ERO

Consultants in Natural Resources and the Environment

Carbondale to Crested Butte Trail Study – Crystal River Section Environmental Review

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Note on Updated Report

This environmental report was originally published for public and stakeholder review in October 2017. This version is updated to include minor text edits and formatting changes, additional information on instream habitat and impacts along the Crystal River, and additional information on environmental mitigation and enhancement possiblitities. No other substantive changes have been made from the October 2007 version.

List of Acronyms and Abbreviations

BMPs	best management practices
CNHP	Colorado Natural Heritage Program
CPW	Colorado Parks and Wildlife
Crystal Valley or valley	Crystal River Valley
CWA	Clean Water Act
DAU	Data Analysis Unit
ESA	Endangered Species Act
FQA	Floristic Quality Assessment
FR	Federal Register
FSM	Forest Service Manual
FSS species	Forest Service Sensitive species
ILBT	Interagency Lynx Biology Team
IPaC	Information for Planning and Conservation database
listed species	ESA-listed species
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
OAHP	Colorado Office of Archeology and Historic Preservation
OST	Pitkin County Open Space and Trails
PCA	Potential Conservation Area
rare species	CNHP-tracked species
RFTA	Roaring Fork Transportation Authority
sensitive species	FSS species
SH 133	State Highway 133
SHPO	Colorado State Historic Preservation Office
TNW	Traditionally Navigable Waterway
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WRNF	White River National Forest

Executive Summary

The Crystal River Valley (Crystal Valley or valley) extends from the headwaters of the Crystal River south of Redstone to its confluence with the Roaring Fork River at Carbondale. The valley has been a travel and transportation corridor for centuries, with trails established before European settlement by the Ute, wagon trails used by European settlers in the 19th and 20th centuries, and a historic railroad grade. Today, State Highway 133 (SH 133) through the Crystal River Valley connects the Roaring Fork Valley to the North Fork Valley. The valley floor is shared by humans and wildlife, with small communities and residential areas adjacent to habitat for Rocky Mountain bighorn sheep, elk, and numerous native bird, bat, large and small mammal, amphibian, and insect species. The Crystal River Valley is also a recreation corridor, as prehistoric and historic routes are now official and unofficial trails used by residents and visitors, providing access to natural areas on U.S. Forest Service (USFS) lands and Pitkin County Open Space and Trails (OST) lands.

Pitkin County (County) is considering trail alternatives with the objective of establishing a multiuse trail that would connect Carbondale to Crested Butte, through the Crystal River Valley. The two trail alternatives under consideration begin at the Crystal River KOA Campground and go over McClure Pass. Alternative A would mostly follow SH 133 and remain on the west side of the Crystal River. Alternative B would mostly follow routes that have been used as a wagon road, railroad grades, OST or USFS system trails, social trails, and existing roads. Any combination of segments from Alternative A and Alternative B could be adopted by the County as the proposed trail alignment.

The purpose of this Environmental Review is to inform the public and County about the potential impacts of the possible trail alternatives and to inform the trail planning process so that environmental impacts are minimized. This report summarizes the existing environmental conditions of the areas where the trail alternatives would intersect and analyzes the potential impacts the trail would have on wildlife, vegetation, in-stream, and cultural resources within the “zone of influence” or “area of potential effects” for each resource.

The impact analysis for each resource is based on review of existing data and information about the Crystal Valley’s ecology, habitat, and context; a reconnaissance-level field review for each resource during June 2017; engagement with scientific literature; and consultation with resource experts. Design measures to avoid, reduce, and mitigate impacts from trail implementation are considered in the analysis.

Environmental impacts of both trail alternatives were analyzed for each of the 21 segments within the Crystal Valley (see Figure 1). The analyses resulted in three categories of impacts (see Table 17):

- **Minor Impacts** are those that would be detectable, but would not result in long-term degradation to resources at a local scale or within the overall Crystal Valley study area
- **Moderate Impacts** are those that would result in detectable impacts on sensitive resources at a local scale, but would not result in long-term degradation or changes to those resources within the overall Crystal Valley study area

- **High Impacts** are those that would result in substantial, long-term impacts on sensitive resources, significant degradation to local areas, or adverse impacts to resources throughout the Crystal Valley study area.

The vegetation and wildlife impact analyses include consideration of suitable habitat for Endangered Species Act (ESA)-listed species, Region 2 Forest Service Sensitive (FSS) species, Colorado state species of concern, and rare species. The cultural resources impact analysis includes consideration of impacts on historical resources that meet the criteria for significance under the National Historic Preservation Act (NHPA).

Vegetation Resources Analysis includes the area within 25 feet of the proposed trail alignments where ground disturbance is likely to take place. The analysis found that impacts on vegetation resources are potentially greatest in areas where the native plant community is diverse and healthy; where suitable habitat for listed, sensitive, and rare species is present; and where potential intersections with wetlands and riparian areas occur. Most of the trail alternatives correspond with previously disturbed areas, where social or system trails are already present. Along Alternative B, high-quality vegetation communities where moderate impacts from trail implementation are most likely include Janeway North and the Narrows. The area south of Avalanche Creek along Alternative B may experience greater impacts.

