. The teahouse is currently mothballed and there is no visitor access to the interior of the building. The trail is 1.74 miles long and permitted uses are hiking and equestrian. Actual visitor use for this trail was not available; however, based on surveys taken at the Storm Pass Trail, there were more than 10,000 users in 2004 from June through September (Bates et al. 2006). Although the trail does not experience heavy use by hikers, it is used by Cheley Colorado Camps and Wind River Ranch for guided horseback rides. A social trail used by equestrians and hikers connects to trails on private lands north of the park boundary.

Flood damage to the trail includes significant erosion, trenching, and structural damage and has made the trail difficult to navigate. In addition, the trail leading to the horse hitchrack collapsed and is inaccessible by equestrian users. Social trails have developed around portions of the damaged trail.

Twin Sisters Trail

In the 1990s, the Twin Sisters Trail was rerouted to move the access road and a portion of the trail off of private property, and the trailhead was moved north and east of the now mothballed Lily Lake Visitor Center. The trail is 3.46 miles long, with an elevation gain of about 2,400 feet, and accesses north Twin Sisters Peaks at an elevation of about 11,500 feet. Permitted uses on the trail are hiking

and equestrian. From June 1 through mid-October each year, about 14,000 visitors use the trail for recreation (Bates et al. 2006).

As a result of the 2013 floods, a landslide destroyed more than 2,100 linear feet and five switchbacks of the Twin Sisters Trail. Visitors have created social trails using cairns along the periphery of the landslide, and the current and future instability of the landslide area may result in visitor safety issues.

ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This section contains the environmental impacts, including direct, indirect, and cumulative effects, for each alternative. The analysis is based on the assumption that the mitigation measures and BMPs described in the Alternatives section of this EA would be implemented for the preferred alternative. Overall, the NPS based these impact analyses and conclusions on the review of existing literature and studies, information provided by experts within the park and other agencies, professional judgment and park staff insights, and public input.

Direct, indirect, and cumulative effects are analyzed for each resource topic carried forward, which requires considerations of impact type, context, and duration.

CUMULATIVE IMPACTS

The CEQ regulations that 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 action alternatives.

Cumulative impacts were determined by combining the impacts of the actions included in the alternatives with other past, present, and reasonably foreseeable future actions. Therefore, it is necessary to identify other past, present, or reasonably foreseeable future projects at the park that could result in cumulative impacts. The geographic scope for this analysis includes actions within the park's boundaries and, in particular, those actions in the vicinity of each of the trail alignments. The temporal scope includes projects within a range of approximately 10 years. Several past and ongoing plans and programs could contribute to cumulative effects, including:

- Bark Beetle Management Plan, 2005 - ongoing
- Fire Management Plan, 2012 - ongoing
- Invasive Exotic Plant Management Plan, 2003 and planned updates to the plan to address the increasing spread of exotic plants - ongoing
- Trails Management Plan, 1982 - ongoing
- Commercial Horse Use Management Plan and Environmental Assessment, 1993 - ongoing
- Trail System Maintenance and Reconstruction Plan, 2000 - ongoing
- Repairs to the Fall River Road (completed in 2014)
- Standards and Protocols for Frontcountry Hazard Tree Management, 2011- ongoing

In addition, future projects that may cumulatively impact park resources include:

- Restoring other trails and facilities in the park damaged from 2013 storms
- Lily Lake Improvement Plan

ASSESSMENT OF EFFECTS

As described in the Alternatives chapter, alternative actions were identified for the five trails, including Alternative A – No Action and Alternative B – Establish and Maintain a Travel Route. Alternative B is the NPS’s preferred alternative for all of the trails. A summary of resource impacts by trail and alternative is included in Tables 2 through 6 in the Alternatives chapter.

SOILS

General Impacts Common For All Trails Under Alternative A – No Action

The no action alternative for each of the trails would allow continued visitor access. Social trails around damaged or missing trail segments would be allowed with minimal improvements to the route. Accelerated erosion and soil loss is possible from both the damaged trails and social trails. Social trails often develop on steeper gradients than designed trails, which could lead to formation of narrow gullies and soil erosion. In addition, multiple social trails can develop, resulting in braided paths with soil impacts occurring over a larger area than the original trail. Existing trails damaged by flooding may continue to erode without stabilization measures. Minor trail maintenance and improvements would help reduce adverse soil impacts. Overall, because erosion and compaction would not extend far beyond the trail footprint, adverse impacts on soil productivity would be minor under the no action alternative.

General Impacts Common For All Trails Under Alternative B – Establish and Maintain a Travel Route

Alternative B would involve various levels of improvements and trail rerouting. Limited improvements would require localized earthwork to reestablish the tread and install water bars, drainage features, and erosion-control measures. Most of the improvement work would be conducted within the footprint of the trail, although some earthwork may be necessary outside of the footprint to meet trail design standards. This work would be conducted primarily with hand tools because all of the trails are located in wilderness. Because of the limited area of new disturbance and implementation of drainage and erosion-control measures, adverse impacts on soils would be minor, with a beneficial effect from improved trail stability over the life of the trail.

Trail rerouting would disturb new areas of soil. New trail construction would typically involve various degrees of cut and fill excavation depending on the gradient and cross slope. New trail design would incorporate drainage and erosion-control measures. Because this work would mostly be conducted by hand, the area of soil disturbance would be contained to the narrow trail corridor. New trails would have a localized adverse impact on soil productivity over the life of the trail. Specific soil impacts for each trail are described below.

Specific Impacts Under Alternative A and Alternative B

Lawn Lake Trail

Alternative A – No Action (Sections 1 through 4)

Continued use of social trails around damaged or washed-out sections of the Lawn Lake Trail would result in soil compaction and loss of soil productivity. Accelerated erosion is possible in some

locations, although trail gradient and cross slopes are mostly moderate. Informal trails near the steeply eroding Roaring River streambank are at risk for further erosion in the loose unconsolidated alluvial material. Trail braiding is possible, which would increase the area of soil disturbance. Minor trail improvements would help reduce the potential for erosion, but an adverse effect on soil resources is likely. Under this no action alternative, it's estimated that, overall, approximately 0.05 acre of soils would be adversely affected as described. This impact, though adverse, is considered minor given that these soil types are common in the park.

Alternative B – Establish and Maintain a Travel Route

Section 1 Reroute (NPS Preferred Alternative) – A reroute for this trail section would disturb 0.06 acre of soil along approximately 280 feet of new trail. Though adverse, this is considered a minor impact given that these soil types are common in the park. Restoration of a similar amount of existing trail near the steep streambank would protect about 0.05 acres of soil and reduce the potential for erosion. Construction of a new trail away from the Roaring River would eliminate the potential for future trail damage from further erosion of the streambank.

Section 2 Limited Improvements (NPS Preferred Alternative) – About 0.02 acre of soil would be disturbed from incorporating two social trail segments in this section (220 and 175 feet in length) into the trail maintenance schedule. Though adverse, this is considered a minor impact given that these soils are common in the park. Revegetation of about 390 feet of remaining portions of the existing trail and other braided social trails would protect about 0.02 acres of soil due to the reduced potential for erosion.

Section 3 Reroute (NPS Preferred Alternative) – About 0.05 acre of soil would be impacted by construction of 460 feet of new trail. Though adverse, this is considered a minor impact given that these soils are common in the park. Restoration of a similar amount of existing trail would protect about 0.05 acre of soil and reduce the potential for erosion. Moving the trail away from the steep banks of the Roaring River would also reduce the potential for future trail damage.

Section 4 Reroute (NPS Preferred Alternative) – A 950-foot reroute of the trail would impact about 0.11 acre of soil. Though adverse, this is considered a minor impact given that these soils are common in the park. Restoration of about 575 feet of abandoned trail would protect about 0.04 acre soil and reduce the potential for erosion. A new sustainably designed trail would provide stability over the life of the trail. Construction of a stable sustainable trail would benefit soil resources.

Ypsilon Lake Trail

Alternative A – No Action

Without replacement of the bridge across the Roaring River and construction of adjacent trail connections, hikers would continue to cross on downed logs or ford the stream using social trails on each side of the stream to reach undamaged trail sections. Informal trails on each side of the stream are likely to result in accelerated erosion, particularly on the west side of the creek where channel scouring has steepened the bank. Under this no action alternative, it's estimated that, overall, about 0.01 acre of soils would be adversely affected as described. This impact, though adverse, is considered minor given that these soil types are common in the park.

Alternative B – Establish and Maintain a Travel Route

Reroute (NPS Preferred Alternative) – Bridge replacement and construction of new trail connections on each side of the Roaring River (about 350 feet total) would impact about 0.08 acre of soil resources over the life of the trail. Though adverse, this is considered a minor impact given that these soils are common in the park. Revegetating abandoned trail sections would help restore about 0.01 acre of vegetation and reduce erosion and soil loss. The new trail would be designed for stability and to minimize erosion and reduce the impact of multiple social trails.

Alluvial Fan Trail*Alternative A – No Action*

Without a defined trail, multiple social paths are likely to develop through the alluvial fan. There would be no adverse impacts on soil resources in this active floodplain because there are no developed soils in the flood-deposited boulders, stones, gravels, and sand.

Alternative B – Establish and Maintain a Travel Route

Reroute (NPS Preferred Alternative) – Construction of about 1,950 feet of new trail through the alluvial fan, plus a 350-foot overlook spur and the overlook itself, would impact about 0.42 acre of sediment and rocks deposited during the 2013 floods. No adverse impacts on soils are anticipated because of the absence of soil material in the alluvial floodplain.

Aspen Brook Trail*Alternative A – No Action*

Additional erosion and soil loss is likely if no trail improvements or reroutes are implemented. Gullies and slumping as a result of the 2013 storm event would remain active, and continued erosion, soil loss, and stream channel sedimentation is likely to occur during precipitation events. Social trails around damaged trail segments would add to soil compaction and loss of soil productivity. Under this no action alternative, it's estimated that, overall, about 0.30 acre of soils would be adversely affected as described. This impact, though adverse, is considered minor given that these soil types are common in the park.

Alternative B Establish and Maintain a Travel Route

Reroute (NPS Preferred Alternative) – Four sections of reroutes would be used to bypass the most damaged trail sections. This would result in an impact on 1.18 acre of soil along about 5,160 feet of new trail construction. About 3,360 feet (0.77 acres) of abandoned trail would be stabilized and revegetated to reduce erosion and soil loss. Extension of the trail about 4,200 feet would result in a long-term disturbance to 0.96 acre of soil resources from trail construction, although a portion of the new trail would follow an existing social trail. The trail extension would be constructed with less gradient than the social trail and would be designed for stability to minimize the potential for erosion. Installation of a new hitchrack would result in a few hundred square feet of compaction and

soil disturbance from use by horses. Adverse soil impacts from trail construction would be considered minor given that these soil types are common in the park.

Resource Restoration and Abandon (Adaptive Management) – The existing damaged trail would be restored, revegetated, and closed to visitor access. Minor soil disturbance would occur from removal of trail structures such as retaining walls, water bars, and stonework that are not contributing features to a historic property. The natural ground contour would be restored to the extent practicable, and the disturbed area would be replanted manually or allowed to naturally regenerate. Overall, reclamation of the trail would have a beneficial effect on about 0.64 acre of soil resources by reducing the potential for continued erosion and soil loss.

Twin Sisters Trail

Alternative A – No Action

Because portions of the trail were completely eliminated by the landslide, multiple social trails have developed around the lost trail. Accelerated soil erosion is likely on these social trails because they typically develop on steeper slopes and because multiple trail routes on either side of the slide are currently present. Minor trail maintenance of these social trails would reduce erosion and soil loss, but an adverse effect on soil resources is likely from erosion. Under this no action alternative, it's estimated that, overall, about 0.07 acre of soils would be adversely affected. This impact, though adverse, is considered minor given that these soil types are common in the park.

Alternative B – Establish and Maintain a Travel Route

Limited Improvement (NPS Preferred Alternative) – Incorporation of the social trails within the trail maintenance program would allow for minor trail improvements, drainage, and erosion-control measures to improve trail stability. Improvements on about 575 feet of social trail to connect existing sections of undamaged trail would result in a loss in soil productivity within about 0.05 acres for the life of the trail. This impact would be offset by protecting about 0.03 acre soil due to the restoration of about 1,110 feet of existing trail and elimination of social trails. Overall, this alternative would have a net benefit on soil resources.

Reroute (Adaptive Management) – A trail reroute would require construction of about 2,730 feet of new trail, which would be designed for long-term stability and reduced maintenance. About 0.63 acre of soils along the new alignment would be disturbed, resulting in a loss in productivity. Though adverse, this is considered a minor impact given that these soils are common in the park. Incorporation of drainage and erosion-control measures in the trail design would minimize soil impacts. About 2,200 feet of the existing trail would be reclaimed and social trails would no longer be used, protecting about 0.10 acre of soil from erosion and other use-related impacts. This alternative would benefit soil resources by providing a stable trail and eliminating and restoring abandoned trail segments and social trails.

Cumulative Impacts

Alternative A – No Action. The impacts of the past, present, and reasonably foreseeable future actions on soils within the Lawn Lake, Ypsilon Lake, Alluvial Fan, Aspen Brook and Twin Sister Trails and nearby sites have primarily occurred as a result of visitor use, ongoing trail maintenance and repairs, and implementation of resource management plans. Impacts from these actions, including

equestrian use in permitted locations, include soil compaction and erosion, along with widening and braiding of the trails. Collectively, all of these uses and activities have had, and would continue to have, minor adverse impacts on soils. As previously described, the 0.43 acres of direct and indirect impacts of the no action alternative on soils would primarily result from accelerated erosion and compaction along social trails. When added to the existing cumulative effects, the impacts of the no action alternative would have a minor adverse contribution, but would not substantially change, the overall cumulative effects already occurring. Thus, when the effects of the no action alternative are combined with these other past, present, and reasonably foreseeable future impacts, the total cumulative impact on soils would continue to be minor and adverse over the life of the five trails.

Alternative B – Establish and Maintain a Travel Route (NPS Preferred Alternative). The impacts of the past, present, and reasonably foreseeable future actions on soils within the Lawn Lake, Ypsilon Lake, Alluvial Fan, Aspen Brook and Twin Sister Trails and nearby sites have primarily occurred as a result of visitor use, ongoing trail maintenance and repairs, and implementation of resource management plans. Impacts from these actions, including equestrian use in permitted locations, include soil compaction and erosion, along with widening and braiding of the trails. Collectively, all of these uses and activities have had, and would continue to have, minor adverse impacts on soils. As previously described, the direct and indirect impact of the preferred alternative on soils would be less than 3 acres spread over five trails. Closing and restoration of abandoned and damaged trails would benefit about 1 acre of soils. When added to the existing cumulative effects, the impacts of the preferred alternative would contribute slightly to, but would not substantially change, the overall cumulative effects already occurring. Thus, when the effects of the preferred alternative are combined with these other past, present, and reasonably foreseeable future impacts, the total cumulative impact on soils would continue to be minor and adverse over the life of the five trails. Cumulative impacts to soils would remain minor even if one or more of the adaptive management strategies were to be implemented.

VEGETATION, INCLUDING NOXIOUS WEEDS

General Impacts Common For All Trails Under Alternative A – No Action

Vegetation impacts would occur from minor trail maintenance and repairs and from trampling along social trails. Visitor use and trail maintenance would continue. Negligible amounts of vegetation would be removed during ongoing trail maintenance. Indirect impacts on vegetation could result from continued erosion in flood-damaged areas and from social trails. Any future noxious weed infestations identified would be managed in accordance with the Park's Invasive Exotic Plant Management Plan (NPS 2003) and future revisions.

General Impacts Common For All Trails Under Alternative B—Establish and Maintain a Travel Route

Limited trail improvements or trail reroutes would require vegetation clearing for the new or reconstructed trail segments. Direct impacts on vegetation would occur from permanent vegetation removal to construct the trail tread. The final trail width and disturbance area would vary with trail design and topography and would be determined during actual trail construction. Tread widths, except for the Alluvial Fan Trail, would be about 3 to 5 feet depending on drainage and topography, plus additional cut and fill depending on the cross slope. The Alluvial Fan Trail, which would be designed to ABA accessibility standards, would be about 6 feet wide. Much of the existing trail and potential reroutes are located in heavily forested areas with limited herbaceous or shrub vegetation cover; therefore, vegetation removal would be limited. Trail reroute locations were chosen to

minimize removal of mature trees, although some trees along the trail reroutes may need to be removed for safety reasons. Closing and revegetating abandoned trail sections would result in a beneficial effect on vegetation.

Construction activities could facilitate the establishment or spread of noxious weeds and nonnative vegetation because many of these species are able to outcompete native vegetation on disturbed sites. Noxious weeds have the highest potential for establishment in and along the areas of proposed soil disturbance. Direct adverse impacts include the potential for new infestations to become established and for existing infestations to expand onto adjacent lands, thereby threatening resource values and uses. The spread of noxious weeds would reduce vegetative species diversity and encroach on native flora and fauna. Revegetation efforts would be monitored to determine success and identify any noxious weeds that become established. Noxious weed infestations would be managed in accordance with the Park's Invasive Exotic Plant Management Plan (NPS 2003). Specific impacts for each trail are described below.

Specific Impacts Under Alternative A and Alternative B

Lawn Lake Trail

Alternative A – No Action

Adverse impacts on vegetation would occur from minor trail maintenance and repairs and from trampling along social trails on all trail sections (Sections 1 through 4). Vegetation disturbance along social trails would have an adverse impact, although herbaceous and shrub vegetation in the understory of the predominantly lodgepole pine forest is sparse. Under this no action alternative, it's estimated that, overall, about 0.05 acre of vegetation would be adversely affected as described. This impact, though adverse, is considered minor given that these vegetation types along the Lawn Lake Trail are common in the park.

Alternative B – Establish and Maintain a Travel Route

Section 1 – Reroute (NPS Preferred Alternative) – A new trail section about 280 feet long would be constructed, resulting in a permanent loss of about 0.06 acre of vegetation within the trail disturbance area. Though adverse, this is considered a minor impact given that the impacted vegetation types are common in the park. Abandoning and revegetating about 290 feet of existing trail would permanently restore vegetation about 0.05 acre within the abandoned trail segment. This would partially compensate for vegetation loss along the new trail. Impacts on vegetation would primarily result from removal of understory species such as bearberry and common juniper. Mature conifers would be avoided wherever practicable.

Section 2 – Limited Improvements (NPS Preferred Alternative) – Improvements to two social trails, 220 and 175 feet in length, would result in a permanent loss of about 0.02 acre of vegetation. Though adverse, this is considered a minor impact given that these vegetation types are common in the park. Impacts on vegetation would primarily result from clearing understory vegetation such as bearberry, Woods' rose, and common juniper. Mature conifers and aspens would be avoided to the extent practicable. Closing and revegetating about 390 feet of remaining portions of the existing trail and other braided social trails would permanently restore and protect about 0.02 acre of vegetation.

Section 3 Reroute (NPS Preferred Alternative) – Constructing a new trail section about 460 feet long would result in a permanent vegetation loss of about 0.05 acre. Though adverse, this is considered a minor impact given that the lost vegetation types are common in the park. Impacts on vegetation would primarily result from clearing understory vegetation such as bearberry, Woods’ rose, and Oregon grape. Mature conifers would be avoided to the extent practicable. Closing and revegetating a similar amount of existing trail would permanently restore and protect about 0.05 acres of vegetation.

Section 4 Reroute (NPS Preferred Alternative) – Trail rerouting would result in a permanent loss of 0.11 acre of vegetation along about 950 feet of trail. Though adverse, this is considered a minor impact given that the lost vegetation types are common in the park. Impacts on vegetation would occur primarily from clearing understory vegetation such as broom huckleberry, heartleaf arnica, and common juniper. Mature trees would be avoided to the extent practicable. A new sustainably designed trail would provide stability over the life of the trail and thereby benefit vegetation. Construction of a stable, sustainable trail would benefit vegetation. Closing and revegetating about 575 feet of abandoned trail would protect about 0.04 acre of vegetation and permanently restore vegetation within the trail alignment.

Ypsilon Lake Trail

Alternative A – No Action

The no action alternative would not result in new vegetation disturbance other than from minor trail maintenance and social trails. In the absence of a bridge, multiple social trails across the Roaring River could develop, impacting about 0.01 acres of wildlife habitat. Though adverse, the loss of this amount of vegetation is minor, given the total amount of streambank vegetation in the park.

Alternative B – Establish and Maintain a Travel Route

Reroute (NPS Preferred Alternative) – Constructing a new trail would result in a permanent loss of about 0.08 acre of vegetation along the new trail. Though adverse, this is considered a minor impact given that the impacted vegetation types are common in the park. Understory vegetation, such as fireweed, wild strawberry, and prairie junegrass, could be affected by trail and bridge construction, although impacts would be minimal because flood scouring removed most of the vegetation along the river. Revegetating abandoned trail sections would permanently restore about 0.01 acre of vegetation within the trail alignment.

Alluvial Fan Trail

Alternative A – No Action

The no action alternative would have negligible vegetation impacts from trail maintenance and minor improvements, because most of the area through which the trail travels consists of rock debris and cobble deposited by the flood, with only scattered patches of willow and nonnative cheatgrass and Canada thistle. Vegetation disturbance along social trails is possible.

Alternative B – Establish and Maintain a Travel Route

Reroute (NPS Preferred Alternative) – New trail and overlook construction would result in a permanent loss of about 0.42 acre of vegetation within the trail tread and overlook area. Most nonwoody vegetation within the project area was removed by the 2013 flooding, and impacts on vegetation would mostly occur to remaining understory species such as the nonnative species cheatgrass and Canada thistle.

Removing the existing bridge abutments may result in temporary disturbance to riparian vegetation along the Roaring River; however, vegetation is currently sparse as a result of channel scouring from the flood, so impacts would be negligible. A new timber bridge would span the river to avoid impacts on riparian and wetlands.

Aspen Brook Trail

Alternative A – No Action

The no action alternative would have negligible impacts on vegetation from trail maintenance, although continued erosion of the trail without major improvements could lead to a loss of vegetation. Social trails around damaged areas would have an adverse impact on 0.30 acres of vegetation from trampling and braided trails.