Minimizing vegetation removal; using best management practices (BMPs) for weed control and revegetation; and exploring opportunities to improve in-stream, riparian, and native plant community quality along the trail corridor would reduce or avoid impacts to vegetation along most of the trail alignment. Delineation of wetlands that intersect the trail and clearance surveys within suitable habitat for ESA-listed and FSS species should be completed before ground disturbance occurs.

Wildlife Analysis includes a 100-meter zone of influence wherein wildlife are likely to experience disturbance from recreation activities. Habitat within ½ mile of the trail alternatives was considered during the field review. The analysis considers impacts to suitable habitat for listed, sensitive, or rare wildlife species; areas with high-quality habitat for a variety of species; landscape-scale disturbances present in the valley and the potential for new disturbance from the trail alternatives; and potential impacts to wildlife from recreation that may result from the trail alternatives. Potential impacts to bighorn sheep, elk, peregrine falcon, lynx, and other sensitive wildlife are considered.

The analysis considers existing disturbances to wildlife from the human population within the valley, SH 133, and the current use of roads, social trails, or system trails. Areas where there is little existing disturbance are likely to experience greater levels of new disturbance from trail implementation. These low disturbance areas include Janeway North, Filoha Meadows, and the section south of Avalanche Creek. Potential moderate wildlife impacts may occur at Crystal River OST Parcel, Red Wind Point, Janeway North, the Narrows, and Filoha Meadows. The area south of Avalanche Creek, along Alternative B, may experience a high level of impact from trail implementation.

Mitigation for potential disturbances may include monitoring bighorn sheep habitat use at Red Wind Point, expanding and continuing to enforce seasonal closures and restrictions on use within critical

wildlife habitat, and exploring opportunities to research and improve the health of bighorn sheep and elk populations and habitat within the valley.

Cultural Resources Analysis includes a 100-foot area of potential effects wherein potential significant historic properties were identified and documented. Six significant historical sites were documented. The analysis considers any activity that may alter the characteristics of a site that make it significant. This includes physical destruction of the resource, alterations that are not consistent with its history, removal from its original location, change in the character of its use or setting, and introduction of any elements that negatively impact the integrity of the site.

Potential moderate impacts to cultural resources may occur from trail implementation at Bridge Option 2 and along Alternative B at the Crystal River OS Parcel, Red Wind Point, Avalanche Creek, the Narrows, Filoha Meadows, and the Castle.

Mitigation measures for reducing or avoiding impacts to cultural resources may include limiting visitors to the trail footprint where significant cultural resources are present and vulnerable, and stabilizing or restoring significant historic features that would be impacted by visitation. Portions of the resources that have integrity may be preserved through a combination of interpretive signage and more detailed documentation (which could include measured drawings of significant features and high-quality photographs).

Introduction

Pitkin County Open Space and Trails (OST) is proposing to construct a multiuse path between the Crystal River KOA Campground and the top of McClure Pass, along the Crystal River Valley (Crystal Valley, valley) (Figure 1). Two possible trail alternatives have been identified. Alternative A would mostly follow State Highway 133 (SH 133) and remain on the west side of the Crystal River. Alternative B would mostly follow routes that have been used as a wagon road, railroad grades, OST or U.S. Forest Service (USFS) system trails, social trails, and existing roads. Any combination of segments from Alternative A and Alternative B could be adopted by Pitkin County (County) as the proposed trail alignment.

The objectives of this report are to inform the County and public about the potential impacts of the possible trail alternatives and to inform the trail planning process so that environmental impacts are minimized. This report summarizes the existing environmental conditions of the areas where the trail alternatives would intersect and analyzes the potential impacts the trail would have on wildlife, vegetation, in-stream, and cultural resources. The possible environmental impacts of Alternative A and Alternative B are analyzed as 21 different segments (Figure 2).

Study Approach

Both desktop reviews of existing environmental data and background information, and reconnaissance-level field reviews of the valley were completed in 2017. A reconnaissance-level field review is limited to the areas and issues that are relevant to trail planning and design, and is intended to provide data that support the planning process and the subsequent USFS National Environmental Policy Act (NEPA) analysis. The field reviews described in this report were limited in scope, constrained by timing, and designed to focus on the trail alternatives' areas of influence. This study is not intended to provide a comprehensive inventory of the Crystal Valley, but rather to provide a baseline understanding of environmental resources, identify salient issues for trail design, and inform analysis of potential impacts and impact mitigation/avoidance along the trail alternative corridors.

Typical corridor along Highway 133. Red Wind Point is seen in the background.