Alternative B – Establish and Maintain a Travel Route

Reroute (NPS Preferred Alternative) – Construction of trail reroutes would result in a permanent loss of 1.18 acre of vegetation along the rerouted trail segments (5,160 feet). Impacts on vegetation would occur primarily from clearing understory vegetation such as bearberry, common juniper, and western golden ragwort. Impacts on mature trees such as Douglas-fir and aspen would be avoided to the extent practicable. Construction of a new 4,200-foot trail extension would result in a permanent loss of about 0.96 acre of vegetation, although a portion of the trail would use an existing social trail where vegetation has been previously disturbed. Though adverse, this is considered a minor impact given that the disturbed vegetation types are common in the park. The Aspen Brook Trail extension would avoid wetlands by spanning Aspen Brook with a log bridge with steel girders. A small unnamed drainage along the proposed trail extension does not support wetlands (ERO 2015a). Closing and revegetating abandoned sections of about 3,360 feet of the existing damaged trail would have a beneficial effect on 0.77 acre of vegetation by permanently restoring vegetation within the trail tread.

Resource Restoration and Abandon (Adaptive Management). Abandoning and restoring the entire Aspen Brook Trail would have beneficial effects from permanently restoring about 0.64 acres of native vegetation. However, continued social use is likely along the abandoned trail that may hamper revegetation.

Twin Sisters Trail

Alternative A – No Action

No ground-clearing activities or vegetation disturbance would occur other than incidental impacts from minor trail maintenance and repairs. Social trails would continue to damage vegetation. About

0.07 acres of vegetation would be impacted by the social trails, an adverse, though minor, impact in the overall context of the park's vegetation.

Alternative B – Establish and Maintain a Travel Route

Limited Improvements (NPS Preferred Alternative) – Limited improvements along approximately 575 linear feet of recently developed social trails would result in a permanent loss of about 0.05 acres of vegetation. However, understory vegetation is sparse and current trail use has already impacted vegetation. Abandoning and revegetating about 1,110 feet of existing trail would permanently restore about 0.03 acre of vegetation.

Reroute (Adaptive Management) – Rerouting the trail would permanently remove about 0.63 acre of vegetation from construction of approximately 2,730 feet of new trail. Though adverse, this is considered a minor impact given that the disturbed vegetation types are common in the park. Rerouting the trail would allow permanent restoration of vegetation along about 2,200 feet of existing trail that would be abandoned. This would result in about 0.10 acres of revegetation. Vegetation along the trail reroute is primarily dense lodgepole pine forest, thus vegetation disturbed would typically be sparse understory species such as common juniper, bracted alumroot, and dotted saxifrage. Impacts on mature conifers would be avoided wherever practicable, with the exception of trees that could pose a hazard to trail users.

Cumulative Impacts

Alternative A – No Action. The impacts of the past, present, and reasonably foreseeable future actions on vegetation within the Lawn Lake, Ypsilon Lake, Alluvial Fan, Aspen Brook and Twin Sister Trails and nearby sites have primarily occurred as a result of visitor use, ongoing trail maintenance and repairs, and implementation of resource management plans. Impacts from these actions, including equestrian use on permitted trails, include trampling and removal of vegetation, and minor work on social trails, as well as the introduction and spread of non-native plants. Collectively, all of these uses and activities have had, and would continue to have, minor adverse impacts on vegetation. As previously described, the 0.43 acres of direct and indirect impacts of the no action alternative on vegetation would primarily result from damage to vegetation from trampling and minor trails work along social trails. When added to the existing cumulative effects, the impacts of the no action alternative would have a minor adverse contribution, but would not substantially change, the overall cumulative effects already occurring. Thus, when the effects of the no action alternative are combined with these other past, present, and reasonably foreseeable future impacts, the total cumulative impact on vegetation would continue to be minor and adverse over the life of the trail.

Alternative B - Establish and Maintain a Travel Route (NPS Preferred Alternative). The impacts of the past, present, and reasonably foreseeable future actions on vegetation soils within the Lawn Lake, Ypsilon Lake, Alluvial Fan, Aspen Brook and Twin Sister Trails and nearby sites have primarily occurred as a result of visitor use, ongoing trail maintenance and repairs, and implementation of resource management plans. Impacts from these actions, including equestrian use on permitted trails, include trampling and removal of vegetation, and minor work on social trails, as well as the introduction and spread of non-native plants. Collectively, all of these uses and activities have had, and would continue to have, minor adverse impacts on vegetation. As previously described, the direct and indirect impact of the preferred alternative on vegetation would be less than 3 acres spread over five trails. Closing and restoration of abandoned and damaged trails would benefit about 1 acre of vegetation. When added to the existing cumulative effects, the impacts of the preferred

alternative would contribute slightly to, but would not substantially change, the overall cumulative effects already occurring. Thus, when the effects of the preferred alternative are combined with these other past, present, and reasonably foreseeable future impacts, the total cumulative impact on vegetation would continue to be minor and adverse over the life of the five trails. Cumulative impacts would remain minor even if one or more of the adaptive management strategies were implemented.

WILDLIFE, INCLUDING SPECIAL STATUS SPECIES

General Impacts Common For All Trails Under Alternative A – No Action

Under the no action alternative, there would be no new impacts on wildlife. No trail reroutes would occur and use of the trails would continue. Ongoing use of trails by hikers and equestrians would likely cause some disturbance or displacement of wildlife. Most wildlife species present near the trails are likely acclimated to human activities; thus, there would be no to negligible effects on wildlife and special status species.

General Impacts Common For All Trails Under Alternative B – Establish and Maintain a Travel Route

Limited improvement of social trails and construction of new rerouted trails would result in wildlife displacement from increased human presence and noise during four to five months of construction over one to three years. Although hand tools would be used wherever possible, chainsaws or other mechanized equipment may be needed for trail repair and reconstruction. Blasting may also be needed in some locations where large rocks are present. Elk, migratory birds, and various small mammals that occur in or near work areas could be adversely affected by the increased noise and activity during construction. Increased noise during construction could cause some species to temporarily leave the area.

Some trees or snags along the new or reconstructed trail alignments may need to be removed for safety reasons, potentially affecting habitat for cavity-nesting birds. Shrub and understory vegetation would also need to be removed in some locations. The potential for impacts from tree and understory removal would be reduced by limiting clearing to the nonbreeding season and preconstruction surveys for nesting birds.

Rerouting trails would have negligible impacts on wildlife because the rerouted trails would be in the same general area as the existing trails, and wildlife species near the trails are likely acclimated to existing levels of human activity. Clearing vegetation for the rerouted trails would result in a permanent loss of wildlife habitat as described previously for vegetation impacts. Vegetation clearing for new trail sections would primarily affect low-density understory vegetation, with limited removal of mature trees. Sections of the abandoned original trails would be revegetated, eventually reestablishing wildlife habitat. Adverse impacts on wildlife from habitat loss would be negligible because for each rerouted trail segment, a nearby segment of existing flood-damaged trail would be closed and revegetated.

Proposed trail improvements and reroutes may affect, but are unlikely to adversely affect, Mexican spotted owl, Canada lynx, or greenback cutthroat trout (Baker 2015). There would be no impact on critical habitat for any federally listed species. Specific impacts for each trail are described below.

Specific Impacts Under Alternative A and Alternative B

Lawn Lake Trail (Sections 1 through 4)

Alternative A – No Action

No new trail construction would occur. Minor periodic trail work along existing social trails would have minimal impacts on wildlife from noise and disturbance. There would be no effect on federally listed threatened or endangered species. It's estimated that, overall, about 0.05 acres of wildlife habitat consisting of lodgepole pine forest with sparse herbaceous and shrub vegetation would be adversely affected by maintenance and use of the social trails. This impact, though adverse, is considered minor given that this habitat type is common in the park.

Alternative B – Establish and Maintain a Travel Route

Limited Improvements and Reroutes (NPS Preferred Alternative) – Limited improvements and new rerouted trail construction would result in impacts on elk, bighorn sheep, migratory birds, small mammals, and other wildlife from increased noise and human presence during four to five months of annual construction over two years.

Reconstructing or rerouting trails would involve ground-disturbing activities and vegetation removal. The delivery of fine sediment (sand, silt, and clay) into the Roaring River has the potential to affect fish and established redds, by clogging the interstitial spaces required to transfer oxygen to developing eggs. However, trail work would be implemented in a manner to reduce the potential for fine sediment to be transferred into live water to a negligible level. Most of the trail work would not be close to the Roaring River and excavation for the project would be conducted using hand tools and, thus, the potential for stream sedimentation affecting fish in the river would be low. No work would occur within flowing water or below the ordinary high water mark of the Roaring River. Stabilizing and revegetating abandoned trail sections would further reduce the potential for impacts. Rerouting sections of the trail farther from the river would be beneficial for fish and would reduce the potential for future trail repairs, which could impact fish.

Based on the above discussion, Alternative B may affect, but is unlikely to adversely affect, the greenback cutthroat trout.

Noise associated with construction activities, such as use of chainsaws and other machinery, has the potential to affect the Canada lynx and wolverine. It is possible that a Canada lynx could pass through the area during construction and be displaced by increased noise and human activity. Although wolverines are unlikely to occur in the Lawn Lake Trail project area, it is also possible a wolverine could pass through the area during construction. If this were to occur, the effects on lynx or wolverines would be minimal and temporary because of the presence of similar habitat in the surrounding area. Reconstructing or rerouting the four sections of trail would not create a movement barrier for lynx or wolverine and would result in a loss of 0.24 acre of habitat. The existing trail already experiences substantial visitor use, which would not change if the trail is rerouted. For these reasons, Alternative B may affect, but is unlikely to adversely affect, Canada lynx and impacts on wolverine would be negligible. There would be no effect on Mexican spotted owl because no habitat is present.

Under this alternative, it's estimated that, overall, about 0.24 acres of wildlife habitat would be lost through trail clearing in the four, rerouted sections, as described. This impact, though adverse, is considered minor given that this type of wildlife habitat is common in the park. Furthermore, this habitat loss would occur along long narrow swaths of the reroutes, rather than in one, single site, thereby reducing the overall impact to wildlife habitat. Habitat loss for trail clearing would be offset by restoration of abandoned trail sections of 0.16 acres.

Ypsilon Lake Trail

Alternative A – No Action

Minor periodic trail work would have minimal impacts on wildlife. There would be no effect on federally listed threatened or endangered species. Under this no action alternative, it's estimated that, overall, about 0.01 acres of wildlife habitat (streambank vegetation), would be adversely affected. This impact, though adverse, is considered minor given that this type of wildlife habitat is common in the park.

Alternative B – Establish and Maintain a Travel Route

Reroute (NPS Preferred Alternative) –Construction of a timber foot bridge across the Roaring River and construction of new trail connections on each side of the Roaring River (about 350 feet total), would result in a permanent loss of about 0.08 acre of wildlife habitat such as fireweed, wild strawberry, and prairie junegrass understory vegetation. However, impacts would be minimal because flood scouring removed most of the vegetation along the river already and what remains reflects a common habitat type in the park. The new reroutes and bridge also would help to direct foot and equestrian traffic, resulting in fewer social trails and helping to protect wildlife habitat. Revegetating abandoned trail sections would permanently restore about 0.01 acre acres of wildlife habitat within the trail alignment.

New trail construction would result in impacts on elk, migratory birds, small mammals, and other wildlife from increased noise and human presence during four to five months of construction over one year. Potential impacts on fish species from sediment introduction associated with trail construction would be minimal as described above for Lawn Lake Trail.

Implementing timing restrictions, along with the BMPs for water quality described above under *Best Management Practices*, would reduce the potential for impacts on greenback cutthroat trout to an insignificant level. Based on the above discussion, Alternative B may affect, but is unlikely to adversely affect, greenback cutthroat trout. Effects on Canada lynx and wolverine would be the same as described above for the Lawn Lake Trail. Alternative B may affect, but is unlikely to adversely affect, Canada lynx and would have no effect on Mexican spotted owl because no habitat is present.

Alluvial Fan Trail

Alternative A – No Action

Trail construction would not occur and no new impacts on wildlife or wildlife impact would occur, except during removal of remnants of the asphalt trail over several months. Removal of the asphalt trail would result in temporary noise disturbance and displacement to wildlife from equipment use. There would be no effect on federally listed threatened or endangered species.

Alternative B – Establish and Maintain a Travel Route

Reroute (NPS Preferred Alternative) – New trail construction of 1,950 feet of new trail through the alluvial fan, plus a 350-foot overlook spur and the overlook itself, would result in impacts to about 0.42 acre of soil and rock and some understory species such as nonnative cheatgrass and Canada thistle, all of which provides limited wildlife habitat. Removing the existing bridge abutments may result in temporary disturbance to riparian habitat along the Roaring River; however, the amount of vegetation (habitat), is currently sparse as a result of channel scouring from the flood, so impacts would be negligible. A new timber bridge would span the river to avoid impacts on riparian and wetland habitat.

Elk, migratory birds, small mammals, and other wildlife could be temporarily displaced from increased noise and human presence during four to five months of annual construction over two to three years; however, this trail is heavily used by visitors. Wildlife use of this area is limited. A portion of the rerouted trail would occur near the West Alluvial Fan bighorn sheep protection closure area. Impacts on bighorn sheep would be negligible because only hand tools would be used for trails work between April 15 and July 15. Exceptions to this limitation will be as follows: 1) if monitoring of bighorn is conducted prior to work commencing and no ewes and/or young lambs are identified in the area, use of mechanized equipment can commence, 2) If monitoring of bighorn is conducted prior to work and ewes and/or lambs are observed, use of equipment may commence in coordination with bighorn observations to assess disturbance; if no adverse impacts are observed mechanized equipment use can continue independent of bighorn monitoring, and 3) once ewes with lambs are being observed at Sheep Lakes use of mechanized equipment can commence.

Remnants of the existing trail and bridge would be removed and a new timber footbridge would be constructed across the Roaring River. These activities, especially work within the river, could potentially result in the introduction of sediment during construction for four to five months. Brook trout and brown trout, two nonnative fish species, occur in this section of the river and could be affected by increased sedimentation, with impacts similar to those described under this alternative for the Lawn Lake Trail. Trail work would be implemented in a manner to reduce the potential for fine sediment to be transferred into live water to a negligible level.

Federally and state-listed threatened greenback cutthroat trout are occasionally found in this section of the Roaring River as well, although greenback cutthroats are more common above Horseshoe Falls (Watry, pers. comm. 2015). Because greenback cutthroat trout are only occasionally found in this section of the river, they are unlikely to be impacted by work in or near the water. Implementing the BMPs for water quality described above under *Best Management Practices* would reduce the potential for impacts on fish to an insignificant level. Alternative B may affect, but is unlikely to adversely affect, greenback cutthroat trout.

The Alluvial Fan Trail project area does not provide quality habitat typically used by Canada lynx and wolverine, although Canada lynx could move through the area occasionally, using the riparian area as a movement corridor. In the unlikely event a Canada lynx were to move through the area during construction, effects would be the same as described above for the Lawn Lake Trail. Alternative B may affect, but is unlikely to adversely affect, Canada lynx and would have no effect on wolverine. The proposed trail reroutes and repairs would not alter forest stands suitable for Mexican spotted owl and, thus, there would be no impact.

Aspen Brook Trail

Alternative A – No Action

Under the no action alternative, trail construction would not occur and no new impacts on wildlife would occur. There would be no effect on federally listed threatened or endangered species. Without trail improvement or reroutes, it's estimated that, overall, about 0.30 acres of wildlife habitat would be adversely affected due to continued slumping and erosion of soil loss and stream channel sedimentation along the flood-damaged trail. This impact, though adverse, is considered minor given that this type of wildlife habitat is common in the park.

Alternative B – Establish and Maintain a Travel Route

Reroute (NPS Preferred Alternative) – Four sections of reroutes would be used to bypass the most damaged trail sections. This would result in an impact on 1.18 acres of wildlife habitat such as bearberry, common juniper, and western golden ragwort, along about 5,160 feet of new trail construction. About 3,360 feet of abandoned trail would be stabilized and revegetated, resulting in about 0.77 acres of habitat restoration. Extension of the trail about 4,200 feet would result in a long-term disturbance to 0.96 acre of wildlife habitat from trail construction, although a portion of the new trail would follow an existing social trail. The net disturbance to wildlife habitat from the adaptive management alternative would be about 1.4 acres after accounting for the abandonment and restoration of about 0.77 acres. The habitat loss would occur along long narrow swaths of the reroutes, rather than in one, single site, thereby reducing the overall impact to wildlife habitat. Taken into the context of the park, this net disturbance to mixed coniferous woodland for wildlife habitat is minor in nature.

New trail construction would impact wildlife from increased noise and human presence during four to five months of annual construction over two years. Construction activity in montane meadow habitat with elk rutting activity would be avoided from September 15 to October 31. If rutting elk are not observed near the project work area, work may proceed. The riparian corridor along Aspen Brook provides suitable habitat for amphibians, including the state-listed endangered boreal toad. Potential impacts on boreal toads and other amphibians, such as boreal chorus frogs and tiger salamanders, would be avoided by constructing the bridge crossing outside of the breeding season and spanning the drainage with a bridge. Also prior to starting work, biologists would conduct searches for boreal toad tadpoles upstream and downstream in the project area for the bridge crossing.

Impacts on beaver activity would be negligible during construction. Trail reroutes would slightly reduce human disturbance to wildlife species, and other stream- and riparian-dependent species, because four trail sections would be routed farther away from Aspen Brook. Park records indicate fish, including the Greenback cutthroat trout, are not present in Aspen Brook; therefore, constructing a new log bridge would not affect fish.

The proposed trail reroute and repairs would not alter forest stands suitable for Mexican spotted owl. Effects on Canada lynx and wolverine would be similar to those described above for the Lawn Lake Trail, although the amount of habitat impacted on the Aspen Brook Trail prior to rehabilitation of 2.14 acres, compared to 0.24 acres impacted along the Lawn Lake Trail, would be greater. Alternative B may affect, but is unlikely to adversely affect, Canada lynx and impacts on wolverine would be negligible.

Resource Restoration and Abandon (Adaptive Management) – Abandoning and restoring the entire Aspen Brook Trail would have beneficial effects from permanently restoring about 0.64 acres of wildlife habitat. Closing the Aspen Brook Trail would benefit wildlife by reducing the ongoing

disturbance to wildlife from hikers and equestrians. Stream- and riparian-dependent species would benefit by permanently closing and revegetating the trail. Closing the trail may have a beneficial effect on Canada lynx.

Twin Sisters Trail

Alternative A – No Action

Trail construction would not occur and there would be no new impacts on wildlife. Continued use and development of social trails at multiple locations could disrupt wildlife activity and adversely impact habitat. There would be no effect on federally listed threatened or endangered species. Because portions of the trail were completely eliminated by the landslide, multiple social trails have developed around the lost trail. Under this no action alternative, it's estimated that, overall, about 0.07 acres of wildlife habitat would be adversely affected by development of these social trails. This impact, though adverse, is considered minor given that this type of wildlife habitat is common in the park.

Alternative B – Establish and Maintain a Travel Route

Limited Improvements (NPS Preferred Alternative) and Reroute – Limited trail improvements would impact wildlife from increased noise and human presence during four to five months of annual construction over two to three years. These actions would not affect fish or aquatic species, because no aquatic habitat is present in the Twin Sisters Trail project area. Trail clearing would result in a habitat loss of about .05 acres. Although adverse, this amount of clearing is minor in nature and would be offset by about 0.03 acres of restoration associated with restoration of about 1,110 feet of existing trail and elimination of social trails.

Greenback cutthroat trout are not present in the Twin Sisters Trail area, so there would be no effect on this species. Effects on Canada lynx and wolverine would be the same as described above for the Lawn Lake Trail. Alternative B may affect, but is unlikely to adversely affect Canada lynx and would have a negligible effect on wolverine. The proposed trail reroute would not alter forest stands suitable for Mexican spotted owl; hence, there would be no effect.

Reroute (Adaptive Management) – New trail construction would result in impacts on wildlife similar to the limited improvements option, although construction disturbances would last for two to three seasons and occur over a larger area of 0.63 acres. Increased noise and human presence during construction and habitat disturbance would impact wildlife activity. These actions would not affect fish or aquatic species because no aquatic habitat is present in the Twin Sisters Trail project area. Impacts on wolverine activity or habitat would be negligible from construction disturbance. About 0.10 acres of wildlife habitat would be reclaimed through rehabilitation of about 2,200 feet of the existing trail.

Greenback cutthroat trout are not present in the Twin Sisters Trail area, so there would be no effect on this species. Trail construction noise and activity may affect, but is unlikely to adversely affect, Canada lynx activity in the area and would have a negligible effect on wolverine. The proposed trail reroute would not alter forest stands suitable for Mexican spotted owl, hence there would be no effect.

Cumulative Impacts

Alternative A – No Action. Because there would be no new impacts on wildlife or special status species, there would be no cumulative effects.

Alternative B – Establish and Maintain a Travel Route (NPS Preferred Alternative). The impacts of the past, present, and reasonably foreseeable future actions on wildlife and special status species along the trail and nearby habitat have primarily occurred as a result of visitor use, ongoing trail maintenance and repair, and implementation of resource management plans. Collectively, all of these uses and activities have had, and would continue to have, negligible to minor adverse impacts on wildlife and special status species from human activity and habitat disturbance. As previously described, the direct and indirect impact of Alternative B on wildlife habitat would be less than 3 acres spread over five trails. Closing and restoration of abandoned and damaged trails would also contribute a beneficial effect. When added to the existing cumulative effects, the impacts of Alternative B would contribute slightly to, but would not substantially change, the overall cumulative effects already occurring. Thus, when the effects of Alternative B are combined with these other past, present, and reasonably foreseeable future impacts, the total cumulative impacts on wildlife would continue to be negligible to minor over the life of the trail. Because Alternative B may affect, but is not likely to adversely affect greenback cutthroat trout, Canada lynx, or Mexican spotted owl, there would be no cumulative impacts on these species. Cumulative impacts would remain minor even if one or more of the adaptive management strategies were implemented.

WILDERNESS

Analysis of impacts on wilderness areas requires a determination of what qualities of wilderness character, if any, would be affected by the proposed project. As described in the *Wilderness Affected Environment* section, these qualities are (1) untrammeled, (2) undeveloped, (3) natural, (4) offers outstanding opportunities for solitude or primitive and unconfined recreation, and (5) other features of scientific, educational, scenic, or historical value. A discussion of impacts on these qualities from the alternatives follows.

General Impacts Common For All Trails Under Alternative A – No Action

The no action alternative would allow continued use of the damaged trails. Social trails around damaged or missing trail segments would be allowed with minimal improvements to the route. Accelerated erosion is possible both from the damaged trails and social trails. Although the flood-damaged trails have been damaged by natural causes, trail use on damaged and social trails may result in further and possibly more rapid damage to unstable trails, resulting in impacts on the natural quality of the wilderness by human disturbance. In addition, multiple social trails have resulted in human impacts occurring over a larger area than the original trail. Minor trail maintenance and improvements would help reduce adverse human disturbance to trails. Overall, an adverse impact on the natural quality of wilderness is likely from creation of social trails and additional trail damage by users.

General Impacts Common For All Trails Under Alternative B – Establish and Maintain a Travel Route

According to the park's Backcountry/Wilderness Management Plan, "Park operations that occur most frequently in wilderness areas and /or have the most potential to affect wilderness areas include: . . . Trails which includes maintenance and monitoring of existing or new trails, bridges, and foot logs" (NPS 2001:3-8). Alternative B involves various levels of trail repairs, reconstruction, and rerouting. Trails work would entail human control or manipulation, with the objective of reestablishing and/or maintaining sustainable ecological conditions. As discussed below, trail improvements and rerouting under this alternative would impact the untrammeled, natural character of wilderness along with opportunities for solitude or primitive and unconfined recreation.

Because most trail work in wilderness would be conducted with hand tools, unnatural sounds during construction would generally be low and disturbance would mostly be contained to the narrow trail corridor. Exceptions include use of mechanized equipment, such as chainsaws, rock drill, generator, possible rock blasting, and use of helicopters for material delivery. Elevated noise levels resulting in adverse impacts on wilderness soundscapes would occur during construction. Noise associated with limited rock blasting for construction of some new trail segments would have an adverse impact on the wilderness qualities of natural and outstanding opportunities for solitude; however, the effects would be localized and temporary.

For those trail segments undergoing limited improvements, work would occur primarily in the footprint of the existing or social trail, although some earthwork may be necessary outside of the footprint to meet trail design standards. Because of the small area of new disturbance, adverse impacts on wilderness character would be minor, with a beneficial effect from active or natural revegetation, restoration of social trails, and a reduction in trail footprints in some areas.

Trail rerouting would require localized earthwork to establish the tread and install trail structural components. Trail reroute would cause human disturbance of new areas within the wilderness; however, old trail sections would be restored. New trails would have a localized adverse impact on undeveloped and natural wilderness qualities over the life of the trail. Native materials would be used for reconstructed trail sections to protect the natural qualities of the wilderness character, wherever possible. Import of tread material or structural material may be needed at some locations.

Overall, Alternative B would have adverse effects on wilderness qualities during the four- to five-month annual construction occurring over one to three years and beneficial effects to primitive recreation over the life of the trail. Specific impacts for each trail are described below.

Specific Impacts Under Alternative A and Alternative B

Lawn Lake Trail

Alternative A – No Action (Sections 1 through 4)

As described for previous impact topics, minor improvements to the social trails would slightly reduce the potential for further and more rapid damage caused by human use of trails, which would affect the natural qualities of wilderness character. However, adverse effects to the natural qualities of wilderness may result if continued human use results in greater trail damage to fundamentally unstable trails and streambank failure that is likely to occur during future storm events. The no action alternative would not result in a net change in mileage of established trails in the wilderness.

Alternative B – Establish and Maintain a Travel Route

Limited Improvements (Section 2) (NPS Preferred Alternative) – Improvements to existing social trails that have developed around damaged trails and periodic maintenance would result in human manipulations and unnatural sounds, affecting the natural qualities of wilderness character along reconstructed segments. Trail improvements would result in similar adverse impacts on wilderness character during four to five months of annual construction over two years. Trail improvements would result in a beneficial effect on wilderness character from protecting and restoring the natural quality of the wilderness area over the life of the trail. Overall, these limited improvements would only impact part of the wilderness along a section of the Lawn Lake Trail. Less than 1% of the 252,085 acres of wilderness would be affected by the limited improvements, which is a negligible impact to wilderness quality in the context of the overall amount of wilderness in the park.

Reroute (Sections 1, 3, and 4) (NPS Preferred Alternative) – Trail reroutes would have similar impacts on wilderness character, but to varying degrees. Trail reroutes would affect the **natural** and opportunities for solitude qualities of wilderness during construction and restoration. Trail reroutes would impact wilderness from new ground disturbance and human disturbance and manipulation during four to five months of annual construction over two years. Overall, these limited improvements would only impact part of the wilderness along a section of the Lawn Lake Trail. Less than 1% of the 252,085 acres of wilderness would be affected by the limited improvements, which is a negligible impact to wilderness quality in the context of the overall amount of wilderness in the park.

Ypsilon Lake Trail*Alternative A – No Action*

The human-made bridge would not be replaced, new trail connections would not be constructed, and natural revegetation and restoration of trails would occur. Overall, an adverse impact on the natural and opportunities for solitude or primitive and unconfined type of recreation quality of wilderness is likely from creation of social trails and additional trail damage by users. The no action alternative would not result in a net change in the mileage of established trails in the wilderness.

Alternative B – Establish and Maintain a Travel Route

Reroute (NPS Preferred Alternative) – Bridge replacement and construction of new trail connections on each side of the Roaring River (about 350 feet total) would result in localized adverse impacts on the natural quality of wilderness and opportunities for solitude or primitive and unconfined recreation of wilderness character during the four- to five-month construction period.

Improvements would result in adverse impacts on the untrammeled, undeveloped, and natural qualities of wilderness character from new disturbance and construction of a human-made bridge, although natural materials for bridge replacement would be used to the extent possible. Overall, the replacement of the bridge and the construction of new trail connections on each side of the Roaring River would not change the total amount of miles of trail in the wilderness of the park, and would only impact wilderness along a section of the Ypsilon Lake Trail. Less than 1% of the 252,085 acres of wilderness would be affected by the limited improvements, which is a negligible impact to wilderness quality in the context of the overall amount of wilderness in the park.

Alluvial Fan Trail

Alternative A – No Action

There would be no impact on wilderness because no new trails would be constructed or restored in wilderness.

Alternative B – Establish and Maintain a Travel Route

Reroute (NPS Preferred Alternative) – New trails would be constructed outside of the wilderness, with the exception of a 350-foot overlook spur that would extend into the wilderness area for about 150 feet. Adverse impacts on all qualities of wilderness character would occur from construction of the overlook during the four- to five-month construction period over two to three years due to human disturbance and manipulation, disturbance of an undeveloped area, and construction noise. Overall, these limited improvements would only impact wilderness along a section of the Alluvial Fan Trail. Far less than 1% of the wilderness would be impacted by the construction of the spur trail.

Aspen Brook Trail

Alternative A – No Action

Visitor access and trail use would be allowed on the damaged trail. Social trails around damaged sections could lead to adverse impacts on the natural quality of wilderness. Equestrian use would not be permitted, resulting in adverse impacts on opportunities for unconfined recreation. The no action alternative would not result in a net change in the mileage of established trails in the wilderness.

Alternative B – Establish and Maintain a Travel Route

Reroute (NPS Preferred Alternative) – Four sections of reroutes would be used to bypass the most damaged trail sections. Approximately 5,160 feet of new trail reroutes would result in impacts on all qualities of wilderness character during four to five months of annual construction over two to three years and on the undeveloped and natural qualities of wilderness character over the life of the trail. About 3,360 feet of abandoned trail would be stabilized and revegetated to reduce erosion that would affect the untrammeled, natural, and opportunities for solitude qualities of wilderness. Extension of the trail about 4,200 feet would have similar impacts on wilderness character during construction and on the undeveloped and natural qualities of wilderness character from trail construction. Overall, these limited improvements would add less than 1% of new trail in the wilderness of the park. The new trail section would only impact wilderness along a section of the Aspen Brook Trail. About 0.77 acres of wilderness would be stabilized and revegetated, resulting in a net increase of impact to about 1.37 acres. Less than 1% of the 252,085 acres of wilderness would be affected by the reroutes which is a negligible impact to wilderness quality in the context of the overall amount of wilderness in the park.

Resource Restoration and Abandon (Adaptive Management) – The existing damaged trail would be restored, revegetated, and closed to visitor access. Reclamation of the trail would have an adverse effect on opportunities for unconfined recreation and a beneficial effect on untrammeled, undeveloped, and natural qualities of wilderness. In the context of the park, reclaiming about 0.64

acres of wilderness through closure and rehabilitation of the trail would impact less than 1% of the wilderness in the park.

Twin Sisters Trail

Alternative A – No Action

Because portions of the trail were completely eliminated by the landslide, multiple social trails have developed around the lost trail. Accelerated erosion from human disturbance is likely on these social trails because they typically develop on steeper slopes and because multiple trail routes on either side of the landslide are currently present. Minor trail maintenance of these social trails would reduce erosion, but social trails would affect the untrammeled wilderness quality during maintenance activities from human disturbance and manipulations. The no action alternative would not result in a net change in the mileage of established trails in the wilderness.

Alternative B – Establish and Maintain a Travel Route

Limited Improvements (NPS Preferred Alternative) – Incorporation of the social trails within the trail maintenance program would allow for minor trail improvements and drainage and erosion-control measures to improve trail stability and reestablish ecological conditions. These measures would reduce the potential for future damage to trails from erosion. Hiking in undisturbed areas and construction during restoration activities with the objective of reestablishing ecological conditions, would impact all wilderness qualities due to human disturbance and manipulation, development of previously undisturbed land, disturbance of natural processes, and introduction of unnatural sounds during the four- to five-month period of trail work in one year. This would have a minor adverse impact on the untrammeled and natural qualities of wilderness with a beneficial effect from active or natural revegetation and restoration of multiple social trails and a reduction in the total trail footprint. Improvements on about 575 feet of social trail to connect existing sections of undamaged trail would impact about 0.05 acres of wilderness. This impact would be offset by protecting about 0.03 acres of wilderness due to the restoration of about 1,110 feet of existing trail and elimination of social trails. Overall, limited improvements would not change the total miles of trail in the wilderness of the park about and would only impact this part of the wilderness for the Twin Sisters Trail.

Reroute (Adaptive Management) – Construction of about 2,730 feet of new trail would impact wilderness character over four to five months each year for about two to three years. About 2,200 feet of the existing trail would be reclaimed and social trails would no longer be used. Although this alternative would result in new disturbance and human activity during construction, it would also provide benefits to wilderness qualities over the life of the trail by providing a stable trail and eliminating and restoring abandoned trail segments and social trails. The new approximately 0.50 miles-long trail section would only impact this part of the wilderness along the Twin Sisters Trail. This is less than 1% of the overall wilderness area in the park.

Cumulative Impacts

Alternative A – No Action. The impacts of the past, present, and reasonably foreseeable future actions on wilderness within the Lawn Lake, Ypsilon Lake, Aspen Brook and Twin Sister Trails and nearby wilderness have primarily occurred as a result of visitor use, ongoing trail maintenance, and

implementation of resource management plans. Impacts from these actions, including equestrian use in permitted locations, include soil compaction and loss of vegetation, along with widening and braiding of the trails. Collectively, all of these uses and activities have had, and would continue to have, minor adverse impacts on wilderness. No net change would result in the miles of established trails from the no action alternative. As previously described, the direct and indirect impact of the no action alternative on wilderness would primarily impact the untrammeled quality of the wilderness by human disturbance along social trails. In total less than 1% of the wilderness would be impacted by the no action alternative for the Lawn Lake, Ypsilon Lake, Aspen Brook and Twin Sister Trails. When added to the existing cumulative effects, the impacts of the no action alternative would have a minor adverse contribution, but would not substantially change the overall cumulative effects already occurring. Thus, when the effects of the no action alternative are combined with these other past, present, and reasonably foreseeable future impacts, the total cumulative impact on wilderness would continue to be minor and adverse over the life of the trails.

Alternative B - Establish and Maintain a Travel Route (NPS Preferred Alternative). The impacts of the past, present, and reasonably foreseeable future actions on wilderness within the Lawn Lake, Ypsilon Lake, Alluvial Fan (150-foot portion of the spur), Aspen Brook and Twin Sister Trails and nearby wilderness have primarily occurred as a result of visitor use, ongoing trail maintenance and implementation of resource management plans. Impacts from these actions are the same as those described for Alternative A. Collectively, all of these uses and activities have had, and would continue to have, minor adverse impacts on wilderness. As previously described, the direct and indirect impacts of Alternative B on wilderness would be to improve wilderness by repairing and rerouting damaged trails, thereby limiting human impacts and protecting natural resources. When added to the existing cumulative effects, the impacts of Alternative B would have a minor beneficial contribution, with a minor improvement in the overall cumulative effects already occurring. Thus, when the effects of Alternative B are combined with these other past, present, and reasonably foreseeable future impacts, the total cumulative impact on wilderness would be beneficial over the life of the trails. Under this alternative, it's estimated that, overall, approximately 0.05 acre, or less than 1%, of wilderness, would be adversely affected; however, this is a negligible amount compared to the total of 252,085 acres of wilderness in the park. Cumulative impacts would remain minor even if one or more of the adaptive management strategies were implemented.

VISITOR USE AND EXPERIENCE

General Impacts Common For All Trails Under Alternative A – No Action

The no action alternative would allow continued visitor access via social trails around damaged or missing trail segments or along existing damaged trails with minimal improvements to the route. An adverse impact on visitor use and experience is likely because of the poor condition of damaged trails, more difficult route finding and often steeper gradients on social trails, and a lack of bridges for stream crossings.

General Impacts Common For All Trails Under Alternative B – Establish and Maintain a Travel Route

Alternative B involves various levels of trail reconstruction and trail rerouting. Trail reconstruction with limited improvements would require localized trail work primarily within the footprint of the existing trail, while new trail construction deviates from the existing or former trail location. Trail work would require full or partial trail closures during repairs. Trail closures during construction would likely result in higher use on other trails within the park. Trail repairs and construction would require temporary closure of trail sections for several weeks, particularly when the trail is being stabilized in place. Construction of trail reroutes would allow hiker passage along existing routes, which have been in use since the September 2013 flood. The park would advertise in advance any trail closures or detours. Trail closures during repairs would have adverse impacts on hikers by reducing access to some parts of the park and possibly increasing crowding on other trails. However, trail repairs would have a beneficial effect over the life of the trail from trail improvements that restore the condition of the trail and increase visitor safety and enjoyment of trails to varying degrees. The trails addressed in this EA are some of the oldest and most popular trails in the park. They are used by thousands of day hikers to access some of the most spectacular and unique wilderness areas in the park. The backcountry campsites accessed by these trails are some of the most popular in the park.

Flood-damaged trails in this analysis and their uses by visitors to the park are described below. Specific impacts for each trail are described below.

Specific Impacts Under Alternative A and Alternative B

Lawn Lake Trail

Alternative A – No Action (Sections 1 through 4)

Visitor access on social trails around damaged or washed-out sections of the Lawn Lake Trail would be allowed. Some of these social trails near the Roaring River present safety concerns because of the steep eroding streambank. The trail would continue to be closed to equestrians because of erosion and safety concerns. Overall, there would be an adverse impact on trail users because of poorly defined trails and the proximity of some social trails to unstable steep slopes.

Alternative B – Establish and Maintain a Travel Route

Limited Improvement (Section 2) (NPS Preferred Alternative) – Existing social trails that have developed around damaged trails would be improved and incorporated into the trail maintenance schedule. Minor trail improvements and periodic maintenance would reduce the potential for erosion and increase safety for users; however, future storm events could result in further streambank failure and loss of trail use. Trail restoration would result in adverse impacts on visitor use due to potential trail closures during four to five months of construction possibly over two years. Restoration activities would accommodate hiking and equestrian use and improve trail conditions, resulting in a beneficial effect on visitor use.

Reroute (Sections 1, 3, and 4) (NPS Preferred Alternative) – Trail reroutes would have similar impacts on visitor use as limited improvements during construction. There may be full or partial trail closures during construction, resulting in adverse impacts on trail users during four to five months of construction over two years, although existing social trails may allow visitor access while new trails are being built. Trail reroutes would reopen the trail to equestrians and provide better trail stability for hikers and equestrians. This would provide increased safety in areas where the trail has moved

away from the streambank and would provide more favorable cross slopes, resulting in a more enjoyable hiking and equestrian experience. Overall, rerouted trails would have a beneficial effect on visitor use over the life of the trail.

Ypsilon Lake Trail

Alternative A – No Action

Without replacement of the bridge across the Roaring River and construction of adjacent trail connections, hikers would have to cross on downed logs or ford the stream using social trails on each side of the stream to reach undamaged trail sections. This may deter some hikers from using the trail. Crossing the river on logs or fording the stream increases the potential for accidents or injury. During high flows, the river may not be passable. Equestrian use would not be permitted. Overall, there would be an adverse impact on visitor use under the no action alternative.

Alternative B – Establish and Maintain a Travel Route

Reroute (NPS Preferred Alternative) – Bridge replacement and construction of new trail connections on each side of the Roaring River (about 350 feet total) would improve visitor access. Adverse impacts on visitor use during four to five months of construction in one year are possible, but trail access could likely be allowed during construction. Trail work would reopen the trail to equestrians with a new horse stream crossing, which would provide better trail stability for hikers and equestrians. A new bridge and trail improvements would provide increased safety at the river crossing and a more stable trail for users. Overall, there would be a beneficial effect on visitor use and experience for the life of the trail.

Alluvial Fan Trail

Alternative A – No Action

Without a defined trail, additional social paths are likely to continue developing throughout the Alluvial Fan Trail area. The ABA-accessible portion of the Alluvial Fan Trail that was destroyed would not be restored, which would have an adverse impact on accessibility for trail users with disabilities. Access to the views and waterfall at the top of the trail would remain difficult to reach without a defined trail. The bridge across the Roaring River would not be replaced; thus, most visitors would likely hike to the river from either the east or west Alluvial Fan parking areas without experiencing the entire trail. Overall, there would be adverse impacts on visitor use if an accessible trail is not constructed.

Alternative B – Establish and Maintain a Travel Route

Reroute (NPS Preferred Alternative) – Construction of about 1,950 feet of new trail through the Alluvial Fan Trail, plus a 350-foot overlook spur and overlook, would impact visitor use during four to five months of annual construction over two to three years. To minimize visitor impact, either the east or the west side of the trail would be kept open during construction. The trail and new bridge would be constructed to ABA accessibility standards, allowing use by all visitors and resulting in a beneficial effect on visitor use over the life of the trail. Improvements to the trail and the addition of the overlook spur would enhance visitors' enjoyment while using the trail.

Aspen Brook Trail

Alternative A – No Action

The Aspen Brook Trail would continue to be difficult to navigate for users due to substantial trenching and trail damage. The trail would remain closed to equestrian use, impacting private and commercial horseback riders who have historically used the area. Additional erosion and trail degradation is likely during precipitation events if repairs are not made. Thus, the trail would become more inaccessible for all users over time. Overall, an adverse impact on visitor use and experience is likely under the no action alternative.

Alternative B – Establish and Maintain a Travel Route

Reroute (NPS Preferred Alternative) – Four sections of reroutes would be used to bypass the most damaged trail sections. Construction activities may result in partial or full closures that impact visitor use during four to five months of annual construction for two to three years. Because new trail segments would be located farther upslope from the drainage, it is anticipated that erosion and trenching would be less than at the current trail locations, reducing the potential for trail damage and closures from future storm events. The extension of the Aspen Brook Trail to the north park boundary would have a beneficial effect on visitor use and experience by allowing additional access in and out of the park from both the Lily Lake area and from Highway 66. Installation of a new hitchrack would also benefit equestrian use. Overall, this alternative would have a beneficial effect on visitor use over the life of the trail by providing greater trail stability and enhancement of the visitor experience with a new trail connection at the north park boundary.

Resource Restoration and Abandon (Adaptive Management) – The existing damaged trail would be restored, revegetated, and closed to visitor access. Reclamation of the trail would have an adverse impact on visitor use by closing the trail and creating higher use on other trails in the park. Continued access to the area on social trails is possible even if the trail is restored and removed from the trail system.

Twin Sisters Trail

Alternative A – No Action

Because portions of the trail were completely eliminated by the landslide, multiple social trails have developed around the lost trail and along both sides of the periphery of the landslide. Some of the social trails are difficult to navigate with steep pitches and poor traction. Social trails across the landslide may also adversely impact visitor safety as the landslide area is unstable and future movement of the rock and debris in the landslide is possible. The trail would continue to be closed to equestrians because social trails are not suitable for equestrian use because of safety concerns. Overall, there would be an adverse impact on trail users under the no action alternative.

Alternative B – Establish and Maintain a Travel Route

Limited Improvements (NPS Preferred Alternative) – Incorporation of the social trails within the trail maintenance program would allow for minor trail improvements and measures to improve trail

stability. These measures would benefit visitors, but not all safety concerns would be addressed. Even with improvements, the social trails bypassing lost trail segments would continue to be steeper than the original designed trail pitch, making it difficult for some visitors to hike. The section of trail alignment crossing the landslide is subject to future movement and instability, which could affect visitor access and safety.

Equestrian use would be prohibited, which may result in higher equestrian use and potential conflicts on other trails in the park.

Improvements to about 575 feet of new trail segments to connect existing sections of undamaged trail and restoration of about 1,110 feet of existing trail may result in trail closures during trail work, which would have an adverse impact on trail users during four to five months of construction in one year.

Overall, this alternative would have a beneficial effect on visitor use over the life of the trail because trail improvements would allow access along a defined maintained trail, although equestrian use would not be allowed.

Reroute (Adaptive Management) – Construction of about 2,730 feet of new trail would create a trail designed for long-term stability. About 2,200 feet of the existing trail would be reclaimed and social trails would no longer be used. New sections would be longer with multiple switchbacks, but would be less steep and easier to ascend and descend for hikers and equestrians. Visitor access could likely be maintained during two to three years of construction of the reroute along existing undamaged trail segments and social trails. This alternative would benefit visitor use by providing a long-term stable trail for hikers and equestrian use.

Cumulative Impacts

Alternative A – No Action. The impacts of the past, present, and reasonably foreseeable future actions on visitor use and experience of the Lawn Lake, Ypsilon Lake, Alluvial Fan, Aspen Brook and Twin Sister Trails have primarily occurred as a result of pedestrian and equestrian visitor use, ongoing trail maintenance and repair, and implementation of resource management plans. Impacts from these actions include the poor condition of damaged trails, more difficult route finding and often steeper gradients on social trails, and a lack of bridges for stream crossings. Collectively, all of these uses and activities have had, and would continue to be long-term and adverse as a result of continued deterioration of trails damaged during the storms in 2013, which can lead to more difficult route finding and steeper gradients, a lack of bridges for stream crossings, and closures to equestrian use. When added to the existing cumulative effects, the impacts of the no action alternative on visitor use and experience would have a minor adverse contribution, but would not substantially change the overall cumulative effects already occurring. Thus, when the effects of the no action alternative are combined with these other past, present, and reasonably foreseeable future impacts, the total cumulative impact on visitor use and experience would continue to be minor.