Context and Study Area

The Crystal Valley is located south of Carbondale in Pitkin County, Colorado. The Crystal River flows through the valley, from its headwaters north of Marble to its confluence with the Roaring Fork River in

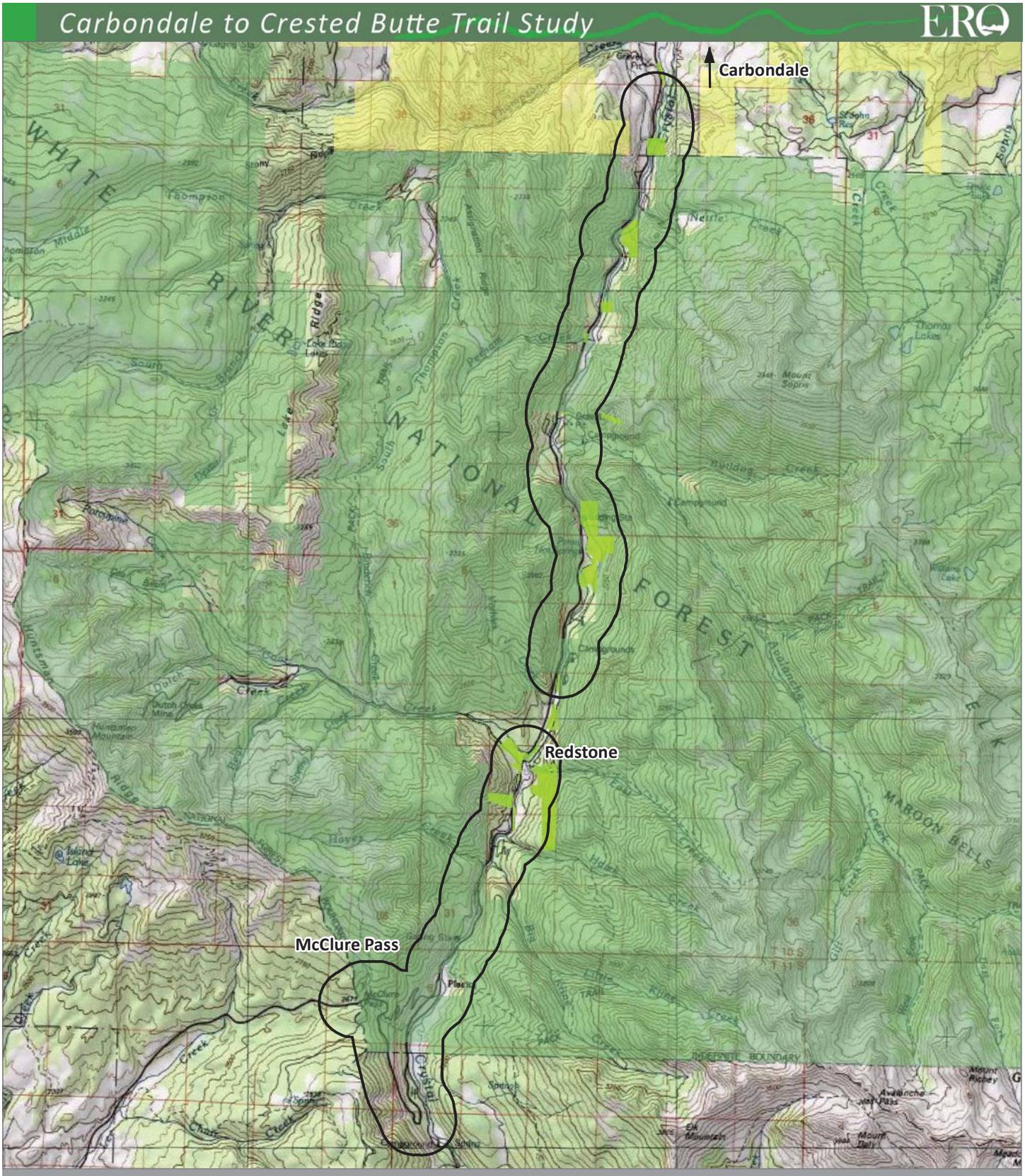


Figure 1. Study area

- Trail Study Area
- Pitkin County Open Space
- BLM
- USFS

Carbondale. The Crystal River is intersected by several tributary creeks and streams including Nettle Creek, Perham Creek, Avalanche Creek, Coal Creek, and Hayes Creek. The Crystal Valley is characterized as a canyon with steep cliff walls. The valley floor is punctuated with woodlands, meadows, wetlands, and shrublands.

The trail alternatives begin at the terminus of the existing Crystal Valley Trail along SH 133, just south of milepost 62 and near the mouth of the canyon at the Crystal River KOA campground; and end at the summit of McClure Pass, at milepost 43. Elevations range from about 6,425 feet to about 8,990 feet. For general planning and analysis purposes, the overall study area consists of the valley floor and includes an area of approximately ½ mile from the trail alternatives. For wildlife-specific analysis, the study area includes a disturbance buffer between 100 meters and ½ mile from the trail alternatives.

For vegetation resources, the study area includes a 25-foot disturbance buffer from the trail alternatives. Analysis for in-stream impacts includes the Crystal River, its tributaries, and associated floodplains, wetlands, and banks. For cultural resources, the study area varies based on the potential area of impact, which varies throughout the corridor.