Alternative B – Establish and Maintain a Travel Route (NPS Preferred Alternative). The impacts of the past, present, and reasonably foreseeable future actions have primarily occurred as a result of visitor use, ongoing trail maintenance and repair, and implementation of resource management plans. Impacts from these actions are the same as those described for alternative A. Trail work closures during repairs would have adverse impacts on hikers by reducing access to some parts of the park and possibly increasing crowding on other trails. However the trail work would also result in beneficial effects by stabilizing existing damaged trails and improving safety and enjoyment for trail

users. As previously described, the direct and indirect impacts of Alternative B would be to improve visitor experience and experience by repairing and rerouting damaged trails. When added to the existing cumulative effects, the impacts of Alternative B would contribute slightly to, but would not substantially change, the overall cumulative impacts already occurring. Thus when the effects of Alternative B are combined with these other past, present, and reasonably foreseeable future impacts, the total cumulative impacts on visitor use and experience would continue to be minor even if one or more of the adaptive management strategies were implemented.

CONSULTATION AND COORDINATION

INTERNAL SCOPING

Internal scoping was conducted by an interdisciplinary team of professionals from the park and Denver Service Center staff. Team members met multiple times in 2014 and 2015 to discuss the purpose and need for the project, various alternatives, potential environmental impacts, reasonably foreseeable actions that may have cumulative effects, and resource protection measures. The team also gathered background information and discussed public outreach for the project. Over the course of the project, team members have conducted multiple biological, cultural, and geotechnical site reviews to collect resource data and evaluate potential alternatives for trail repairs and rerouting.

EXTERNAL SCOPING

The park initiated public scoping with a press release that was sent to numerous media sources along the Front Range from Cheyenne to Colorado Springs, and was published on November 5, 2014. A scoping announcement was posted to the Planning, Environment, and Public Comment (PEPC) and park website on November 5, 2014. In addition, a newsletter describing the project, options for treatment of flood-damaged trails, and opportunities for public comment was published to the PEPC and park website on November 4, 2014. The newsletter also was posted at the trailheads for those trails proposed for repairs or rerouting.

A public scoping meeting was held on November 18, 2014 at the Estes Valley Library – Hondius Room, 325 East Elkhorn Avenue, Estes Park, Colorado to provide information to the public on the proposed project and solicit comments on the alternative actions. Approximately 19 members of the public attended the meeting.

The scoping period was defined as November 4, 2014 through December 8, 2014. During the scoping period, the public was given an opportunity to comment on the proposed project using the PEPC website at <http://parkplanning.nps.gov/romo> or by mailing comments to the park. Fourteen comments were received during the scoping period. An overview of the comments received is described in the Public Scoping section on page 3.

AGENCY CONSULTATION

Endangered Species Act

In accordance with the Endangered Species Act, the NPS contacted the USFWS on April 15, 2015 to inform them of the project and EA and solicit input on federally listed species of concern. The park sent a letter on September 8, 2015 seeking concurrence from the USFWS on the park's determination of effects for several threatened and endangered species that could be affected by trail rerouting and repair work. The USFWS responded in a letter dated October 9, 2015 concurring with the park's findings that the proposed action may affect, but is not likely to adversely affect, the greenback cutthroat trout, Mexican spotted owl, and Canada lynx. The USFWS also concurred that the proposed action would not occur in critical habitat for any of these species.

Section 106 of the National Historic Preservation Act

Compliance with section 106 of the NHPA is being conducted through ongoing consultation with the Colorado SHPO, Rocky Mountain National Park-affiliated American Indian tribes, and the ACHP.

In accordance with section 106 of the NHPA, the NPS provided the Colorado SHPO an opportunity to comment on the effects of this project with regard to historic properties. The NPS submitted the results of cultural survey of the project area to the SHPO on March 26, 2015. In a letter dated April 23, 2015, the SHPO concurred with the park's determination on the eligibility status for several resources discovered in the project area. The SHPO also concurred that the proposed undertaking would have no adverse effects on historic properties with implementation of management recommendations. Subsequent to the original cultural survey of the project area, the park added an extension of the Aspen Brook Trail to the proposed project and submitted a cultural resource survey of the additional area of potential effect to the SHPO on September 9, 2015. The SHPO responded in a letter dated September 18, 2015 that one cultural resource found in the Aspen Brook Trail extension is not eligible for the NRHP and the proposed action would not have an adverse effect on historic properties.

Clean Water Act

Any discharges of dredged or fill material into surface waters would be regulated under the Clean Water Act Section 404 permitting process. Section 404 permits may require a Water Quality (401) Certification from the Colorado Department of Public Health and Environment. The 401 certification would not allow discharges into surface water to result in any violations of applicable water quality standards and policies. A Nonpoint Source Discharge Elimination System Permit would be obtained from the Colorado Department of Public Health and Environment and a stormwater management plan would be prepared prior to construction if necessary.

American Indian Consultation

The park initiated consultation with six American Indian tribes (see list below) on November 13, 2014, informing them of the proposed project and soliciting comments. Information from the tribes was also requested to determine if any ethnographic resources are in the project area and if the tribes wanted to be involved in the environmental compliance process.

The following American Indian tribes were contacted and invited to participate in the planning process:

- Jicarilla Apache Tribe of the Jicarilla Apache Indian Reservation, New Mexico
- Northern Arapaho Tribe
- Northern Cheyenne Tribe of the Northern Cheyenne Indian Reservation, Montana
- Shoshone Tribe of the Wind River Reservation, Wyoming
- Southern Ute Indian Tribe of the Southern Ute Reservation, Colorado
- Ute Indian Tribe of the Uintah & Ouray Reservation, Utah
- Ute Mountain Tribe of the Ute Mountain Reservation, Colorado, New Mexico, and Utah

The park invited interested American Indian tribes to a government-to-government tribal consultation on February 25, 2015, which later was changed to June 3, because of inclement weather. Tribal participants at the June 3 meeting included representatives from the Northern Arapaho Tribe, Cheyenne and Arapaho Tribes, and the Southern Ute Tribe. Tribal representatives expressed a preference for letting nature take its course on restoration of damaged trail segments and rehabilitating the best social trail or rerouting trails to a preferred location. The tribes also preferred treating trails on a case by case basis with repairs that minimize impacts. The park and tribe also discussed the protection of resources as part of the trails work.

To date, no additional concerns have been expressed and no additional information regarding ethnographic resources or traditional uses has been provided by any of the American Indian tribes. American Indian tribes traditionally associated with the lands of the park will have an opportunity to review and comment on this EA.

ENVIRONMENTAL ASSESSMENT REVIEW AND LIST OF RECIPIENTS

This EA is subject to a 30-day public comment period. To inform the public of the availability of the EA, the NPS will publish and distribute a letter to various agencies, tribes, and the park's mailing list, as well as place an ad in the local newspaper. The document will be available for review on the PEPC website at <http://parkplanning.nps.gov/romo> and at the park's visitor center. Copies of the EA will be provided to 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 EA. 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 and will make appropriate changes to the EA, as needed.

LIST OF PREPARERS

The following persons assisted with the preparation of this EA.

National Park Service, Rocky Mountain National Park

Vaughn Baker, Former Superintendent
Larry Gamble, Chief of Planning and Compliance
Sheri Fedorchak, Biologist
Kevin Soviak, Program Supervisor Trails
Ian Brighton, Landscape Architect
Chris Davis, Ecologist
Kelly Stehman, Cultural Resource Specialist

National Park Service, Denver Service Center

Steve Culver, Natural Resource Specialist
Jan Burton, Project Manager

ERO Resources Corporation

Mark DeHaven, Project Manager
Nicole Bauman, Environmental Planner
Steve Butler, Biologist
Clive Briggs, Archeologist
Sean Larmore, Archeologist
Dave Hesker, Graphic Designer
Kay Wall, Technical Editor

Yeh and Associates

Wade Noon, Geologist
Samantha Sheridan, Geologist

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Appendix A
Construction Stipulations for Native Plant Conservation and Restoration
ROCKY MOUNTAIN NATIONAL PARK, COLORADO
(Revised March 2011)

Purpose

The enabling legislation for Rocky Mountain National Park (RMNP) and National Park Service (NPS) Management Policies require park managers to preserve natural conditions within the park. These construction stipulations have three purposes:

- to protect the natural environment and preserve natural conditions
- to reduce the cost of seed collection, plant propagation, outplanting, topsoil restoration, and exotic plant treatments required for native plant restoration once a project is completed
- to reduce the cost of invasive exotic plant control

These stipulations should be used as a guideline for minimizing impacts caused by ground-disturbing projects. Each project should be reviewed on an individual basis and stricter stipulations may be necessary in sensitive locations. Ground disturbing projects may require a vegetation restoration plan that identifies the type of restoration that will be done once construction is complete. The Division of Resources Stewardship in cooperation with other divisions usually writes the restoration plan in accordance to the RMNP Vegetation Restoration Management Plan Version 2 July 2006.

Checklist

Check all items that apply to this project

Implementation

- ☐ The Contractor/NPS personnel shall take every precaution and make every effort to protect the delicate environment of Rocky Mountain National Park.
- ☐ Construction stipulations will be incorporated in the contract documents and all NPS construction projects.
- ☐ A performance bond will be required to cover all portions of the contract.
- ☐ A one-year warranty will be required for all seeding or planting of vegetation completed by contractors.
- ☐ The project budget includes sufficient funds to cover the cost of all restoration work.
- ☐ To the degree possible, the project will be planned to maximize the survivability of salvaged trees and shrubs. Plant salvage will occur in early spring or late fall/early winter during dormancy.
- ☐ Sufficient lead time (as much as one year or more) will be provided for seed collection and propagation of plants for vegetation restoration.
- ☐ Reseeding will be scheduled in the fall or spring when soil temperature reaches 50 degrees.

Construction Limits:

- ☐ The construction area limits will be clearly defined, fenced, flagged or somehow delineated to keep ground disturbance to a minimum. Any deviation from the approved area of disturbance must be approved by the signatories to this document.
- ☐ Construction equipment will be kept within the construction limits to protect adjacent undisturbed vegetation. Under no circumstance will any vehicle be allowed outside the construction limits. Whenever possible keep equipment on hardened surfaces.

- ☐ Turning areas for hauling vehicles shall be approved by the CO and/or Project Manager.
- ☐ Areas to be used for parking and stockpiling material are strictly controlled and will require approval of the CO and/or Project Manager prior to their use by the Contractor.

Equipment

- ☐ Rubber-tired or tracked vehicles will be used unless specific approval for tracked vehicles has been granted by the Project Manager. This will reduce soil compaction and erosion.
- ☐ Equipment will be refueled on an existing road or parking lot. Any spills will be cleaned up immediately. All equipment must have a spill kit on hand at all times.
- ☐ Construction equipment not being used shall be parked out of the traveled way of roads and trails and within the construction limits or on approved paved surfaces.
- ☐ All earth-moving equipment (excluding hauling vehicles) shall be cleaned of mud, plant materials and weed seed prior to entering the National Park and when moving between project sites inside the park as per the RMNP Aquatic Disinfection Guidelines and Technical Memorandum No. 86-68220-07-05. Hauling vehicles shall meet the same requirement before their initial entrance into the park; subsequent entries will not require cleaning unless ordered by the Project Manager.
- ☐ Solvents used to clean pavers, tools, etc., shall be carefully used, completely contained at the work site, and satisfactorily cleaned up as may be required.

Clearing and Grubbing

- ☐ Selected snags with 4 to 12 inches diameter at breast height (dbh) shall be salvaged and stockpiled in designated storage areas for subsequent placement on the completed slopes. The trees and snags shall be cut into random lengths from 8 to 30 feet and shall be limbed on one side. Sound snags and dead trees are preferred over live trees.
- ☐ Surface boulders that will remain on the site following construction shall be carefully stockpiled with natural face up to protect natural lichen growth. Boulders will be replaced in their natural position partially buried at 1/2 to 2/3 of the total boulder height with lichen facing up.
- ☐ Trees larger than 12 inches dbh and trees from 4 to 12 inches dbh not designated for salvaging and stockpiling shall become the property of the contractor and shall be removed from the park. Trees less than 4 inches dbh and over 3 feet in height shall be disposed of outside the park.
- ☐ Grubbing of stumps shall be accomplished in such a manner as to conserve topsoil material. Non-conventional methods will be required to remove stumps in order to conserve topsoil without contaminating the material with underlying inorganic soils. Pushing trees over with heavy equipment or performing grubbing operations shall not be permitted until topsoil is conserved.
- ☐ If stumps are to be left in place, trees should be flush cut to ground level. Designated trees and snags once cut shall be removed in such a manner as to minimize damage to adjacent trees and vegetation.
- ☐ Furrows created by dragging larger timber away for disposal shall be hand raked to blend with finished grade.
- ☐ Burning of debris within the park will not be permitted. All debris and left over construction materials shall be removed from the park and disposed of in accordance with applicable local, State, and Federal regulations.

Excavation

- ☐ If excavation and/or grading is required for ditches, foundations, road construction, etc., the topsoil shall be salvaged and stored in a separate location (refer to next section). Topsoil refers to the uppermost soil horizon, and natural humus bearing soils, duff, and vegetable matter. The depth of topsoil in the park varies and must be evaluated for each project to determine how much of the topsoil should be saved. As a rule, the depth of

topsoil in the park is about the first six inches of soil. The NPS will designate topsoil salvage depths by location.

- ☐ Trees and shrubs are to be avoided if possible during trenching or excavation.
- ☐ Any excavated boulders, subsoil or topsoil that will not be needed for the project are to be removed as soon as possible to minimize damage to underlying vegetation.

Topsoil Salvage

- ☐ Salvaged topsoil will be separated from the sub-soil and stored in windrows no higher than three feet and three feet wide. If possible, the soil will be stockpiled in a disturbed area to minimize the impact to adjacent vegetation.
- ☐ If the topsoil is to be stockpiled for several months or longer, it should be planted in a cover crop as specified by the Biologist or Natural Resource Specialist.
- ☐ A minimum of 2 inches of material shall be conserved in all cases, and a depth of 12+ inches of material is possible in some locations. Live vegetation less than 3 feet in height and limbs less than 1 inch in diameter may be incorporated as topsoil in the stockpiles. Conserved topsoil shall consist of natural humus bearing soils, duff, and vegetable mater obtained from the overlying portions of the project excavation and embankment areas.
- ☐ Due to the limited amount of material available for topsoil and the need to establish the best growing medium possible for revegetation, non-conventional methods will be required to excavate, stockpile, and place the conserved material. Equipment capable of excavating small, isolated pockets of soil; removing stumps as required; and placing material on slopes and in pockets on rock ledges will be required to perform the work.

Vegetation Salvage

- ☐ A representative from the Division of Resources Stewardship shall clearly identify all plant materials (trees, shrubs, grasses and forbs) to be salvaged prior to the start of construction. Do not disturb these areas until the materials have been harvested or cleared by a Resource Stewardship representative.
- ☐ A representative from the Division of Resources Stewardship shall clearly identify all plant materials to be transplanted outside the zone of disturbance.
- ☐ RMNP contains many plant species of special concern. If a species of special concern is present at the project site, the goal of plant salvage and revegetation is no net loss of this plant. The representative from the Division of Resource Stewardship will identify any species of special concern.
- ☐ When salvaging trees and shrubs, as much soil as possible shall be preserved around the roots. Root balls from salvaged trees and shrubs will either be boxed, placed in containers or wrapped in burlap. The plants must be watered to keep the soil moist until they are replanted. Stockpile salvaged trees in a safe area where they can be watered.
- ☐ Trees, shrubs and other containerized plants will be watered during the first growing season.
- ☐ If sod will be salvaged at the project site, the sod can be stripped with a backhoe, sod cutter or spade. Ground disturbing projects in the alpine tundra should salvage all sod.
 - ☐ If sod is to be replaced within five (5) days it can placed on canvas burlap and stored at the construction site. The sod should be watered and covered to prevent the vegetation from drying out. During hot, dry weather, the salvaged sod must be watered every day.
 - ☐ Sod that cannot be replanted within five days must be placed into wooden flats lined with three inches of vermiculite and peat and watered daily. These flats would have to be watered daily.

Rough Grading

- ☐ A balance is to be achieved between these competing and equal considerations: (a) the creation of steep cuts and fills to minimize the amount of disturbance, and (b) the creation of flatter cuts and fills to minimize erosion and promote the reestablishment of vegetative cover. This will help to create micro-habitats and terraces that provide for erosion control and ease in native plant establishment.

Finish Grading

- ☐ Once construction is complete, the natural contour of the land is to be restored to the degree possible. Slopes shall simulate the irregularity of the existing terrain.
- ☐ Abrupt angles are to be avoided at the top, toe and ends of newly formed slopes. The top, toe and ends of the slope are to blend in with natural contours. NPS Landscape Architect will provide direction as needed.
- ☐ All earth and rock slopes shall be left with a roughened surface as they are being constructed.

Cut Slopes

- ☐ Boulders firmly in place and protruding from cut slopes shall be left undisturbed.
- ☐ All cut slopes shall be sculpted to irregular surfaces preserving segments of large rock outcrops leaving staggered, irregular ledges, shelves, and outcrops with jagged edge appearance and planting pockets suitable for placement of topsoil and plants. NPS Landscape Architect will provide direction as needed.

Fill Slopes

- ☐ Fill slopes shall be graded to provide an irregular surface with staggered ridges steeper than the nominal slope ratio, staggered ledges, planting pockets, and large boulders exposed above the nominal fill slope.
- ☐ Where shown on the plans or directed by CO and/or Project Manager, additional material shall be incorporated into the fill slopes to obtain additional blending into the natural terrain and to develop areas for planting.
- ☐ Any soil that has been over-compacted by traffic or equipment, especially when wet, will be tilled to a minimum depth of 4 inches, and up to 24 inches, to break up rooting restrictive layers, and then harrowed to prepare the required seedbed.

Imported aggregate and soil

- ☐ All imported topsoil must be approved by a representative from the Division of Resource Stewardship prior to delivery and placement.
- ☐ All material sources used in the production of aggregates require archaeological clearance by a state or federal agency. The Contractor shall furnish written proof of archaeological clearance before transporting any aggregate into the park.
- ☐ All material sources require clearance for exotic plants. The Contractor/NPS personnel shall notify the CO and/or Project Manager of the sources(s) proposed for use at least 1 month before beginning operations. The source(s) will be investigated for exotic plants during the period. If exotics are present, the investigator will determine if the upper portion of the source is to be stripped or the exotics sprayed with an herbicide. When an herbicide is required, a licensed applicator shall apply the spray. An agronomist's certification that the source(s) is free from exotic plants may be substituted for the above requirements.

Placement of Topsoil

- ☐ Prior to placement of topsoil, prepare the areas as follows.
 - (a) Slope ratios of 3:1 or less should be scarified to a nominal depth of 4 inches, but up to 24 inches is possible. Disking or scarification shall be done in a direction perpendicular to the natural flow of water.

(b) Slopes steeper than 3:1 shall be prepared as directed by the CO and/or Project Manager.

- ☐ Conserved topsoil shall be spread a minimum of 2 inches in depth, loose measurement, over all disturbed soil areas. Topsoil is to be replaced without compacting the soil. If topsoil is compacted, it must be scarified to a minimum depth of 4 inches and possibly up to 24 inches as determined by Resource Stewardship staff.
- ☐ Imported topsoil, when being used, shall be spread a minimum of 4 inches in depth, loose measurement, over all disturbed soil areas. Imported topsoil is to be placed without compacting the soil and must be incorporated (mixed) into native subsoil to a depth of 12 inches. If topsoil is compacted, it must be scarified to a minimum depth of 4 inches and possibly up to 24 inches as determined by Resource Stewardship staff.
- ☐ After spreading has been completed, large clods, loose stones larger than 12 inches, stumps, and large roots shall be removed and disposed of outside the park in accordance with local, county, State, and Federal regulations. Stones smaller than 12 inches which are firmly embedded in the topsoil may be left on the finished slopes

Erosion Control

- ☐ Temporary erosion control devices or methods shall be used to protect sensitive areas. Sensitive areas include but are not limited to lakes, stream corridors, drainages, riparian areas, wetlands, and aspen groves.
- ☐ In areas where slopes are greater than 2:1, soil erosion devices (including but not limited to weed-seed free straw bales, wattles and blankets) will be applied to the disturbed area. Certified weed seed free hay is not acceptable for use in RMNP. For larger disturbed areas, erosion control fencing must be installed. Areas requiring erosion control will be delineated and inspected by the park Biologist.
- ☐ Logs shall be placed on all erodible slopes. Logs shall be staggered and placed in a random fashion to prevent the appearance of a pattern. Logs will be measured by the linear foot, in place, completed and accepted.
- ☐ Logs should be staked to the slope by at least 1 inch by 2 inch by 2-1/2 foot hardwood stakes. Reinforcing steel (no. 5), 2-1/2 feet in length may be used in hard material where wood stakes cannot be driven. A minimum of three stakes shall be required to anchor logs up to 8 feet in length. Additional stakes shall be required for each 2 feet of additional length over the 8 feet. A minimum of five stakes shall be used to anchor logs over 8 inches in diameter. Stakes shall be driven perpendicular to the ground line to a minimum depth of 18 inches. The top of the stake shall not extend above the log nor shall it protrude from the ground less than one-half the diameter of the log. Remove branches on one side of logs to allow maximum contact with the ground. Place logs such that log maximizes contact with the ground.
- ☐ Trees and snags shall be placed on slopes following the placement of topsoil.

Seeding

- ☐ Planted seed shall be covered with no more than 1/4 to 3/4 inch of soil.

Mulching

- ☐ Division of Resources Stewardship personnel will determine if a project requires the use of mulch. Wood products such as chips should be made about one year before use to allow time for the chips to cure, otherwise they may inhibit vegetation restoration. Mulch spread over a seeded area will cover approximately 75% of the area up to a 1/2 inch depth.

Special Considerations

GENETIC GUIDELINES FOR RESTORATION PROJECTS

Rocky Mountain National Park has been actively involved in restoring human caused disturbances since the 1960's and has been an UNESCO International Biosphere Preserve since 1976. In the late 1980's preserving genetic integrity in vegetation restoration projects became a priority issue. Following are guidelines adopted by the park:

1. Evaluate which restoration class (I, II, III) project is located in. Each class has specific guidance from the RMNP Restoration Management Plan to what restoration techniques and plant materials can be used.
2. Salvage as much plant material (e.g. whole plants, sometimes sod) and topsoil prior to the disturbance as possible.
3. Evaluate sites to determine if salvageable material and/or natural regeneration will provide sufficient plant cover to compete with weeds, retard erosion, and meet other management goals. (If natural regeneration is selected, it may be enhanced by activities such as raking, watering and weeding).
4. When collection of additional plant material is necessary, whenever possible, plant material will be collected from either directly on or adjacent to the site to be revegetated. If parts of plants are collected for propagation, a minimum of fifty plants should be sampled to protect local genotypes
5. A plants material program is an appropriate technique when local plant material is needed for large-scale projects via a seed increase program. The nearest plants material center is in Meeker Colorado and the park has been involved in a seed increase program with Meeker for years. If seed is collected from shrubs, a minimum of fifty shrubs should be sampled from any one area to protect local genotypes and no more than 10% of the seed from any one shrub should be collected to leave an adequate amount of seed behind for natural plant germination and also as a food source for wildlife. If blue grama (*Bouteloua gracilis*) is to be used, the appropriate plant material center would be in Los Alamos, New Mexico.
6. If collection of plant material directly on site is not possible, material may be moved within the major drainages of the park. When possible match habitat type, aspect and elevation.
7. In special circumstances, material may be moved between the major drainages in the park, to be approved on a case by case basis.
8. To protect genetic integrity, no plant material will be moved across the Continental Divide.
9. No plant material will be planted higher or lower than 1,500 feet in elevation from their point of origin. Nursery material grown from seed or propagules not collected in Rocky Mountain National Park or in immediately adjacent drainages will not be planted in the park unless approved on a case by case basis.
10. Transplanting plants from adjacent undisturbed sites may be suitable in some areas on a limited basis, particularly in the backcountry. However, transplanting is very expensive, frequently fails, and should be done very cautiously so as not to impact the undisturbed site.
11. Plant cultivars or other non-local native species in class III areas only when absolutely necessary for competition with exotics or to retard erosion. This would only be allowed in developed areas of the park such as park housing, National Historic Register sites as mandated by the National Historic Preservation Act after a case by case review by the park's natural resource specialist, park archeologist, landscape architect, and/or designated historian or on severe sites where succession will go from grass/forb to dense forest. In an area that would eventually become dense forest, the cultivars will eventually be shaded out. For example steep ski slopes being restored at Hidden Valley. All other revegetation alternatives including sterile cover crops, heavy mulch, and delaying planting until local material is available will be considered before cultivars are used. Only cultivars of species growing in Rocky Mountain National Park will be used and varieties will be chosen that originated as close to the park as possible.
12. Non-invasive exotic ornamentals may be planted in National Historic Register sites as mandated by the National Historic Preservation Act after a case by case review by the park's natural resources specialist, park archeologist, landscape architect and/or designated historian. The park's natural resources specialist will ensure the exotic species are not on the state of Colorado's noxious weed list or show aggressive tendencies that could allow the plant to escape into natural areas of the park.
13. Exotic grasses may be planted to meet historical management goals in developed areas only, but only in association with National Historic Register Sites or in some limited cases around park employee houses. However, Kentucky bluegrass (*Poa pratensis*), smooth brome (*Bromus inermis*) timothy (*Phleum commutatum*) and red top (*Agrotis gigantea*), which are commonly used in seed mixes are aggressive invaders into natural areas of the park and other native grasses should be seriously considered before these species are used. Seed mixes should also avoid using clovers such as White sweetclover (*Melilotus alba*) and yellow sweetclover (*Melilotus officinalis*) due to their aggressive tendencies.

Appendix B
Minimum Requirement Decision Guide
Reroutes and Repairs to Flood Damaged Trails Environmental Assessment



ARTHUR CARHART NATIONAL WILDERNESS TRAINING CENTER

MINIMUM REQUIREMENTS DECISION GUIDE

WORKSHEETS

"... 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.

The spaces in the worksheets will expand as necessary as you enter your response.

The MRDG Instructions may be found at: <http://www.wilderness.net/mrdg/>

Project Title:

Reroutes and Repairs to Flood Damaged Trails Environmental Assessment

Step 1: Determine if any administrative action is necessary.

Description: Briefly describe the situation that may prompt action.
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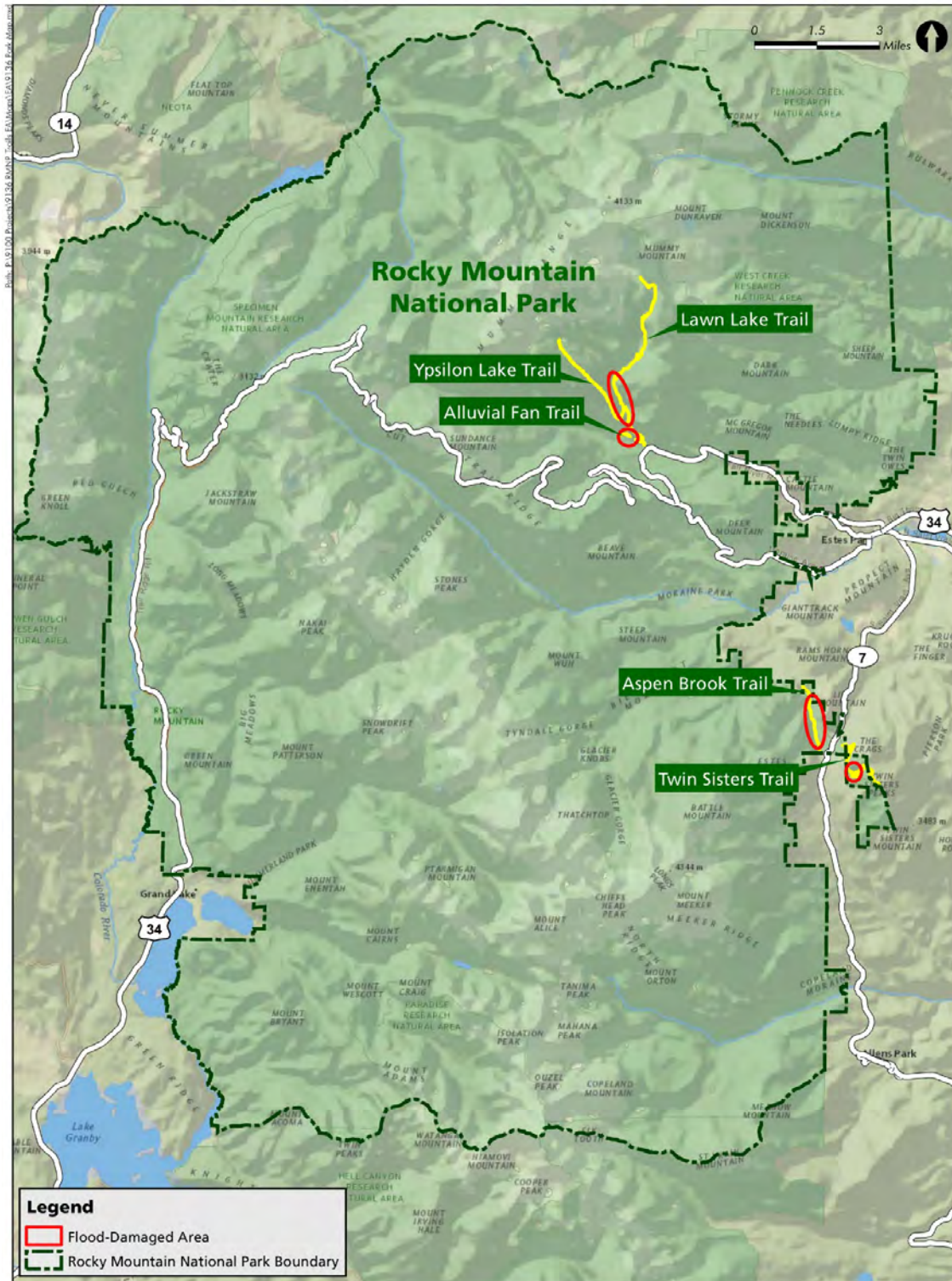
Rocky Mountain National Park (ROMO) was established in 1915. The purpose of the 265,761-acre park according to the Foundation Document for Rocky Mountain National Park (National Park Service (NPS) 2013a) "is to preserve the high-elevation ecosystems and wilderness character of the southern Rocky Mountains within its borders and to provide the freest recreational use of and access to the park's scenic beauties, wildlife, natural features and processes, and cultural objects." The NPS administers the historic, natural, and scenic values that contribute to the public's enjoyment of the park.

ROMO is proposing to reroute and/or repair the following five trails that were heavily damaged or lost during the September 2013 flood: Lawn Lake, Ypsilon Lake, Alluvial Fan¹, Aspen Brook, and Twin Sisters (Figure 1). The purpose of the proposed projects is to address damaged portions of these trail while protecting natural and cultural resources and preserving wilderness character. These five trails were

¹ Although the Alluvial Fan Trail is not located in designated wilderness, a 350ft. spur trail has been included in the EA and this MRDG for consideration. This trail spur does extend beyond the established wilderness boundary.

substantially damaged by heavy precipitation and the resulting flooding, landslides, and erosion that occurred in 2013. The park and nearby Colorado Front Range communities received up to 12 inches of rain from September 11 to 13, 2013, which caused catastrophic flooding across the northern Front Range and downstream areas in northeastern Colorado. Damage in the park included the loss of two road bridges, washed-out and damaged roads, damage to or complete loss of 16 trail bridges, and heavy damage to several trails, including the five trails listed above. After thorough assessment, park trails personnel and engineers have documented the damage and corrective actions needed.

Figure 1: Project Sites



This MRDG has been developed to support the associated Environmental Assessment (EA) which was established to examine the environmental effects associated with the alternative actions to reroute and repair these damaged trails. To provide a baseline for evaluating the impact of alternative actions, a no action alternative that does not restore or reroute trails damaged by flooding was also evaluated. This EA was prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, regulations of the Council on Environmental Quality (CEQ) (40 Code of Federal Regulations (CFR) §1508.9), and NPS Director's Order (DO)-12: Conservation Planning, Environmental Impact Analysis, and Decision-Making. The EA will determine whether significant impacts would occur as a result of the proposed action and if an environmental impact statement or finding of no significant impact would be required.

Compliance with section 106 of the National Historic Preservation Act (NHPA) is being conducted separately from the NEPA process through ongoing consultation with the Colorado State Historic Preservation Office (SHPO), park-affiliated American Indian tribes, and the Advisory Council on Historic Preservation (ACHP).

Currently these five damaged trails remain open to the public. However portions of the trails and bridges have been washed out by flooding and landslides or are badly damaged. Social trails have developed in some locations around the damaged or missing trails, which can lead to soil erosion and vegetation damage over time.

Summary of Project Objectives

- Allow for non-motorized recreational uses of trails damaged by flooding.
- Protect and preserve natural, cultural, and scenic values along all rerouted or repaired trails.
- Preserve wilderness character for the trails located in designated wilderness, supporting visitor access, safety, and resource protection.
- Provide safe accessible visitor use on the Alluvial Fan Trail, which the majority is located outside of designated wilderness aside from a 300 foot spur that is located within the park's wilderness boundary.
- Efficiently implement construction and repair work while minimizing impacts on visitors.
- Use trail design and construction methods that minimize impacts on park resources in accordance with NPS regulations and policies and consistent with park regulations and policies.

To determine if administrative action is necessary, answer the questions listed in A - F on the following pages by answering Yes, No, or Not Applicable and providing an explanation.

A. Describe Options Outside of Wilderness

Is action necessary within wilderness?

Yes: ☒ No: ☐

Explain: Work to be accomplished is within existing trail corridors several miles within the wilderness boundary with the exception of the Alluvial Fan Spur Trail that extends 150 feet into wilderness. These trails allow access to highly visited resource and cannot be removed or the experience is impossible to recreate outside the wilderness boundary as each resource has its own unique ambiance.

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.

Yes: ☐ No: ☒ Not Applicable: ☐

Explain: There are no provisions in ROMO's wilderness legislation that requires these trails to be repaired or reconstructed.

C. Describe Requirements of Other Legislation

Is action necessary to meet the requirements of other laws?

Yes: ☐ No: ☒ Not Applicable: ☐

Explain: There is no provision of any other federal law that requires trail maintenance with or without use of motorized equipment.

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: ☒ No: ☐ Not Applicable: ☐

Explain: 1) The NPS provides guidance about trails management in wilderness areas in section 6.3 of NPS Management Policies (2006). Section 6.3.10.2 provides guidance about trails in NPS wilderness and permits trails when they are determined to be necessary for resource protection and/or for providing for visitor use for the purposes of wilderness.

2) ROMO's Backcountry/Wilderness Management Plan and Environmental Assessment (BCMP) (2001) provides guidance about trail maintenance. Section 2.1.4.7.3 of the BCMP specifies:

Work on park trails is generally allowed via the categorical exclusion for established trails under NEPA and Section 106 of the National Historic Preservation Act as outlined in the Servicewide Programmatic Agreement July 17, 1995, stipulation IV.B.(6)... Trails will be maintained, constructed, or reconstructed to the standards established in the Rocky Mountain National Park Trail Plan (1982), the Trails Management Plan (1984), the Trail System Maintenance and Reconstruction Plan 2000 and the NPS Trails Management Handbook (1983).

In this case, the 2013 flood caused such extensive damage to portions of these five trails (Lawn Lake, Ypsilon Lake, Alluvial Fan, Aspen Brook, and Twin Sisters), that a categorical exclusion does not apply. Portions of these five trails were heavily damaged or lost during the flood. In order to return them to visitor use, relocations and/or extensive repairs are required. As such, an environmental assessment has been prepared to address reroutes and repairs to these trails. The EA 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 on the resources and values, and 3) identifies mitigation measures to lessen the degree or extent of these impacts.

ROMO's Backcountry Management Plan (BCMP) provides guidance about the use of motorized equipment:

For actions which motorized equipment or mechanical transport uses are approved, they will be planned to minimize impacts to park users and resources by utilizing the least obtrusive and impacting schedules. Season of year, day of week and time of day should be considered. Any proposed use of motorized equipment, except in emergency situations, on holidays and weekends between Memorial Day and June 30th or anytime between July 1st and Labor Day will require that a Minimum Requirement Analysis Worksheet be prepared and the action approved by the Assistant Superintendent. This will be done on a case-by-case basis (e.g., special project) or on a programmatic level (e.g., trail work) in an approved management plan (e.g., Backcountry/Wilderness Stewardship Plan, Fire Management Plan).

Section 2.1.4.7.8 of the BCMP further states about the use of motorized equipment for trail maintenance:

The use of the following motorized equipment, as outlined below, has been analyzed and is pre-approved for use during annual trail opening and routine trail operations. Any deviation from this will require a separate Minimum Requirement Analysis to be completed.

- **Chainsaws.** Chainsaws are allowed for the expeditious seasonal clearing of park trails of downfall to prevent resource impacts caused by park visitors being forced off-trail and establishing unwanted routes.
- **Rock Drills.** Motorized rock drills are allowed as the minimum tools feasible for maintaining and reconstructing trails in the rugged rocky areas of RMNP, where major rock drilling or chipping is necessary.
- **Human Powered Wheelbarrows and Carts.** These forms of mechanical transport are approved to be used to haul fill material and supplies to work sites when other means (e.g. stock) are not available or will create more impacts.

3) ROMO's trail maintenance plan (Griswold, 2000) and the United States Forest Service (USFS) provides further guidance about trail maintenance and standards. All of the trails included in this MRDG and EA have been classified as an interagency trail standard of '3'². (Aside from the Alluvial Fan Trail which has been classified as a Class 5 trail) A standard '3' trail is described as:

- *Tread standard and traffic flow.*
 - Tread continuous and obvious.
 - Single lane, with allowances constructed for passing where required by traffic volumes in places where there is no reasonable opportunity to pass.
 - Native or imported materials.
- *Obstacles.*
 - Obstacles may be common, but not substantial or intended to provide challenge.
 - Vegetation cleared outside of trailway.
- *Constructed features and trail elements*
 - Structures may be common and substantial; constructed of imported or native materials.
 - Natural or constructed fords.
 - Bridges as needed for resource protection and appropriate access.

4) House Report 95-540 that accompanied the Endangered American Wilderness Act of 1978 provides guidance about wilderness management. The section entitled, "Trails, Bridges, Trail Signs", states:

Trails, trail signs, and necessary bridges are all permissible when designed in keeping with the wilderness concept. These are often important to the recreational access and use of a wilderness area. Trail construction or maintenance can include the use of mechanical equipment where appropriate and/or necessary.

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: Yes: ☐ No: ☒ Not Applicable: ☐

Explain: Maintaining trails is a minor trammeling of wilderness because it is a human interference with natural processes in the immediate work area. This trail maintenance project will have short term, negligible to minor, adverse impacts to the untrammeled quality of wilderness.

² "USFS Trail Matrix" United States Forest Service, http://www.fs.fed.us/recreation/programs/trail-management/documents/trailfundamentals/National_Trail_Class_Matrix_10_16_2008.pdf, (January 22, 2016)
Revised 11/2010 Available at: <http://www.wilderness.net/MRDG/> Worksheets – p.5

Undeveloped: Yes: ☐ No: ☒ Not Applicable: ☐

Explain: Soil retention structures to prevent erosion are primitive structures in wilderness areas. The proposed management actions will have long term, negligible to minor, adverse impacts to the undeveloped quality of wilderness.

Natural: Yes: ☒ No: ☐ Not Applicable: ☐

Explain: Trail maintenance helps preserve natural resource conditions by limiting the impacts of visitor use to narrow travel corridors. Soil erosion and trampling of vegetation are mitigated on well-maintained/defined trail systems. The natural character of wilderness, outside of established trails, will continually benefit from decreased impacts due to focused visitor use on designated trails. The proposed management actions will have long term, minor, beneficial impacts to the natural quality of wilderness.

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

Yes: ☒ No: ☐ Not Applicable: ☐

Explain: A maintained trail system promotes and facilitates primitive and unconfined recreation (i.e. hiking, travel by stock, etc...). The proposed management actions will have long term, minor, beneficial impacts to primitive and unconfined recreation in wilderness.

Other unique components that reflect the character of this wilderness:

Yes: ☒ No: ☐ Not Applicable: ☐

Explain: The trails addressed in this MRDG and EA are some of the oldest and most popular trails in the park. They are used by thousands of day and overnight hikers to access some of the most spectacular and unique wilderness areas in the park. The backcountry campsites along these trails are some of the most popular in the park.

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: ☒ No: ☐ Not Applicable: ☐

Explain: This action supports the public purpose of recreation by providing for access to the Park's wilderness on a maintained trail system

Scenic: Yes: ☒ No: ☐ Not Applicable: ☐

Explain: Maintaining trails supports the public purpose of protecting opportunities to view natural scenery by providing for safe access to scenic destinations and vistas.

Scientific: Yes: ☐ No: ☒ Not Applicable: ☐

Explain:

Education: Yes: ☐ No: ☒ Not Applicable: ☐

Explain:

Conservation: Yes: ☒ No: ☐ Not Applicable: ☐

Explain: A defined and established trail system contributes toward increased protection of a wilderness area. Long term conservation of impacts to vegetation and the local ecosystem is decreased with established travel routes.

Historical use: Yes: ☐ No: ☒ Not Applicable: ☐

Explain:

Step 1 Decision: Is any administrative action necessary in wilderness?

Yes: ☒ No: ☐ More information needed: ☐

Explain: Established trails reduce impacts to vegetation, decrease soil erosion, and protect some disturbances to watersheds. As such, trail maintenance on trails within the park's established wilderness is needed to ensure that erosion and vegetation trampling related to recreation use are minimized. A variety of project work is needed to prevent undesirable impacts to natural resources in this area including construction of rock causeway or paver rocks, clearing of logs and debris, sign installation and repair, drainage improvement through construction of rock/log drains, and rehabilitation of braided (social) trails outside the original corridor.

This action is necessary to ensure that trails are repaired and/or rerouted in order to protect natural resources from the effects of visitor use (i.e. vegetation trampling and soil erosion). Regular maintenance ensures that trails are more resilient to environmental effects such as erosion caused by water runoff. Continued soil erosion has already taken place and a primary problem of trails is the loss of trail tread material. NPS policy does not allow for soil "borrow pits", thus it is necessary to import soil/fill material to these sites to re-establish the trail tread. In addition, it will be necessary to import materials when needed materials cannot be found in the wilderness and/or the amount of materials needed would be detrimental to the surrounding wilderness character if gathered onsite. These actions promote the public purpose of recreation in the Wilderness Act.

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 A: No Action, No Improvements on Current Corridors

Description: No trail preservation/reconstruction will be completed; these trails will remain maintained in its existing corridor with no improvements made.

Effects:

Wilderness Character

“Untrammeled”- There will be no change to the untrammeled component of wilderness character.

“Undeveloped”- There will be no change to the undeveloped component of wilderness character.

“Natural”- Poor water drainage from the trail promotes soil transport and consequently erosion of the trail tread. In addition, informal trails are likely to continue developing in this area as a result of poor trail conditions. As a result, there is likely to be increasing levels of trampling across vegetation as a result of visitors hiking off of the existing trail due to adverse trail conditions from continued erosion. This will cause **long term, minor, adverse** impacts to the natural quality of wilderness.

“Outstanding opportunities for solitude or a primitive and unconfined type of recreation”- Opportunities for solitude or a primitive and an unconfined type of recreation will not change.

Other unique components that reflect the character of this wilderness

Heritage and Cultural Resources - There are no heritage/cultural resources in this portion of the wilderness that would be affected by this alternative.

Maintaining Traditional Skills - Traditional skills will not be maintained by this alternative.

Special Provisions - There are no special provisions of the Wilderness Act of 1964 or subsequent wilderness legislation that applies to maintenance of the managed trail system.

Economics and Timing Constraints - There are no economic or time constraints associated with this alternative.

Additional Wilderness-specific Comparison Criteria - There are no unique characteristics or criteria specific to this wilderness that would be affected by the implementation of this alternative.

Safety of Visitors, Personnel, and Contractors - Safety of visitors is a concern due to further deteriorating trail conditions.