Existing Studies and Data Review

Before the field reviews were conducted, a detailed review of the existing environmental resources studies and data listed below was completed.

Trail Planning Studies

- Crystal River Valley Bicycle Trail Study (Haefeli 1994)
- West Elk Loop Scenic and Historic Byway Crested Butte to Carbondale Feasibility Study (Colorado Scenic and Historic Byway Commission 2004)

Environmental Resource Studies

- Roaring Fork Watershed Biological Inventory (Colorado Natural Heritage Program [CNHP] 1999)
- Crystal River Caucus Wildlife and Habitat Report, 2007 (Crystal River Caucus 2007)
- Wildlife and Riparian Impacts of the Crystal River Trail Construction, Prince Creek to Seven Oaks Subdivision (BRB Campground) (Crystal River Caucus Trail Task Force 2010)
- White River National Forest Rare Plant Survey, Colorado Natural Heritage Program (CNHP 2006)
- State of the Roaring Fork Watershed Report (Roaring Fork Conservancy 2008)
- Wetland Mapping and Fen Survey in the White River National Forest (CNHP 2011)
- Crystal River Management Plan (Roaring Fork Conservancy 2016)
- Crystal River Trail Preliminary Wildlife Analysis, Wilderness Workshop (Thompson 2017)
- Potential Conservation Area (PCA) Reports (CNHP 2017a)

Pitkin County Open Space and Trails Documents

- Filoha Meadows Nature Preserve Resource Management Plan (Pitkin County 2009)
- Red Wind Point Management Plan (Pitkin County 2005)
- Redstone Management Plan (Pitkin County 2010)

State Species of Concern Population Data from Colorado Parks and Wildlife

- Avalanche Creek Elk Herd E-15 Data Analysis Unit Plan (Colorado Parks and Wildlife [CPW] 2013)
- Colorado Bighorn Sheep Management Plan, 2009-2019 (CPW 2009)
- Colorado Parks and Wildlife – Species Activity Data for state species of concern habitat GIS data (CPW 2016)

General Ecological Information Sources

- U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey database, to evaluate the geologic context of the Crystal Valley for specific sensitive species habitat requirements (USDA 2017a)
- U.S. Geological Survey (USGS) GAP Land Cover Data, which provides descriptions of vegetation and land use patterns, and provides information on vegetation types, elevation, soils, slope, and aspect (USDA-NRCS 2007)
- CNHP ecological community descriptions, which provide detailed descriptions of vegetation and land use patterns in Colorado and tools for assessing the quality of ecological communities (CNHP 2005)
- CNHP Floristic Quality Assessment (FQA) Indices, which provide an efficient method for assessing the quality of native plant and ecological communities (CNHP 2012 and 2017b)
- U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) database to identify where jurisdictional waters, wetlands, and riparian habitat areas are likely to be present (USFWS 2017a)
- CNHP Wetland Information Center, which provides location-specific information and characteristics of wetlands (CNHP 2017c)
- Aerial photographs and imagery of the Crystal Valley

Cultural Resources Studies and Information

- Colorado Office of Archaeology and Historic Preservation (OAHP) site files
- USFS White River National Forest site files
- Aerial photographs, historical maps, and other archival sources

Listed, Sensitive, and Rare Species Information

The vegetation and wildlife studies included review of suitable habitat for Endangered Species Act-listed (ESA-listed, or listed) species, USFS sensitive (FSS, or sensitive) species, and CNHP ranked and tracked (rare) species.

ESA-Listed Species

The ESA is intended to provide a program to protect and recover imperiled species and the ecosystems on which they depend (16 U.S.C. Section 1531 et seq. 1973). The ESA was implemented in 1973 by Congress, which recognized that many of our nation's native plants and animals were in danger of becoming extinct, and that this would result in a loss of the aesthetic, ecological, educational, recreational, and scientific value of our natural heritage. Terrestrial and freshwater species protection under the ESA is administered by the USFWS.

Under the ESA, species may be listed as either endangered or threatened. "Endangered" means a species is in danger of extinction throughout all or a significant portion of its range. "Threatened" means a species is likely to become endangered within the foreseeable future. Species may be candidates for listing or proposed for listing, which means they are under review by the USFWS. ESA-listed species may include subspecies, varieties, and, for vertebrates, distinct population segments of a species.

The ESA requires federal agencies and states to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of listed species. The USFWS uses a variety of tools and incentives for private landowners to manage for conservation of listed species' habitat as well.

The USFWS maintains a list of species protected under the ESA, including endangered, threatened, proposed, and candidate species (USFWS 2017b). A list of ESA species with potential to occur or with habitat in an area can be accessed from the USFWS's Information for Planning and Conservation (IPaC) database website: https://ecos.fws.gov/ipac/.

Forest Service Sensitive Species

The USFS designates sensitive species when there are concerns about a species' population status, trends, and habitat conditions (Forest Service Manual [FSM] 2672.11). USFS policy requires that the agency biologists conduct a review of proposed actions on their lands to comply with the ESA and ensure that "actions do not contribute to loss of viability of native or desired non-native plant or animal species, or cause a trend towards listing under the ESA" (FSM 2670.3). In other words, the USFS must consider sensitive species and their habitat when they review projects and analyze whether the project will affect the species, resulting in decline of the species and the need for the species to be protected by the ESA. Usually, a project can be modified during the design phase to reduce potential negative effects to sensitive species or their habitats. If surveys are not conducted but habitat is present, species' presence is assumed and the project effects are analyzed and documented. Each USFS region maintains a list of FSS species that are known, have potential to occur, or are likely to occur in each forest. The White River National Forest (WRNF) is within the USFS Region 2. FSS species with potential to occur include those on the Region 2 FSS species list, with habitat present in the Crystal Valley (USFS 2017). A list of the USFS Region 2 FSS species can be accessed from the Rocky Mountain Region's land and resource management website: https://www.fs.usda.gov/main/r2/landmanagement.

For this analysis, habitat for FSS species was considered throughout the study area, not just on USFS land. FSS species with the potential to occur in the Crystal Valley study area are presented in Table 4 in the *Wildlife Resources* section. The potential presence of FSS species along the trail alternative corridors means that the plant or animal should be considered when planning the trail, developing the alternatives, and designing modifications to minimize impacts to the species.

Colorado Natural Heritage Program Tracked Species

The CNHP tracks and ranks Colorado's rare and imperiled species and habitat and provides scientific information and expertise to promote the conservation of the state's biological resources and diversity, on coordination with the Werner College of Natural Resources at Colorado State University (CNHP 2017d). CNHP-tracked species are considered rare but are not necessarily protected under federal,

state, or agency programs. The CNHP provides information on the status of rare and sensitive native species through an online database, various publications, and partnerships with researchers and stakeholders. CNHP-tracked species and ecological communities are evaluated and ranked based on their global, national, and state significance and their importance to Colorado's biological diversity. Species occurrences with Colorado's counties and USGS 7.5-minute quads can be accessed from the CNHP website: http://www.cnhp.colostate.edu/download/gis.asp.

Within the Crystal Valley, the CNHP has mapped several Potential Conservation Areas (PCAs) that support the long-term survival of tracked species or natural communities, and tracks habitat and occurrences for native and rare plants and wildlife species. These PCAs are Avalanche Creek, East Creek, Big Kline Creek, and McClure Pass. The tracked species and communities within these PCAs are incorporated into the vegetation and wildlife assessments elsewhere in this report. A complete list of species and PCAs can be accessed at the CNHP website: http://www.cnhp.colostate.edu/.

Colorado Wildlife Species of Concern and CPW-Tracked Species

CPW tracks and monitors several wildlife species that are considered important to the state's ecology and economy, including game birds and big game species with habitat and populations within the Crystal Valley.

CPW tracks and manages Rocky Mountain bighorn sheep, elk, black bear, moose, wild turkey, mule deer, bald eagle, and peregrine falcon. Some of these species are also sensitive, including Rocky Mountain bighorn sheep (FSS sensitive). A list of Colorado's species of concern and descriptions of the habitat requirements can be accessed from CPW's website: http://cpw.state.co.us/learn/Pages/SpeciesProfiles.aspx.

Colorado Department of Agriculture has identified noxious weed species that are of concern for biodiversity and native species habitat, including wildlife and plant communities. Noxious weeds are exotic plant species that can either directly or indirectly cause damage to natural resources, public health, or the environment, as defined under the Federal Plant Protection Act (7 U.S.C. Section 7701 et seq. 2000). Noxious weed populations are able to establish on a broad range of sites, spread rapidly, and disrupt native plant communities and ecosystems, which may result in degradation of native wildlife habitat (USDA 2017b). A list of Colorado's noxious plant species can be accessed from the state Department of Agriculture website: https://www.colorado.gov/pacific/agconservation/noxious-weed-species.

2017 Field Review

Existing trail along Rock Creek Wagon Road, looking north.

From June 19 to 23, 2017, a team of resource specialists conducted a reconnaissance-level field review (field review) of biological and cultural resources for the entire study area between the Crystal River KOA and McClure pass. Specialists included two plant ecologists, two wildlife biologists, and one archaeologist. The team walked all segments of the trail alternatives except where access was not granted to private land parcels.

Survey methods and approaches were developed with input and concurrence from resource specialists with WRNF and were informed by the existing data and information review. General field approaches are described below.

- Vegetation resources field approach – Plant ecologists documented general vegetation communities; suitable habitat for listed, sensitive, or rare plant species; areas with high-quality plant communities; wetland, riparian, and water resources; and noxious weeds. The vegetation survey included the area within 25 feet of the proposed trail alignments.
- Wildlife resources field approach – Wildlife biologists documented suitable habitat for listed, sensitive, or rare wildlife species; areas with high-quality habitat for a variety of species; evidence of wildlife use; and incidental observations of specific species. Limited owl surveys and acoustic monitoring for bat activity were conducted at a few key locations. A broad corridor (up to ½ mile) was considered for wildlife habitat observations.
- Cultural resources field approach – An archaeologist conducted a Class II pedestrian survey of the trail alternatives, identifying and documenting potential historic properties within the area of potential effect for the trail alternatives. A 100-foot-wide corridor was surveyed.