Alternative B: Trail Reconstruction Completed with No Use of Mechanized Tools and Equipment, Pack Stock, or Helicopter

Description: Hand grubbing tools such as shovels and picks will be used to re-bench sections of trail. Cross-cut saws, hand saws, and wood chisels will be used to cut and shape log structures such as log retaining/ water bars, turnpike/causeways. Footbridges will not be completed because milling logs with crosscut saws is infeasible. Masonry hand tools such as masonry chisels, hammers, and rock bars will be used to quarry and shape rocks for erosion control structures and walls. The tread surface will consist of crushed rock or filled with minimally available dirt from the surrounding area. Borrow pits are not permissible according to management policies (i.e. ROMO Wilderness Plan sec. 2.1.4.7.3 and NPS Management policies sec 6.3.10.2).

Effects:

Wilderness Character

“Untrammeled” – Maintenance/reconstruction of trails will have a **short-term, negligible to minor, adverse** impacts to the untrammeled quality of wilderness.

“Undeveloped” – The installation of trail structures will have **short-term, negligible to minor, adverse** impacts to the undeveloped quality of wilderness

“Natural” – The natural quality of wilderness character will be improved by consolidating use within the trail corridor and minimizing vegetation trampling and soil erosion. This will have **long term, minor, beneficial** impacts to the natural quality of wilderness character.

“Outstanding opportunities for solitude or a primitive and unconfined type of recreation” –

Opportunities for solitude or primitive and unconfined experiences are improved when trails are maintained to a level that ensures reasonable access. This alternative proposes to improve sections of the current trail system but not create any new trails. The management actions proposed will have long term, negligible to minor, adverse impacts to the solitude or primitive/unconfined characteristic of wilderness character, but will also provide **long term, minor, beneficial** impacts to primitive recreation (i.e. hiking).

Other unique components that reflect the character of this wilderness

Heritage and Cultural Resources

There are no heritage/cultural resources in this portion of the wilderness that would be affected by any of the alternatives.

Maintaining Traditional Skills

Traditional, non-motorized skills currently exist and will be maintained within the workforce. Traditional skills will be enhanced within the park by the use of crosscut saws to remove trees, hand tools to shape logs for erosion control structures, rock bars to move rocks, etc.... In addition, hand tools such as shovels, picks, rock hammers, and rock bars will be used to construct trail structures.

Special Provisions

There are no special provisions of the Wilderness Act of 1964 or subsequent wilderness legislation that applies to maintenance of the managed trail system.

Economic and Time Constraints

Work to maintain the trail will continue using existing budget allocations for paid staff and support to volunteers. Crew efficiency will be reduced as shaping log trail structures by with cross-cut saws, hand saws, and wood chisels are time consuming.

Additional Wilderness-specific Comparison Criteria

There are no unique characteristics or criteria specific to this wilderness that would be affected by the implementation of any alternatives.

Safety of Visitors, Personnel, and Contractors

Repetitive use injuries will be a major area of concern for the crews if they are required to build all stone structures using hand tools only. Gathering stone exclusively by hand will expose crewmembers to injuries associated with repetitive heavy lifting.

Alternative C: Trail Reconstruction Completed with No Use of Mechanized Equipment or Helicopter Support, but with the use of Pack Stock

Description: Hand grubbing tools such as shovels and picks will be used to re-bench sections of trail. Cross-cut saws, hand saws, and wood chisels will be used to cut and shape log structures such as log retaining/ water bars, turnpike/causeways. Footbridges will not be completed because milling logs with crosscut saws is infeasible. Masonry hand tools such as masonry chisels, hammers, and rock bars will be used to quarry and shape rocks for erosion control structures and walls. The use of mule strings will transport tools and tread material to and from the trailhead and project sites.

Effects:

Wilderness Character

“Untrammeled” – Maintenance/reconstruction of trails will have a ***short-term, negligible to minor, adverse*** impacts to the untrammeled quality of wilderness.

“Undeveloped” – The installation of trail structures will have ***short-term, negligible to minor, adverse*** impacts to the undeveloped quality of wilderness

“Natural” – The natural quality of wilderness character will be improved by consolidating use along the trail corridor and minimizing vegetation trampling and soil erosion. This will have ***long term, minor, beneficial*** impacts to the natural quality of wilderness character. However, the extensive use of pack stock to transport soil/fill material to re-establish the trail tread will accelerate soil erosion along many sections of trail. This will result in a ***long term, minor, adverse*** impact to the natural quality of wilderness.

“Outstanding opportunities for solitude or a primitive and unconfined type of recreation” -

Opportunities for solitude or primitive and unconfined experiences are improved when trails are maintained to a level that ensures reasonable access. This alternative proposes to improve sections of the current trail system but not create any new trails. The management actions proposed will have long term, negligible to minor, adverse impacts to the solitude or primitive/unconfined characteristic of wilderness character, but will also provide ***long term, minor, beneficial*** impacts to primitive recreation (i.e. hiking).

Other unique components that reflect the character of this wilderness

Heritage and Cultural Resources

There are no heritage/cultural resources in this portion of the wilderness that would be affected by any of the alternatives.

Maintaining Traditional Skills

Traditional, non-motorized skills currently exist and will be maintained within the workforce. Traditional skills will be enhanced within the park by the use of crosscut saws to remove trees, hand tools to shape logs for erosion control structures, rock bars to move rocks, pack stock to transport tools and tread material, etc.... In addition, hand tools such as shovels, picks, rock hammers, and rock bars will be used to construct trail structures.

Special Provisions

There are no special provisions of the Wilderness Act of 1964 or subsequent wilderness legislation that applies to maintenance of the managed trail system.

Economic and Time Constraints

Work to maintain the trail will continue using existing budget allocations for paid staff and support to volunteers. Crew efficiency will be reduced as shaping log trail structures by with cross-cut saws, hand saws, and wood chisels are time consuming. Funds for reconstruction will be reduced as the cost of supplying tread material will be elevated due to the cost of pack support.

Additional Wilderness-specific Comparison Criteria

There are no unique characteristics or criteria specific to this wilderness that would be affected by the implementation of any alternatives.

Safety of Visitors, Personnel, and Contractors

Repetitive use injuries will be a major area of concern for the crews if they are required to build all stone structures using hand tools only. Gathering stone exclusively by hand will expose crewmembers to injuries associated with repetitive heavy lifting.

The frequency of accidents is increased and the severity of injury can be major to employees and visitors when working with livestock. This is due to dynamic weather conditions and visitors who have not been exposed to or untrained in livestock operations. However, the frequency of employee accidents in this park has been significantly reduced due to training and qualified personnel overseeing such operations.

Alternative D: Trail Reconstruction Completed with No Use of Mechanized Equipment, but with the use of Pack Stock and Helicopter Support

Description: Hand grubbing tools such as shovels and picks will be used to re-bench sections of trail. Cross-cut saws, hand saws, and wood chisels will be used to cut and shape log structures such as log retaining/ water bars, turnpike/causeways. Footbridges will not be completed because milling logs with crosscut saws is infeasible. Masonry hand tools such as masonry chisels, hammers, and rock bars will be used to quarry and shape rocks for erosion control structures and walls. The use of mule strings will transport tools and tread material to and from the trailhead and project sites.

The use of a helicopter will transport materials and/or tread material to project sites from a designated helispot as close to the project site as possible to minimize exposure to the wilderness and improve safety. A park management team approved flight safety plan will be in place before flights are initiated and include wilderness character considerations.

Effects:

Wilderness Character

“Untrammeled” – Maintenance/reconstruction of trails will have a **short-term, negligible to minor, adverse** impacts to the untrammeled quality of wilderness. The use of a helicopter will be limited in its exposure in the wilderness and have a **short-term, negligible to minor, adverse** impact to the untrammeled quality of wilderness.

“Undeveloped” – The installation of trail structures will have **short-term, negligible to minor, adverse** impacts to the undeveloped quality of wilderness.

“Natural” – The natural quality of wilderness character will be improved by consolidating use along the trail corridor and minimizing vegetation trampling and soil erosion. This will have **long term, minor, beneficial** impacts to the natural quality of wilderness character. The extensive use of pack stock to transport soil/fill material to re-establish the trail tread will accelerate soil erosion along many sections of trail. This will result in a **long term, minor, adverse** impact to the natural quality of wilderness. The limited use of helicopters to transport tread and materials would have a **short-term, negligible to minor, adverse** impact to the natural quality of wilderness.

“Outstanding opportunities for solitude or a primitive and unconfined type of recreation” -

Opportunities for solitude or primitive and unconfined experiences are improved when trails are maintained to a level that ensures reasonable access. This alternative proposes to improve sections of the current trail system but not create any new trails. The management actions proposed will have long term, negligible to minor, adverse impacts to the solitude or primitive/unconfined characteristic of wilderness character, but will also provide **long term, minor, beneficial** impacts to primitive recreation (i.e. hiking).

Other unique components that reflect the character of this wilderness

Heritage and Cultural Resources

There are no heritage/cultural resources in this portion of the wilderness that would be affected by any of the alternatives.

Maintaining Traditional Skills

Traditional, non-motorized skills currently exist and will be maintained within the workforce. Traditional skills will be enhanced within the park by the use of crosscut saws to remove trees, hand tools to shape logs for erosion control structures, rock bars to move rocks, pack stock to transport tools and tread material, etc.... In addition, hand tools such as shovels, picks, rock hammers, and rock bars will be used to construct trail structures.

Special Provisions

There are no special provisions of the Wilderness Act of 1964 or subsequent wilderness legislation that applies to maintenance of the managed trail system.

Economic and Time Constraints

Work to maintain the trail will continue using existing budget allocations for paid staff and support to volunteers. Crew efficiency will be reduced as shaping log trail structures by with cross-cut saws, hand

saws, and wood chisels are time consuming. Funds for reconstruction will be reduced as the cost of supplying tread material will be elevated due to the cost of pack stock and helicopter support.

Additional Wilderness-specific Comparison Criteria

There are no unique characteristics or criteria specific to this wilderness that would be affected by the implementation of any alternatives.

Safety of Visitors, Personnel, and Contractors

Repetitive use injuries will be a major area of concern for the crews if they are required to build all stone structures using hand tools only. Gathering stone exclusively by hand will expose crewmembers to injuries associated with repetitive heavy lifting.

The frequency of accidents is increased and the severity of injury can be major to employees and visitors when working with livestock and helicopters. This is due to dynamic weather conditions, limited exposure for employees to helicopter operations, and visitors who have not been exposed to or untrained in livestock operations. However, the frequency of employee accidents in this park has been significantly reduced due to training and qualified personnel overseeing such operations. Visitor use will be actively managed during all helicopter operations to ensure the public's safety.

Alternative E: Trail Reconstruction Completed with the use of Limited Mechanized Equipment Use and without the use of Pack Stock or Helicopter Support

Description: Hand grubbing tools such as shovels and picks will be used to re-bench sections of trail. Cross-cut saws, hand saws, and wood chisels will mostly be used to cut and shape log structures such as log retaining/ water bars, turnpike/causeways. Gas powered drills will only be used to create joinery between logs by driving/fastening lag screws when assembling bridges and log retaining walls. The joining of logs in the construction of backcountry turnpikes and retaining bars will be primarily completed using chainsaws. The milling of bridge stringers, lap joints, and cutting of kerf cuts will be completed using chainsaws.

Griphoists and dollies will be used to help transport materials to job sites. Gas or battery powered drills, gas powered generators and electric drills, and motorized flat plate compactors will also be used. Masonry hand tools such as masonry chisels, hammers, and rock bars will be used to quarry and shape rocks for erosion control structures and walls. The tread surface will consist of crushed rock or filled with minimally available dirt from the surrounding area. Borrow pits are not permissible according to management policies (i.e. ROMO Wilderness Plan sec. 2.1.4.7.3 and NPS Management policies sec 6.3.10.2).

Effects:

Wilderness Character

“Untrammeled” – Maintenance/reconstruction of trails will have a **short-term, negligible to minor, adverse** impacts to the untrammeled quality of wilderness.

“Undeveloped” – The installation of trail structures will have **short-term, negligible to minor, adverse** impacts to the undeveloped quality of wilderness

“Natural” – The natural quality of wilderness character will be improved by consolidating use along the trail corridor and minimizing vegetation trampling and soil erosion. This will have **long term, minor, beneficial** impacts to the natural quality of wilderness character. However, crushed rock is an undesirable walking surface for humans and stock and is sometimes avoided. This has the potential to cause vegetation trampling and soil erosion around sites with crushed rock used as trail tread. This will have **long term, negligible to minor, adverse** impacts to the natural quality of wilderness character.

“Outstanding opportunities for solitude or a primitive and unconfined type of recreation” -

Opportunities for solitude or primitive and unconfined experiences are improved when trails are maintained to a level that ensures reasonable access. This alternative proposes to improve sections of

the current trail system but not create any new trails. The management actions proposed will have long term, negligible to minor, adverse impacts to the solitude or primitive/unconfined characteristic of wilderness character, but will also provide **long term, minor, beneficial** impacts to primitive recreation (i.e. hiking).

Other unique components that reflect the character of this wilderness

Heritage and Cultural Resources

There are no heritage/cultural resources in this portion of the wilderness that would be affected by any of the alternatives.

Maintaining Traditional Skills

Traditional, non-motorized skills currently exist and will be maintained within the workforce. Traditional skills will be enhanced within the park by the use of crosscut saws to remove trees, hand tools to shape logs for erosion control structures, rock bars to move rocks, etc.... In addition, hand tools such as shovels, picks, rock hammers, and rock bars will be used to construct trail structures.

Special Provisions

There are no special provisions of the Wilderness Act of 1964 or subsequent wilderness legislation that applies to maintenance of the managed trail system.

Economic and Time Constraints

Work to maintain the trail will continue using existing budget allocations for paid staff and support to volunteers. Crew efficiency will be reduced as shaping log trail structures by with cross-cut saws, hand saws, and wood chisels are time consuming. More funds could also be allocated towards preserving or building more structures as we will not be allocating funds towards a helicopter or pack support to deliver trail tread. However, limited soil is available to re-establish trail tread and many sections of this trail will be left as crushed rock.

Additional Wilderness-specific Comparison Criteria

There are no unique characteristics or criteria specific to this wilderness that would be affected by the implementation of any alternatives.

Safety of Visitors, Personnel, and Contractors

Repetitive use injuries will be a major area of concern for the crews if they are required to build all stone structures using hand tools only. The frequency of accidents is minimal and the severity of injury is major when working with chainsaws and power tools. However, the frequency of accidents in this park have been significantly reduced due to training and qualified personnel overseeing such operations. Visitor use will be actively managed during all chainsaw operations to ensure the public's safety.

Alternative F: Trail Reconstruction Completed with the use of Limited Mechanized Equipment and the use of Pack Stock, but without the use of Helicopter Support

Description: Hand grubbing tools such as shovels and picks will be used to re-bench sections of trail. Cross-cut saws, hand saws, and wood chisels will mostly be used to cut and shape log structures such as log retaining/ water bars, turnpike/causeways. Gas powered drills will only be used to create joinery between logs by driving/fastening lag screws when assembling bridges and log retaining walls. The joining of logs in the construction of backcountry turnpikes and retaining bars will be primarily completed using chainsaws. The milling of bridge stringers, lap joints, and cutting of kerf cuts will be completed using chainsaws.

Gripheists and dollies will be used to help transport materials to job sites. Masonry hand tools such as masonry chisels, hammers, and rock bars will be used to quarry and shape rocks for erosion control structures and walls. The use of mule strings will transport tools and tread material to and from the trailhead and project sites.

Effects:

Wilderness Character

“Untrammeled” – Maintenance/reconstruction of trails will have a **short-term, negligible to minor, adverse** impacts to the untrammeled quality of wilderness.

“Undeveloped” – The installation of trail structures will have **short-term, negligible to minor, adverse** impacts to the undeveloped quality of wilderness

“Natural” – The natural quality of wilderness character will be improved by consolidating use along the trail corridor and minimizing vegetation trampling and soil erosion. This will have **long term, minor, beneficial** impacts to the natural quality of wilderness character. However, the extensive use of pack stock to transport soil/fill material to re-establish the trail tread will accelerate soil erosion along many sections of trail. This will result in a **long term, minor, adverse** impact to the natural quality of wilderness.

“Outstanding opportunities for solitude or a primitive and unconfined type of recreation” -

Opportunities for solitude or primitive and unconfined experiences are improved when trails are maintained to a level that ensures reasonable access. This alternative proposes to improve sections of the current trail system but not create any new trails. The management actions proposed will have long term, negligible to minor, adverse impacts to the solitude or primitive/unconfined characteristic of wilderness character, but will also provide **long term, minor, beneficial** impacts to primitive recreation (i.e. hiking).

Other unique components that reflect the character of this wilderness

Heritage and Cultural Resources

There are no heritage/cultural resources in this portion of the wilderness that would be affected by any of the alternatives.

Maintaining Traditional Skills

Traditional, non-motorized skills currently exist and will be maintained within the workforce. Traditional skills will be enhanced within the park by the use of crosscut saws to remove trees, hand tools to shape logs for erosion control structures, rock bars to move rocks, pack stock to transport tools and tread material, etc.... In addition, hand tools such as shovels, picks, rock hammers, and rock bars will be used to construct trail structures.

Special Provisions

There are no special provisions of the Wilderness Act of 1964 or subsequent wilderness legislation that applies to maintenance of the managed trail system.

Economic and Time Constraints

Work to maintain the trail will continue using existing budget allocations for paid staff and support to volunteers. Crew efficiency will be reduced as shaping log trail structures by with cross-cut saws, hand saws, and wood chisels are time consuming. Funds for reconstruction will be reduced as the cost of supplying tread material will be elevated due to the cost of pack support.

Additional Wilderness-specific Comparison Criteria

There are no unique characteristics or criteria specific to this wilderness that would be affected by the implementation of any alternatives.

Safety of Visitors, Personnel, and Contractors

Repetitive use injuries will be a major area of concern for the crews if they are required to build all stone structures using hand tools only. The frequency of accidents is minimal and the severity of injury is major when working with chainsaws and power tools. However, the frequency of accidents in this park have been significantly reduced due to training and qualified personnel overseeing such operations. Visitor use will be actively managed during all chainsaw operations to ensure the public's safety.

During transportation operations, the frequency of accidents is increased and the severity of injury can be major to employees and visitors when working with livestock. This is due to dynamic weather conditions

and visitors who have not been exposed to or untrained in livestock operations. However, the frequency of employee accidents in this park has been significantly reduced due to training and qualified personnel overseeing such operations.

Alternative G: Trail Reconstruction Completed with the use of Limited Mechanized Equipment and the use of Pack Stock and Helicopter Support

Description: Hand grubbing tools such as shovels and picks will be used to re-bench sections of trail. Cross-cut saws, hand saws, and wood chisels will mostly be used to cut and shape log structures such as log retaining/ water bars, turnpike/causeways. Gas powered drills will only be used to create joinery between logs by driving/fastening lag screws when assembling bridges and log retaining walls. The joining of logs in the construction of backcountry turnpikes and retaining bars will be primarily completed using chainsaws. The milling of bridge stringers, lap joints, and cutting of kerf cuts will be completed using chainsaws.

Gripshoists and dollies will be used to help transport materials to job sites. Masonry hand tools such as masonry chisels, hammers, and rock bars will be used to quarry and shape rocks for erosion control structures and walls. The use of mule strings will transport tools and tread material to and from the trailhead and project sites.

The use of a helicopter will transport materials and/or tread material to project sites from a designated helispot as close to the project site as possible to minimize exposure to the wilderness and improve safety. A park management team approved flight safety plan will be in place before flights are initiated and include wilderness character considerations.

Effects:

Wilderness Character

“Untrammeled” – Maintenance/reconstruction of trails will have a **short-term, negligible to minor, adverse** impacts to the untrammeled quality of wilderness. The use of a helicopter will be limited in its exposure in the wilderness and have a **short-term, negligible to minor, adverse** impact to the untrammeled quality of wilderness.

“Undeveloped” – The installation of trail structures will have **short-term, negligible to minor, adverse** impacts to the undeveloped quality of wilderness

“Natural” – The natural quality of wilderness character will be improved by consolidating use along the trail corridor and minimizing vegetation trampling and soil erosion. This will have **long term, minor, beneficial** impacts to the natural quality of wilderness character. However, the extensive use of pack stock to transport soil/fill material to re-establish the trail tread will accelerate soil erosion along many sections of trail. This will result in a **long term, minor, adverse** impact to the natural quality of wilderness.

“Outstanding opportunities for solitude or a primitive and unconfined type of recreation” -

Opportunities for solitude or primitive and unconfined experiences are improved when trails are maintained to a level that ensures reasonable access. This alternative proposes to improve sections of the current trail system but not create any new trails. The management actions proposed will have long term, negligible to minor, adverse impacts to the solitude or primitive/unconfined characteristic of wilderness character, but will also provide **long term, minor, beneficial** impacts to primitive recreation (i.e. hiking).

Other unique components that reflect the character of this wilderness

Heritage and Cultural Resources

There are no heritage/cultural resources in this portion of the wilderness that would be affected by any of the alternatives.

Maintaining Traditional Skills

Traditional, non-motorized skills currently exist and will be maintained within the workforce. Traditional skills will be enhanced within the park by the use of crosscut saws to remove trees, hand tools to shape logs for erosion control structures, rock bars to move rocks, pack stock to transport tools and tread material, etc.... In addition, hand tools such as shovels, picks, rock hammers, and rock bars will be used to construct trail structures.

Special Provisions

There are no special provisions of the Wilderness Act of 1964 or subsequent wilderness legislation that applies to maintenance of the managed trail system.

Economic and Time Constraints

Work to maintain the trail will continue using existing budget allocations for paid staff and support to volunteers. Crew efficiency will be reduced as shaping log trail structures by with cross-cut saws, hand saws, and wood chisels are time consuming. Funds for reconstruction will be reduced as the cost of supplying tread material will be elevated due to the cost of pack support.

Additional Wilderness-specific Comparison Criteria

There are no unique characteristics or criteria specific to this wilderness that would be affected by the implementation of any alternatives.

Safety of Visitors, Personnel, and Contractors

Repetitive use injuries will be a major area of concern for the crews if they are required to build all stone structures using hand tools only. The frequency of accidents is minimal and the severity of injury is major when working with chainsaws and power tools. However, the frequency of accidents in this park have been significantly reduced due to training and qualified personnel overseeing such operations. Visitor use will be actively managed during all chainsaw operations to ensure the public's safety.