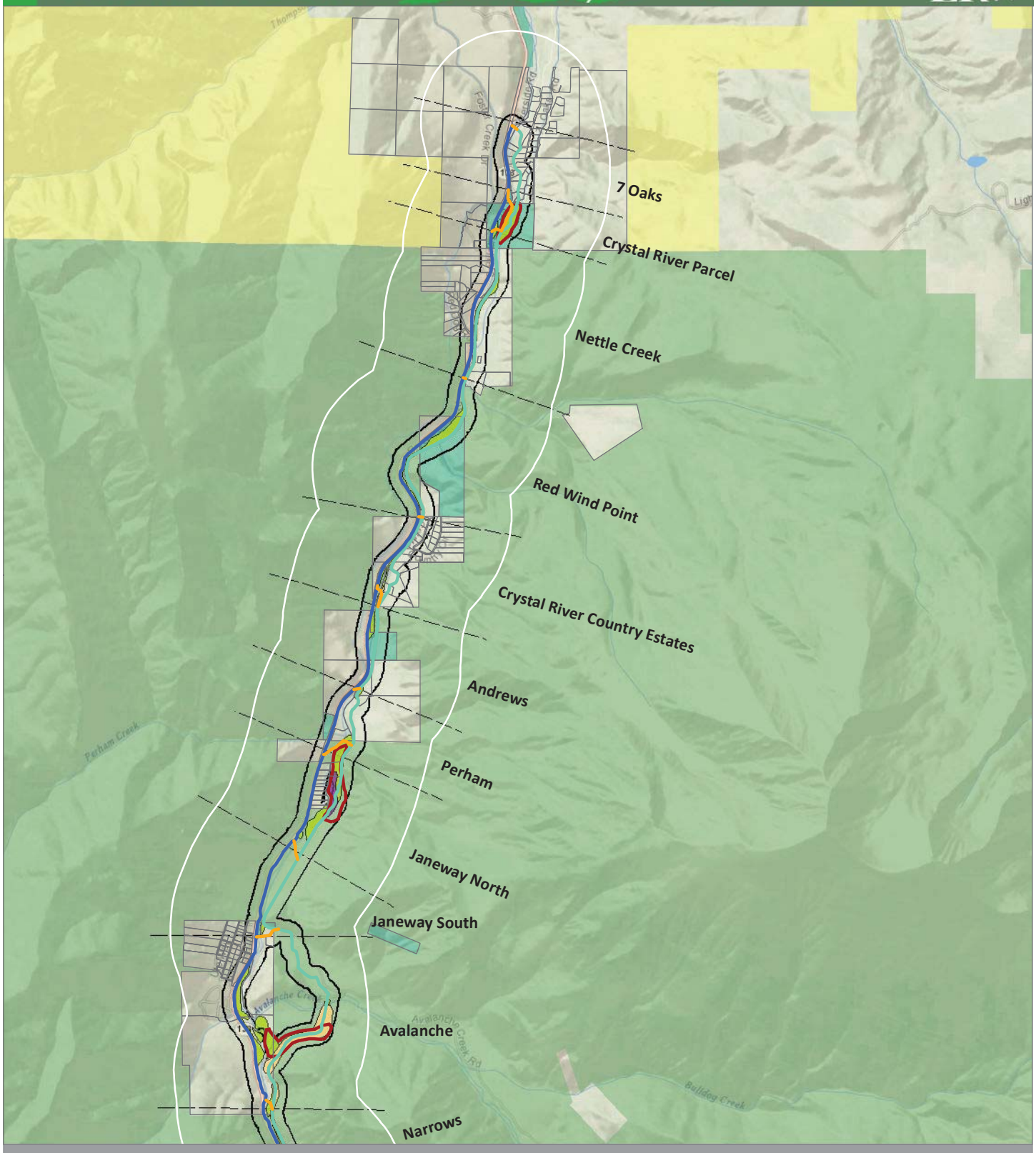
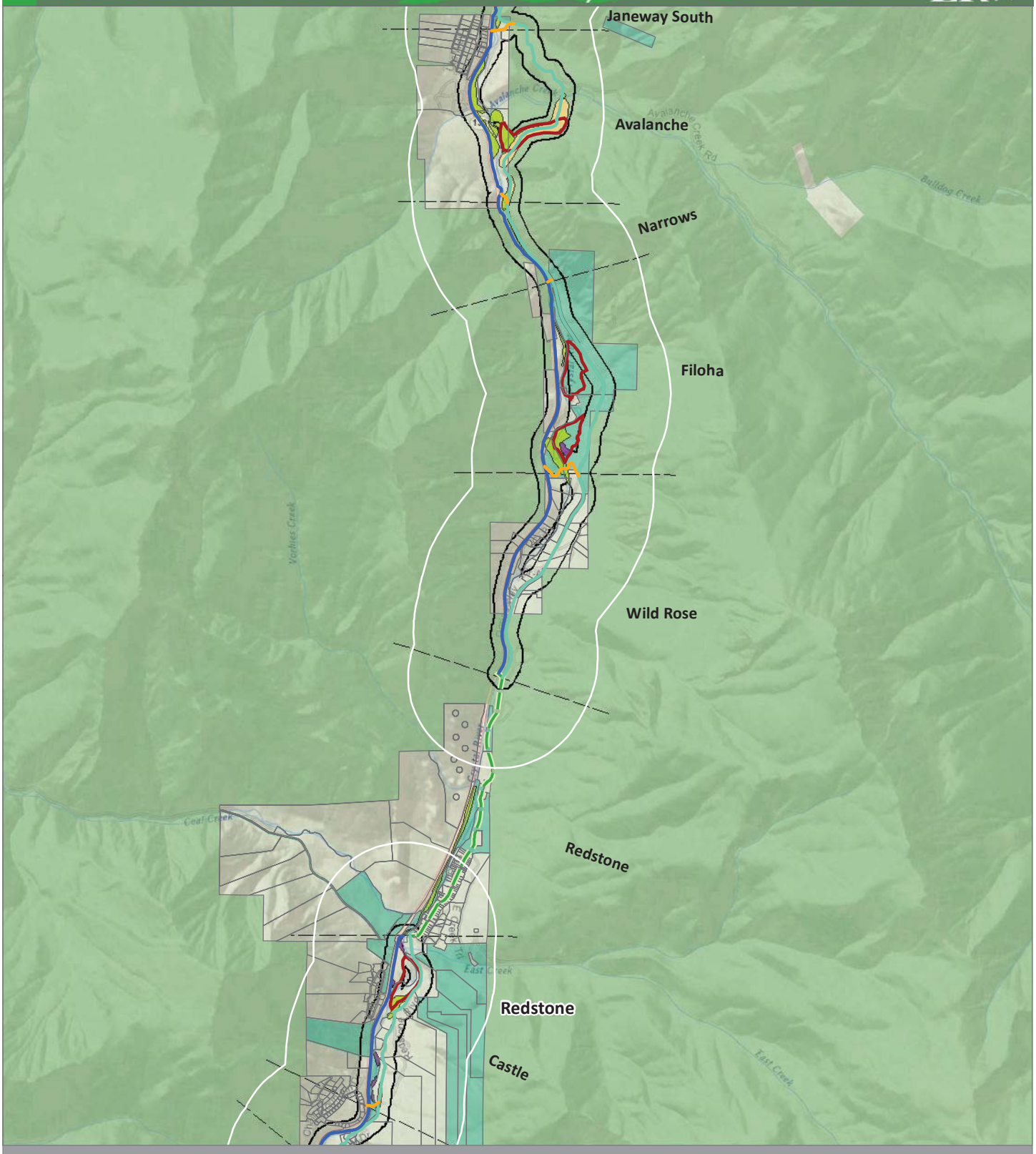