During transportation operations, the frequency of accidents is increased and the severity of injury can be major to employees and visitors when working with livestock and helicopters. This is due to dynamic weather conditions, limited exposure for employees to helicopter operations, and visitors who have not been exposed to or untrained in livestock operations. However, the frequency of employee accidents in this park has been significantly reduced due to training and qualified personnel overseeing such operations. Visitor use will be actively managed during all helicopter operations to ensure the public's safety.

Alternative H: Trail Reconstruction Completed with the use of Mechanized Equipment and without the use of Pack Stock or Helicopter Support

Description: Hand grubbing tools such as shovels and picks will be used to re-bench sections of trail. Chainsaws and wood chisels will mostly be used to cut and shape log structures such as log retaining/water bars, turnpike/causeways. Gas powered drills will only be used to create joinery between logs by driving/fastening lag screws when assembling bridges and log retaining walls. The joining of logs in the construction of backcountry turnpikes and retaining bars will be primarily completed using chainsaws

Gripoists and dollies will be used to help transport materials to job sites. Gas or electric powered drills along with masonry hand tools such as masonry chisels, hammers, and rock bars will be used to quarry and shape rocks for erosion control structures and walls. The tread surface will consist of crushed rock or filled with minimally available dirt from the surrounding area. Borrow pits are not permissible according to management policies (i.e. ROMO Wilderness Plan sec. 2.1.4.7.3 and NPS Management policies sec 6.3.10.2).

Effects:

Wilderness Character

“Untrammelled” – Maintenance/reconstruction of trails will have a **short-term, negligible to minor, adverse** impacts to the untrammelled quality of wilderness.

“Undeveloped” – The installation of trail structures will have *short-term, negligible to minor, adverse* impacts to the undeveloped quality of wilderness

“Natural” – The natural quality of wilderness character will be improved by consolidating use along the trail corridor and minimizing vegetation trampling and soil erosion. This will have *long term, minor, beneficial* impacts to the natural quality of wilderness character. However, crushed rock is an undesirable walking surface for humans and stock and is sometimes avoided. This has the potential to cause vegetation trampling and soil erosion around sites with crushed rock used as trail tread. This will have *long term, negligible to minor, adverse* impacts to the natural quality of wilderness character.

“Outstanding opportunities for solitude or a primitive and unconfined type of recreation” -

Opportunities for solitude or primitive and unconfined experiences are improved when trails are maintained to a level that ensures reasonable access. This alternative proposes to improve sections of the current trail system but not create any new trails. The management actions proposed will have long term, negligible to minor, adverse impacts to the solitude or primitive/unconfined characteristic of wilderness character, but will also provide *long term, minor, beneficial* impacts to primitive recreation (i.e. hiking).

Other unique components that reflect the character of this wilderness

Heritage and Cultural Resources

There are no heritage/cultural resources in this portion of the wilderness that would be affected by any of the alternatives.

Maintaining Traditional Skills

Traditional, non-motorized skills currently exist and will be maintained within the workforce. Traditional skills will be enhanced within the park by the use of hand tools to shape logs for erosion control structures, rock bars to move rocks, etc... In addition, hand tools such as shovels, picks, rock hammers, and rock bars will be used to construct trail structures.

Special Provisions

There are no special provisions of the Wilderness Act of 1964 or subsequent wilderness legislation that applies to maintenance of the managed trail system.

Economic and Time Constraints

Work to maintain the trail will continue using existing budget allocations for paid staff and support to volunteers. With the use of powered tools, work efficiency will be improved resulting in more funds to be allocated towards preserving or building more structures. In addition, as we will not be allocating funds towards a helicopter or pack support to deliver trail tread we will be able to direct more funding towards trail structures. However, limited soil is available to re-establish trail tread and many sections of this trail will be left as crushed rock.

Additional Wilderness-specific Comparison Criteria

There are no unique characteristics or criteria specific to this wilderness that would be affected by the implementation of any alternatives.

Safety of Visitors, Personnel, and Contractors

The frequency of accidents is minimal and the severity of injury is major when working with chainsaws and power tools. However, the frequency of accidents in this park have been significantly reduced due to training and qualified personnel overseeing such operations. Visitor use will be actively managed during all chainsaw operations to ensure the public's safety.

Alternative I: Trail Reconstruction Completed with the use of Mechanized Equipment and Pack Stock, but without the use of Helicopter Support

Description: Hand grubbing tools such as shovels and picks will be used to re-bench sections of trail. Chainsaws and wood chisels will mostly be used to cut and shape log structures such as log retaining/water bars, turnpike/causeways. Gas powered drills will only be used to create joinery between logs by

driving/fastening lag screws when assembling bridges and log retaining walls. The joining of logs in the construction of backcountry turnpikes and retaining bars will be primarily completed using chainsaws

Gripheists and dollies will be used to help transport materials to job sites. Gas or electric powered drills along with masonry hand tools such as masonry chisels, hammers, and rock bars will be used to quarry and shape rocks for erosion control structures and walls. The use of mule strings will transport tools and tread material to and from the trailhead and project sites.

Effects:

Wilderness Character

“Untrammeled” – Maintenance/reconstruction of trails will have a ***short-term, negligible to minor, adverse*** impacts to the untrammeled quality of wilderness.

“Undeveloped” – The installation of trail structures will have ***short-term, negligible to minor, adverse*** impacts to the undeveloped quality of wilderness

“Natural” – The natural quality of wilderness character will be improved by consolidating use along the trail corridor and minimizing vegetation trampling and soil erosion. This will have ***long term, minor, beneficial*** impacts to the natural quality of wilderness character. However, the extensive use of pack stock to transport soil/fill material to re-establish the trail tread will accelerate soil erosion along many sections of trail. This will result in a ***long term, minor, adverse*** impact to the natural quality of wilderness.

“Outstanding opportunities for solitude or a primitive and unconfined type of recreation” -

Opportunities for solitude or primitive and unconfined experiences are improved when trails are maintained to a level that ensures reasonable access. This alternative proposes to improve sections of the current trail system but not create any new trails. The management actions proposed will have long term, negligible to minor, adverse impacts to the solitude or primitive/unconfined characteristic of wilderness character, but will also provide ***long term, minor, beneficial*** impacts to primitive recreation (i.e. hiking).

Other unique components that reflect the character of this wilderness

Heritage and Cultural Resources

There are no heritage/cultural resources in this portion of the wilderness that would be affected by any of the alternatives.

Maintaining Traditional Skills

Traditional, non-motorized skills currently exist and will be maintained within the workforce. Traditional skills will be enhanced within the park by the use of hand tools to rocks for erosion control structures, rock bars to move rocks, etc... In addition, hand tools such as shovels, picks, rock hammers, and rock bars will be used to construct trail structures.

Special Provisions

There are no special provisions of the Wilderness Act of 1964 or subsequent wilderness legislation that applies to maintenance of the managed trail system.

Economic and Time Constraints

Work to maintain the trail will continue using existing budget allocations for paid staff and support to volunteers. With the use of powered tools, work efficiency will be improved resulting in more funds to be allocated towards preserving or building more structures. Funds for reconstruction will be reduced as the cost of supplying tread material will be elevated due to the cost of pack support.

Additional Wilderness-specific Comparison Criteria

There are no unique characteristics or criteria specific to this wilderness that would be affected by the implementation of any alternatives.

Safety of Visitors, Personnel, and Contractors

The frequency of accidents is minimal and the severity of injury is major when working with chainsaws and power tools. However, the frequency of accidents in this park have been significantly reduced due to

training and qualified personnel overseeing such operations. Visitor use will be actively managed during all chainsaw operations to ensure the public's safety.

During transportation operations, the frequency of accidents is increased and the severity of injury can be major to employees and visitors when working with livestock. This is due to dynamic weather conditions and visitors who have not been exposed to or untrained in livestock operations. However, the frequency of employee accidents in this park has been significantly reduced due to training and qualified personnel overseeing such operations.

Alternative J: Trail Reconstruction Completed with the use of Mechanized Equipment, Pack Stock and Helicopter Support

Hand grubbing tools such as shovels and picks will be used to re-bench sections of trail. Chainsaws and wood chisels will mostly be used to cut and shape log structures such as log retaining/ water bars, turnpike/causeways. Gas powered drills will only be used to create joinery between logs by driving/fastening lag screws when assembling bridges and log retaining walls. The joining of logs in the construction of backcountry turnpikes and retaining bars will be primarily completed using chainsaws

Grip-hoists and dollies will be used to help transport materials to job sites. Gas or electric powered drills along with masonry hand tools such as masonry chisels, hammers, and rock bars will be used to quarry and shape rocks for erosion control structures and walls. The use of mule strings will transport tools and tread material to and from the trailhead and project sites.

The use of a helicopter will transport materials and/or tread material to project sites from a designated helispot as close to the project site as possible to minimize exposure to the wilderness and improve safety. A park management team approved flight safety plan will be in place before flights are initiated and include wilderness character considerations.

Effects:

Wilderness Character

“Untrammeled” – Maintenance/reconstruction of trails will have a **short-term, negligible to minor, adverse** impacts to the untrammeled quality of wilderness. The use of a helicopter will be limited in its exposure in the wilderness and have a **short-term, negligible to minor, adverse** impact to the untrammeled quality of wilderness.

“Undeveloped” – The installation of trail structures will have **short-term, negligible to minor, adverse** impacts to the undeveloped quality of wilderness

“Natural” – The natural quality of wilderness character will be improved by consolidating use along the trail corridor and minimizing vegetation trampling and soil erosion. This will have **long term, minor, beneficial** impacts to the natural quality of wilderness character. However, the extensive use of pack stock to transport soil/fill material to re-establish the trail tread will accelerate soil erosion along many sections of trail. This will result in a **long term, minor, adverse** impact to the natural quality of wilderness.

“Outstanding opportunities for solitude or a primitive and unconfined type of recreation” -

Opportunities for solitude or primitive and unconfined experiences are improved when trails are maintained to a level that ensures reasonable access. This alternative proposes to improve sections of the current trail system but not create any new trails. The management actions proposed will have long term, negligible to minor, adverse impacts to the solitude or primitive/unconfined characteristic of wilderness character, but will also provide **long term, minor, beneficial** impacts to primitive recreation (i.e. hiking).

Other unique components that reflect the character of this wilderness

Heritage and Cultural Resources

There are no heritage/cultural resources in this portion of the wilderness that would be affected by any of the alternatives.

Maintaining Traditional Skills

Traditional, non-motorized skills currently exist and will be maintained within the workforce. Traditional skills will be enhanced within the park by the use of hand tools to rocks for erosion control structures, rock bars to move rocks, etc... In addition, hand tools such as shovels, picks, rock hammers, and rock bars will be used to construct trail structures.

Special Provisions

There are no special provisions of the Wilderness Act of 1964 or subsequent wilderness legislation that applies to maintenance of the managed trail system.

Economic and Time Constraints

Work to maintain the trail will continue using existing budget allocations for paid staff and support to volunteers. With the use of powered tools, work efficiency will be improved resulting in more funds to be allocated towards preserving or building more structures. Funds for reconstruction will be reduced as the cost of supplying tread material will be elevated due to the cost of pack support.

Additional Wilderness-specific Comparison Criteria

There are no unique characteristics or criteria specific to this wilderness that would be affected by the implementation of any alternatives.

Safety of Visitors, Personnel, and Contractors

The frequency of accidents is minimal and the severity of injury is major when working with chainsaws and power tools. However, the frequency of accidents in this park have been significantly reduced due to training and qualified personnel overseeing such operations. Visitor use will be actively managed during all chainsaw operations to ensure the public's safety.

During transportation operations, the frequency of accidents is increased and the severity of injury can be major to employees and visitors when working with livestock and helicopters. This is due to dynamic weather conditions, limited exposure for employees to helicopter operations, and visitors who have not been exposed to or untrained in livestock operations. However, the frequency of employee accidents in this park has been significantly reduced due to training and qualified personnel overseeing such operations. Visitor use will be actively managed during all helicopter operations to ensure the public's safety.

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."

	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F	Alternative G	Alternative H	Alternative I	Alternative J	No Action
Untrammeled	-	-	-	-	-	-	-	-	-	N/A
Undeveloped	-	-	--	--	--	--	--	--	--	N/A
Natural	+-	+-	-	+-	+-	+-	+-	+-	+-	-
Solitude or Primitive Recreation	+-	+-	+-	+-	+-	+-	+-	+-	+-	N/A
Unique components	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	NA	N/A
WILDERNESS CHARACTER	++----	++----	++-----	++-----	++-----	++-----	++-----	++-----	++-----	N/A

	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F	Alternative G	Alternative H	Alternative I	Alternative J	No Action
Heritage & Cultural Resources	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Maintaining Traditional Skills	+	+	+-	+	+	+-	+-	+-	+-	N/A
Special Provisions	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Economics & Timing	-	-	-	+-	+-	+-	+	+	+	N/A
Additional Wilderness Criteria	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
OTHER CRITERIA SUMMARY	+-	+-	+-	++-	++-	++-	++-	++-	++-	N/A

	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F	Alternative G	Alternative H	Alternative I	Alternative J	No Action
SAFETY (PUBLIC AND WORKERS)	+-	+-	+-	+-	+-	+-	+-	+-	+-	N/A

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.

Documentation:

To support the evaluation of alternatives, provide an analysis, reference, or documentation and avoid assumptions about risks and the potential for accidents. This documentation can take the form of agency accident-rate data tracking occurrences and severity; a project-specific job hazard analysis; research literature; or other specific agency guidelines.

A repetitive motion injury (RMI) or repetitive strain injury (RSI) is a work-related injury caused by overuse of a particular musculoskeletal group to perform a task that is repeated hundreds to thousands of times in day-to-day work; repetitive motion injury affects workers in the textile industry, meat-packers, keyboard operators and others. This is especially true in trail work where employees are required to complete several repetitive tasks each day such as digging, swinging hammers and picks, rolling and carrying rocks, and carrying logs.

RMI is essentially a disorder of motor function caused by any often-repeated activity that is persisted in beyond a particular threshold, especially if the activity involves an inherently awkward or uncomfortable position of the body. With RMI, connective tissues can become sore and sometimes unusable from repeated exposure to such over use. Symptoms can be acute pain and cramp-like stiffness, and sometimes result in the total inability to continue in the associated occupation.

Below is a list of five (5) academic sites that list the causes, symptoms, and care for repetitive motion injuries or repetitive stress injuries.

- http://www.ninds.nih.gov/disorders/repetitive_motion/repetitive_motion.htm
- <http://www.webmd.com/fitness-exercise/repetitive-motion-injuries>
- http://www.hopkinsmedicine.org/healthlibrary/conditions/physical_medicine_and_rehabilitation/repetitive_motion_injury_85.P01176/
- https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=SPEECHES&p_id=206
- <http://www.medicalnewstoday.com/articles/176443.php>

Step 2 Decision: What is the Minimum Activity?

Please refer to the accompanying MRDG Instructions before describing the selected alternative and describing the rationale for selection.

Selected alternative: Alternative G: Trail Reconstruction Completed with the use of Limited Mechanized Equipment and the use of Pack Stock and Helicopter Support

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

Work on park trails is generally allowed via the categorical exclusion for established trails under NEPA and Section 106 of the National Historic Preservation Act as outlined in the Servicewide Programmatic Agreement July 17, 1995, stipulation IV.B.(6). (RMNP Wilderness Management Plane, sec. 2.1.4.7.3) The plan also states that trails serve to “contain and consolidate” wilderness and existing trails should be “maintained at “desired standards” as long crews will “avoid unacceptable impact on the resources and disturbance to the visitor.” The Trail’s Management Team has determined that the significant loss of natural resources due to erosion, widening of the trail from visitor and livestock use, the poor conditions of the trail tread, and the deterioration of the historic structures warrant preservation/reconstruction operation to proceed.

In this case, the 2013 flood caused such extensive damage to portions of these five trails (Lawn Lake, Ypsilon Lake, Alluvial Fan, Aspen Brook, and Twin Sisters), that a categorical exclusion does not apply. Portions of these five trails were heavily damaged or lost during the flood. In order to return them to visitor use, relocations and/or extensive repairs are required. As such, an environmental assessment has been prepared to address reroutes and repairs to these trails. The EA 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 on the resources and values, and 3) identifies mitigation measures to lessen the degree or extent of these impacts.

In most instances, we would be asking for the limited use of mechanized equipment and pack support or Alternative E. Aside from the loss of productivity and efficiency, the use of non-motorized equipment is the rational alternative as this alternative implements the minimum requirements direction in the 1964 Wilderness Act for use of non-motorized equipment while also meeting other criteria for preserving the undeveloped and opportunities for solitude and a primitive and unconfined type of recreation qualities of wilderness character, use of traditional skills. Every effort of the crew would be focused on maintaining the quality of the wilderness by using non-mechanized equipment whenever possible.

This alternative provides a good balance of using both primitive tools and mechanized equipment in regards to safety, production, efficiency, cost, visitor solitude and construction requirements. Considering the use of using dead vs. live trees also points in favor of using mechanized equipment to at least rip and notch the logs before fine tuning the logs with hand tools. This will allow the crew to not fell any live trees in a beetle kill environment.

Under this alternative, most of the log joints would be required to be notched and joined while the logs are in place. This ensures tight and long-lasting joints as a saw is passed through the joint and the logs are then pushed together eliminating any gaps that exist. This method requires close proximity of the saw to dirt/rock; most of the areas are limited in space. This restricts the work as most crosscut saws are of

significant length. It also creates a problem since work areas while using a crosscut need to be free of dirt and rock. If a crosscut is used in such an area, it significantly dulls the teeth and the saw will need to be sharpened which might take two to 20 hours depending on the damage.

The use of griphoists and rock dollies are detrimental in preventing repetitive motion injuries and injuries to the natural resources in the park. Griphoists allow the crews to safely move rock greater than 100 lbs. when needed, which is frequently. They also provide a non-impact way of moving materials great distances which saves the crew members from continuously moving material across these distances over natural resources. Once the materials are within the trail corridor, rock dollies help move the material to the project site efficiently and safely.

In addition to the use of griphoist and dollies to move material, we will be asking for the use of pack stock to be the primary method of importing tools and tread material to the project sites. Although the repetitive use of pack stock on trails can cause significant impacts to the trail, they are considered a traditional tool and minimally impactful on the wilderness character. In the case that a project would require large amounts of imported tread material or special materials such as steel I-beams, we would be asking for the use of a helicopter to transport these materials. As prolonged pack stock use on trails can be detrimental to the sustainability of the tread, transporting large materials and/or large amounts of tread material by helicopter will be necessary to protect vegetation and sustain the overall condition of the trail for visitor use. In these cases the use of helicopters is selected because:

1. The size, weight, and/or shape of required materials make them unable to be secured to a pack animal.
2. NPS and ROMO guidelines prohibit the use of borrow pits to obtain large quantities of tread material.
3. The cumulative impact of multiple days of stock traffic to transport material is potentially hazardous to the health of pack stock.
4. Such use will also include severe, negative impacts on the condition of the trail by promoting soil erosion below the project sites and undermine the overall objective to improve the trail's sustainability and quality.

We would also be asking for the use of a gas or battery powered drills to drive in the TimberLok lags. These are lags that are just as structurally strong as traditional lags, but are smaller in width. Because of the size of TimberLoks we have noticed that the surrounding wood does not decay as fast improving the lifespan of our bridge structures and are less noticeable to visitors. However, they are extremely difficult to drive in by hand and with an electric drill, which is why we request the use of a gas powered drill. The drill is usually operated only for a minute for each lag.

Due to the limitations of the established corridor for gathering materials, we would also be requesting the use of gas powered generators and electric drills to drill holes for quarrying and blasting of rock. This corridor can range from 50ft. to 200ft. but also limits crews in rock selection. These limitations make the quarrying and shaping of rock essential. In most cases, crews will quarry and shape rock with sledge hammers and chisels; however, in some cases with bigger rock and to reduce the crew's exposure to repetitive motion injuries the crew will need to drill and split the rock to more manageable sizes. This is accomplished with the use of a 36V drill or an electric powered drill plugged into a gas powered generator. The drills and generators are selected because of their minimal noise levels and emissions output. Each drill and generator is usually operated for one to two minutes for each hole and no more than five holes are drilled at any one time.

However, there are some limiting concerns and some benefits to these alternatives:

1. Alternative B allows us to really find out how long it would take a crew to build a bridge using just primitive tools. This would allow us to update our estimating tool for future projects. At this time, we are estimating that it would increase building time one third.
2. The use of primitive tools would allow the crew to start to develop new skills. As these skills are further developed, construction efficiency could also improve over time.
3. Repetitive motion injuries might increase with the use of primitive tools. Frequent breaks would be needed to prevent these injuries which would increase the time of construction.
4. If primitive tools are to be used, we are delaying the ability of visitors to safely use Park backcountry campsites by not building the footbridges in a timely manner.

5. Primitive hand tools are best used when working with live “green” trees. If so, we would be felling live trees in areas that have already been hit by beetle kill. Subsequently, we would be killing some of the only live trees in these areas.

Exception: 150ft. Accessible Spur on the Alluvial Fan Trail

A short trail spur about 350 feet long has been proposed to be constructed to a new overlook of the Roaring River. This spur would extend into designated wilderness about 150 ft. Because this spur will be considered a Class 4 or Class 5 trail, it would be constructed to Architectural Barriers Act (ABA) accessibility standards to allow use by all visitors.

Selected alternative: Alternative H: Trail Reconstruction Completed with the use of Mechanized Equipment and without the use of Pack Stock or Helicopter Support

Although the surface of this trail has yet to be determined at a minimum it would be constructed using the park’s established design guidelines for accessible trails. Currently all recreational accessible trails within the park are constructed of a treated log retaining structure and of a compacted, crushed granite surface or other type of sustainable aggregate such as StayLok. The proposed alignment of the trail is along a very rocky corridor on the east bank of the Roaring River. (Figure 2) In addition, the use of heavy machinery will be needed to compact the tread surface to meet ABA guidelines.

In most instances, we would be asking for the limited use of mechanized equipment or Alternative E. However; aside from the loss of productivity and efficiency, the use of non-motorized equipment is the rational alternative as this alternative implements the minimum requirements direction in the 1964 Wilderness Act for use of non-motorized equipment while also meeting other criteria for preserving the undeveloped and opportunities for solitude and a primitive and unconfined type of recreation qualities of wilderness character, use of traditional skills. Every effort of the crew would be focused on maintaining the quality of the wilderness by using non-mechanized equipment whenever possible.

This alternative provides a good balance of using both primitive tools and mechanized equipment in regards to safety, production, efficiency, cost, visitor solitude, and construction requirements. Under this alternative, most of the log joints would be required to be notched and joined while the logs are in place. This ensures tight and long-lasting joints as a saw is passed through the joint and the logs are then pushed together eliminating any gaps that exist. This method requires close proximity of the saw to dirt/rock; most of the areas are limited in space. This restricts the work as most crosscut saws are of significant length. It also creates a problem since work areas while using a crosscut need to be free of dirt and rock. If a crosscut is used in such an area, it significantly dulls the teeth and the saw will need to be sharpened which might take two to 20 hours depending on the damage.

The use of griphoists and rock dollies, which are considered non-motorized mechanized equipment, are detrimental in preventing repetitive motion injuries and injuries to the natural resources in the park. Griphoists allow the crews to safely move rock greater than 100 lbs. when needed, which is frequently. They also provide a non-impact way of moving materials great distances which saves the crew members from continuously moving material across these distances over natural resources. Once the materials are within the trail corridor, rock dollies help move the material to the project site efficiently and safely.

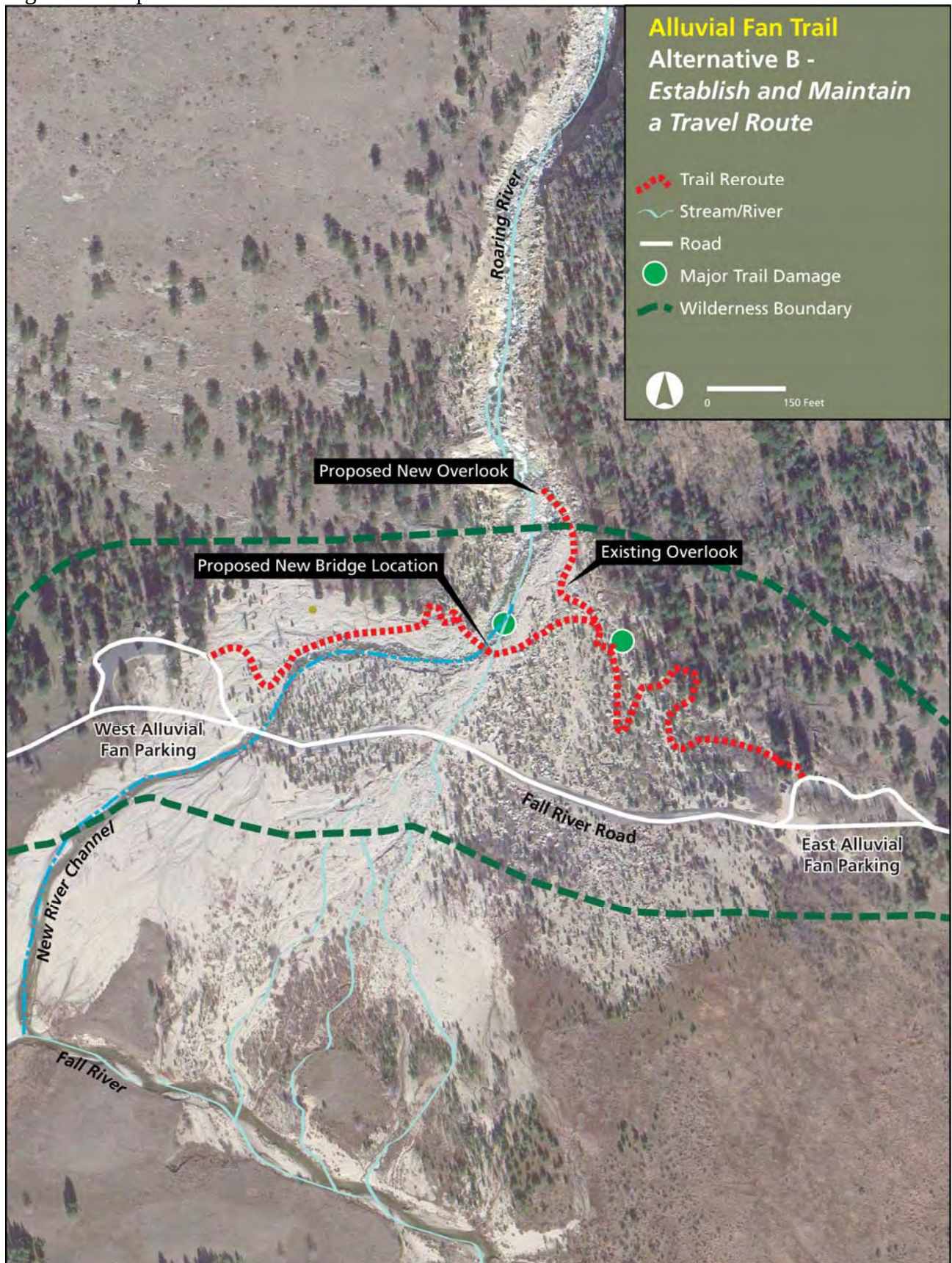
We would also be asking for the use of a gas or battery powered drills to drive in the TimberLok lags. These are lags that are just as structurally strong as traditional lags, but are smaller in width. Because of the size of TimberLoks we have noticed that the surrounding wood does not decay as fast improving the lifespan of our bridge structures and are less noticeable to visitors. However, they are extremely difficult to drive in by hand and with an electric drill, which is why we request the use of a gas powered drill. The drill is usually operated only for a minute for each lag.

Due to the limitations of the established corridor for gathering materials, we would also be requesting the use of gas powered generators and electric drills to drill holes for quarrying and blasting of rock. This corridor can range from 50ft. to 200ft. but also limits crews in rock selection. These limitations make the quarrying and shaping of rock essential. In most cases, crews will quarry and shape rock with sledge hammers and chisels; however, in some cases with bigger rock and to reduce the crew's exposure to repetitive motion injuries the crew will need to drill and split the rock to more manageable sizes. This is accomplished with the use of a 36V drill or an electric powered drill plugged into a gas powered generator. The drills and generators are selected because of their minimal noise levels and emissions

output. Each drill and generator is usually operated for one to two minutes for each hole and no more than five holes are drilled at any one time.

To finish the trail the final tread layer will need to be compacted with the use of a motorized flat plate compactor. This is essential to gaining the desired compaction of the aggregate to meet accessible tread standards. The tread will be brought in with the use of wheelbarrows and spread along the trailway at two (2) inch lift increments. A vibrating plate compactor will then be passed over the aggregate twice. Usually one (1) lift is needed; however, in some cases two (2) lifts might be required. We anticipate that the use of the plate compactor should be around 8 hours in total.

Figure 2 - Proposed Alluvial Fan Trail—



Monitoring and reporting requirements:

Track the following information on motorized equipment use:

- 1 Date
- 2 Location
- 3 Number of hours
- 4 Purpose of use

Track the following for helicopter use

- 1 Date
- 2 Location
- 3 Number of slings and quantity of materials transported
- 4 Purpose of use

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

- | | |
|--|---|
| ☒ mechanical transport | ☐ landing of aircraft |
| ☒ motorized equipment (chainsaw limited use) | ☐ temporary road |
| ☐ motor vehicles | ☒ structure or installation |
| ☐ motorboats | |

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

Approvals	Signature	Name	Position	Date
Prepared by:		Kevin J Soviak	Program Supervisor Trails	
Recommended:		Paul McLaughlin	Wilderness Coordinator	
Recommended:				
Approved:				

Appendix C
Wilderness Character, USFS Trail Class Matrix and Design Parameters

SUMMARY OF QUALITIES, INDICATORS, AND MEASURES OF WILDERNESS CHARACTER

NATURAL Wilderness “...is protected and managed so as to preserve its natural conditions” Wilderness ecological systems are substantially free from the <u>effects</u> of modern civilization Indicators are: • Plant and animal species and communities • Physical resources • Biophysical processes Measures could include: • abundance/distribution for species of concern • non-native species • grazing allotments • visibility, ozone, chemical deposition • departure from natural fire regimes • loss of connectivity • measures related to climate change	UNTRAMMELED Wilderness is “...an area where the earth and its community of life are untrammed by man...” and is “...affected primarily by the forces of nature” Wilderness ecological systems are essentially unhindered and free from the <u>actions</u> of modern human control or manipulation Indicators are: • Actions authorized by the Federal land manager that manipulate the biophysical environment • Actions <u>not</u> authorized by the Federal manager that manipulate the biophysical environment Measures could include: • spraying weeds • suppressing or lighting fire • introducing non-native species • unauthorized actions such as predator control
UNDEVELOPED Wilderness is “...an area of undeveloped Federal land...without permanent improvement or human habitation” and “...where man himself is a visitor who does not remain” Wilderness retains its primeval character and influence, and is essentially without permanent improvement or modern human occupation Indicators are: • Non-recreational structures, installations, developments • Inholdings • Use of motor vehicles, motorized equipment, or mechanical transport Measures could include: • authorized installations and developments such as scientific equipment, radio repeaters, fish barriers • unauthorized installations and developments • inholdings • administrative and emergency uses of motor vehicles, motorized equipment, or mechanical transport • unauthorized uses of motor vehicles, motorized equipment, or mechanical transport	SOLITUDE OR PRIMITIVE AND UNCONFINED RECREATION Wilderness “...has outstanding opportunities for solitude or a primitive and unconfined type of recreation” Wilderness provides outstanding opportunities for solitude or primitive and unconfined recreation Indicators are: • Remoteness from sights and sounds of people inside the wilderness • Remoteness from occupied and modified areas outside the wilderness • Facilities that decrease self-reliant recreation • Management restrictions on visitor behavior Measures could include: • visitor use • area affected by travel routes • night sky visibility • impacts to soundscape • authorized recreation facilities such as trails, toilets, bridges, shelters • unauthorized recreation facilities such as user-created campsites, illegal motorcycle/ATV trails • visitor management restrictions
OTHER FEATURES OF VALUE Wilderness “...may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.” Wilderness preserves other tangible features that are of scientific, educational, scenic, or historical value Indicators and measures of other features must be identified separately for each wilderness, and not readily fit within one of the other qualities. Examples include cultural and historic sites, and paleontological features.	

Modified from -- *Keeping it Wild: An Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System*. 2008. USDA Forest Service RMRS-GTR-212. Fort Collins, CO.



Trail Class Matrix

Trail Classes are general categories reflecting trail development scale, arranged along a continuum. The Trail Class identified for a National Forest System (NFS) trail prescribes its development scale, representing its intended design and management standards.¹ Local deviations from any Trail Class descriptor may be established based on trail-specific conditions, topography, or other factors, provided that the deviations do not undermine the general intent of the applicable Trail Class.

Identify the appropriate Trail Class for each National Forest System trail or trail segment based on the management intent in the applicable land management plan, travel management direction, trail-specific decisions, and other related direction. Apply the Trail Class that most closely matches the management intent for the trail or trail segment, which may or may not reflect the current condition of the trail.

Trail Attributes	Trail Class 1 Minimally Developed	Trail Class 2 Moderately Developed	Trail Class 3 Developed	Trail Class 4 Highly Developed	Trail Class 5 Fully Developed
Tread & Traffic Flow	♦ Tread intermittent and often indistinct ♦ May require route finding ♦ Single lane with no allowances constructed for passing ♦ Predominantly native materials	♦ Tread continuous and discernible, but narrow and rough ♦ Single lane with minor allowances constructed for passing ♦ Typically native materials	♦ Tread continuous and obvious ♦ Single lane, with allowances constructed for passing where required by traffic volumes in areas with no reasonable passing opportunities available ♦ Native or imported materials	♦ Tread wide and relatively smooth with few irregularities ♦ Single lane, with allowances constructed for passing where required by traffic volumes in areas with no reasonable passing opportunities available ♦ Double lane where traffic volumes are high and passing is frequent ♦ Native or imported materials ♦ May be hardened	♦ Tread wide, firm, stable, and generally uniform ♦ Single lane, with frequent turnouts where traffic volumes are low to moderate ♦ Double lane where traffic volumes are moderate to high ♦ Commonly hardened with asphalt or other imported material
Obstacles	♦ Obstacles common, naturally occurring, often substantial and intended to provide increased challenge ♦ Narrow passages; brush, steep grades, rocks and logs present	♦ Obstacles may be common, substantial, and intended to provide increased challenge ♦ Blockages cleared to define route and protect resources ♦ Vegetation may encroach into trailway	♦ Obstacles may be common, but not substantial or intended to provide challenge ♦ Vegetation cleared outside of trailway	♦ Obstacles infrequent and insubstantial ♦ Vegetation cleared outside of trailway	♦ Obstacles not present ♦ Grades typically < 8%

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Trail Attributes	Trail Class 1 Minimally Developed	Trail Class 2 Moderately Developed	Trail Class 3 Developed	Trail Class 4 Highly Developed	Trail Class 5 Fully Developed
Constructed Features & Trail Elements	- Structures minimal to non-existent - Drainage typically accomplished without structures - Natural fords - Typically no bridges	- Structures of limited size, scale, and quantity; typically constructed of native materials - Structures adequate to protect trail infrastructure and resources - Natural fords - Bridges as needed for resource protection and appropriate access	- Structures may be common and substantial; constructed of imported or native materials - Natural or constructed fords - Bridges as needed for resource protection and appropriate access	- Structures frequent and substantial; typically constructed of imported materials - Constructed or natural fords - Bridges as needed for resource protection and user convenience - Trailside amenities may be present	- Structures frequent or continuous; typically constructed of imported materials - May include bridges, boardwalks, curbs, handrails, trailside amenities, and similar features
Signs²	- Route identification signing limited to junctions - Route markers present when trail location is not evident - Regulatory and resource protection signing infrequent - Destination signing, unless required, generally not present - Information and interpretive signing generally not present	- Route identification signing limited to junctions - Route markers present when trail location is not evident - Regulatory and resource protection signing infrequent - Destination signing typically infrequent outside of wilderness; generally not present in wilderness - Information and interpretive signing not common	- Route identification signing at junctions and as needed for user reassurance - Route markers as needed for user reassurance - Regulatory and resource protection signing may be common - Destination signing likely outside of wilderness; generally not present in wilderness - Information and interpretive signs may be present outside of wilderness	- Route identification signing at junctions and as needed for user reassurance - Route markers as needed for user reassurance - Regulatory and resource protection signing common - Destination signing common outside of wilderness; generally not present in wilderness - Information and interpretive signs may be common outside of wilderness - Accessibility information likely displayed at trailhead	- Route identification signing at junctions and for user reassurance - Route markers as needed for user reassurance - Regulatory and resource protection signing common - Destination signing common - Information and interpretive signs common - Accessibility information likely displayed at trailhead
Typical Recreation Environments & Experience³	- Natural, unmodified - ROS: Typically Primitive to Roaded Natural - WROS: Typically Primitive to Semi-Primitive	- Natural, essentially unmodified - ROS: Typically Primitive to Roaded Natural Typically - WROS: Typically Primitive to Semi-Primitive	- Natural, primarily unmodified - ROS: Typically Primitive to Roaded Natural - WROS: Typically Semi-Primitive to Transition	- May be modified - ROS: Typically Semi-Primitive to Roaded Natural to Rural setting - WROS: Typically Portal or Transition	- May be highly modified - Commonly associated with visitor centers or high-use recreation sites - ROS: Typically Roaded Natural to Urban - Generally not present in Wilderness

¹ For National Quality Standards for Trails, Potential Appropriateness of Trail Classes for Managed Uses, Design Parameters, and other related guidance, refer to FSM 2353, FSH 2309.18, and other applicable agency references.

² For standards and guidelines for the use of signs and posters along trails, refer to the Sign and Poster Guidelines for the Forest Service (EM-7100-15).

³ The Trail Class Matrix shows the combinations of Trail Class and Recreation Opportunity Spectrum (ROS) or Wilderness Recreation Opportunity Spectrum (WROS) settings that commonly occur, although trails in all Trail Classes may and do occur in all settings. For guidance on the application of the ROS and WROS, refer to FSM 2310 and 2353 and FSH 2309.18.



Design Parameters

Design Parameters are technical guidelines for the survey, design, construction, maintenance, and assessment of National Forest System trails, based on their Designed Use and Trail Class and consistent with their management intent¹. Local deviations from any Design Parameter may be established based on trail-specific conditions, topography, or other factors, provided that the deviations are consistent with the general intent of the applicable Trail Class.

Designed Use HIKER/PEDESTRIAN		Trail Class 1	Trail Class 2	Trail Class 3 ²	Trail Class 4 ²	Trail Class 5 ²
Design Tread Width	Wilderness (Single Lane)	0" – 12"	6" – 18"	12" – 24" Exception: may be 36" – 48" at steep side slopes	18" – 24" Exception: may be 36" – 48" at steep side slopes	Not applicable
	Non-Wilderness (Single Lane)	0" – 12"	6" – 18"	18" – 36"	24" – 60"	36" – 72"
	Non-Wilderness (Double Lane)	36"	36"	36" – 60"	48" – 72"	72" – 120"
	Structures (Minimum Width)	18"	18"	18"	36"	36"
Design Surface ³	Type	Native, ungraded May be continuously rough	Native, limited grading May be continuously rough	Native with some onsite borrow or imported material where needed for stabilization, occasional grading Intermittently rough	Native with improved sections of borrow or imported material, routine grading Minor roughness	Likely imported material, routine grading Uniform, firm, and stable
	Protrusions	≤ 24" Likely common and continuous	≤ 6" May be common and continuous	≤ 3" May be common, not continuous	≤ 3 " Uncommon, not continuous	No protrusions
	Obstacles (Maximum Height)	24"	14"	10"	8"	No obstacles
Design Grade ³	Target Grade	5% – 25%	5% – 18%	3% – 12%	2% – 10%	2% – 5%
	Short Pitch Maximum	40%	35%	25%	15%	5% FSTAG: 5% – 12% ²
	Maximum Pitch Density	20% – 40% of trail	20% – 30% of trail	10% – 20% of trail	5% – 20% of trail	0% – 5% of trail

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Designed Use HIKER/PEDESTRIAN		Trail Class 1	Trail Class 2	Trail Class 3 ²	Trail Class 4 ²	Trail Class 5 ²
Design Cross Slope	Target Cross Slope	Natural side slope	5% – 20%	5% – 10%	3% – 7%	2% – 3% (or crowned)
	Maximum Cross Slope	Natural side slope	25%	15%	10%	3%
Design Clearing	Height	6'	6' – 7'	7' – 8'	8' – 10'	8' – 10'
	Width	≥ 24" Some vegetation may encroach into clearing area	24" – 48" Some light vegetation may encroach into clearing area	36" – 60"	48" – 72"	60" – 72"
	Shoulder Clearance	3" – 6"	6" – 12"	12" – 18"	12" – 18"	12" – 24"
Design Turn	Radius	No minimum	2' – 3'	3' – 6'	4' – 8'	6' – 8'

¹ For definitions of Design Parameter attributes (e.g., Design Tread Width and Short Pitch Maximum) see FSH 2309.18, section 05.

² Trail Classes 3, 4, and 5, in particular, have the potential to provide accessible passage. If assessing or designing trails for accessibility, refer to the Forest Service Trail Accessibility Guidelines (FSTAG) for more specific technical provisions and tolerances (FSM 2350).

³ The determination of trail-specific design grades, design surface, and other Design Parameters should be based upon soils, hydrological conditions, use levels, erosion potential, and other factors contributing to surface stability and overall sustainability of the trail.



Design Parameters

Design Parameters are technical guidelines for the survey, design, construction, maintenance, and assessment of National Forest System trails, based on their Designed Use and Trail Class and consistent with their management intent¹. Local deviations from any Design Parameter may be established based on trail-specific conditions, topography, or other factors, provided that the deviations are consistent with the general intent of the applicable Trail Class.

Designed Use PACK AND SADDLE		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Tread Width	Wilderness (Single Lane)	Typically not designed or actively managed for equestrians, although use may be accepted	12" – 18" May be up to 48" along steep side slopes 48" – 60" or greater along precipices	18" – 24" May be up to 48" along steep side slopes 48" – 60" or greater along precipices	24" May be up to 48" along steep side slopes 48" – 60" or greater along precipices	Typically not designed or actively managed for equestrians, although use may be accepted
	Non-Wilderness (Single Lane)		12" – 24" May be up to 48" along steep side slopes 48" – 60" or greater along precipices	18" – 48" 48" – 60" or greater along precipices	24" – 96" 48" – 60" or greater along precipices	
	Non-Wilderness (Double Lane)		60"	60" – 84"	84" – 120"	
	Structures (Minimum Width)		Other than -bridges: 36" Bridges without handrails: 60" Bridges with handrails: 84" clear width	Other than bridges: 36" Bridges without handrails: 60" Bridges with handrails: 84" clear width	Other than bridges: 36" Bridges without handrails: 60" Bridges with handrails: 84" clear width	
Design Surface ²	Type		Native, limited grading May be frequently rough	Native with some onsite borrow or imported material where needed for stabilization, occasional grading Intermittently rough	Native, with improved sections of borrow or imported material, routine grading Minor roughness	
	Protrusions		≤ 6" May be common and continuous	≤ 3" May be common, not continuous	≤ 3" Uncommon, not continuous	
	Obstacles (Maximum Height)		12"	6"	3"	

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Designed Use PACK AND SADDLE		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Grade ²	Target Grade		5% – 20%	3% – 12%	2% – 10%	
	Short Pitch Maximum		30%	20%	15%	
	Maximum Pitch Density		15% – 20% of trail	5% – 15% of trail	5% – 10% of trail	
Design Cross Slope	Target Cross Slope		5% – 10%	3% – 5%	0% – 5%	
	Maximum Cross Slope		10%	8%	5%	
Design Clearing	Height		8' – 10'	10'	10' – 12'	
	Width		72" Some light vegetation may encroach into clearing area	72" – 96"	96"	
	Shoulder Clearance		6" – 12" Pack clearance: 36" x 36"	12" – 18" Pack clearance: 36" x 36"	12" – 18" Pack clearance: 36" x 36"	
Design Turn	Radius		4' – 5'	5' – 8'	6' – 10'	

¹ For definitions of Design Parameter attributes (e.g., Design Tread Width and Short Pitch Maximum) see FSH 2309.18, section 05.

² The determination of trail-specific design grades, design surface, and other Design Parameters should be based upon soils, hydrological conditions, use levels, erosion potential, and other factors contributing to surface stability and overall sustainability of the trail.



As the nation's principal conservation agency, the Department of the Interior has the 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.

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