Figure 2. High Quality Habitat and Vegetation

0 2,000 4,000 feet

October 9, 2017

- Trail Study Area
- Bridge Option
- Option A Alignment
- Option B Alignment
- Existing Redstone Trail Alignment
- High Quality Wildlife Habitat
- High Quality Riparian
- Other Riparian
- High Quality Vegetation
- 100m Trail Impact Area
- Pitkin County Open Space
- BLM
- State of Colorado
- USFS



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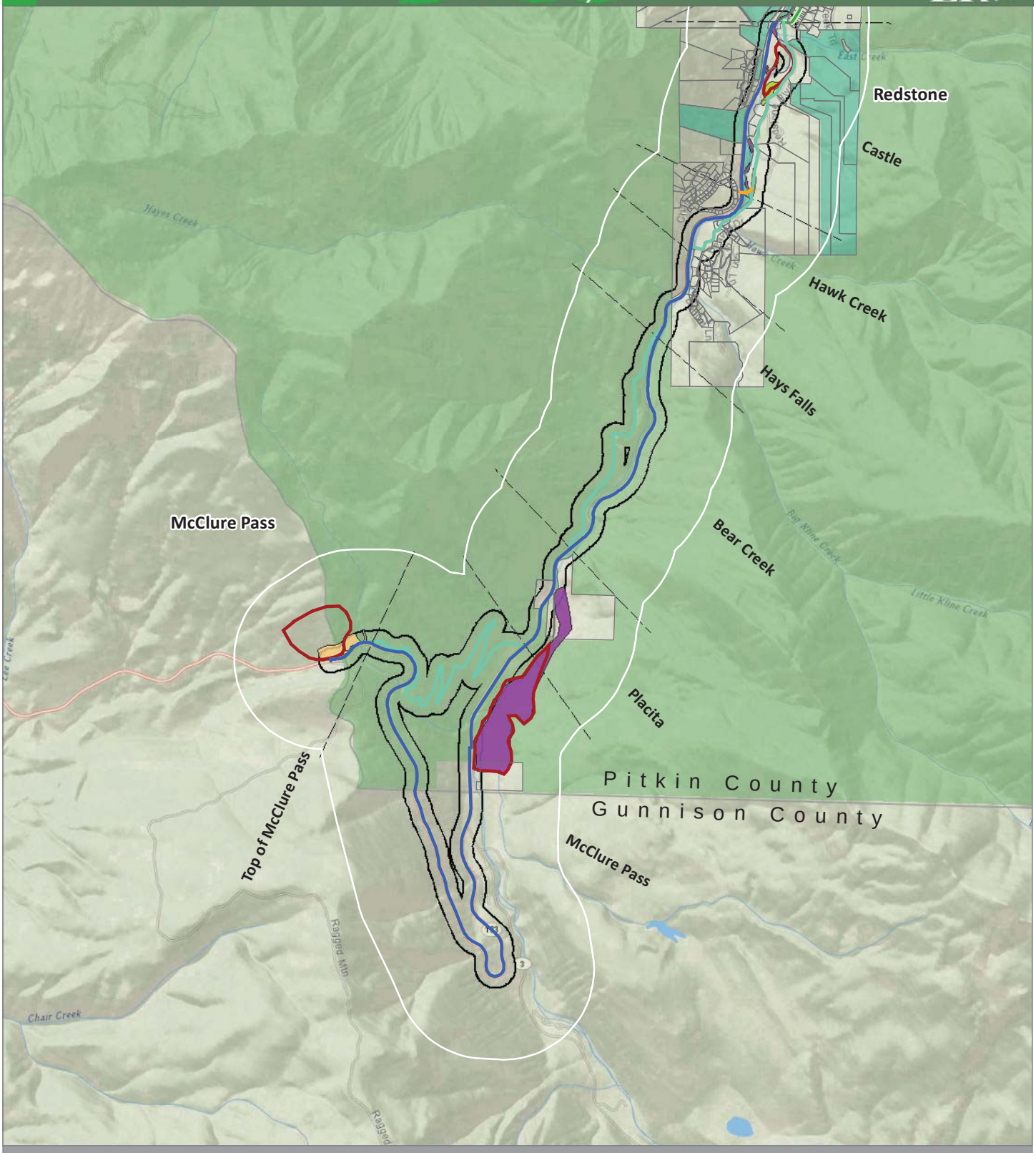

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Vegetation Resources

The vegetation field review gathered a broad range of information about the ecological communities that intersect with and may be affected by the trail alternatives. Areas may require additional surveys for specific species or resources. In areas where wetlands or open waters intersect the trail alternatives, detailed delineations and permitting under the Clean Water Act (CWA) may be required if disturbance is anticipated.

To support the trail planning process, the vegetation study has the following objectives:

- Describe general vegetation communities
- Identify high-quality and sensitive vegetation communities
- Identify suitable habitat for ESA-listed, FSS, and CNHP-tracked species
- Identify wetland and riparian vegetation communities

The pre-field review of existing data and studies resulted in a refined list of ESA-listed, FSS, and CNHP-tracked plant species with potential to occur in the Crystal Valley; a familiarity with existing information about the Crystal Valley's ecological communities; and a reconnaissance-level methodology to evaluate the ecological communities and sensitive plant habitat within the alignment and disturbance buffer. A list of plant species observed during the field review is in Appendix A. Listed, sensitive, and rare species are listed in Appendix B.

Field Review Methods

The vegetation field review included the following elements:

- Characterization of general plant communities and mapping of transitions between ecological communities
- Documentation of species diversity and dominant species
- Evaluation of vegetation community structure (forest, shrubland, grassland, etc.)
- Evaluation of habitat characteristics for listed and sensitive species
- Identification of wetland and riparian areas
- Documentation of noxious weeds and non-native species

Species diversity, structure, and composition data were collected at ½-mile intervals, or where dominant plant communities transitioned. Noxious weed species were documented wherever observed.

The following factors were considered when evaluating a segment's vegetation community:

- Habitat requirements for sensitive species, such as soil and geological characteristics, wetland or upland associations, and elevation ranges
- Unique or diverse native vegetation community characteristics
- Proximity to and characteristics of PCAs
- Proximity to known occurrences of listed, sensitive, and rare species
- Plant species and communities that support specific sensitive wildlife habitat (such as milkweed, which is a necessary component of FSS monarch butterfly habitat)

General Vegetation Communities

The Crystal Valley's ecological context includes both native and introduced species and is characterized by Rocky Mountain, Southern Rocky Mountain, Colorado Plateau, and Inter-Mountain Basins ecological communities (USGS 2017). Vegetation within the valley varies between montane wetland, riparian, and upland communities. The wetlands and riparian shrublands and woodlands along the Crystal River provide habitat for a rich diversity of native plant and wildlife species. Upland vegetation communities include a mosaic of shrublands, woodlands, and forests. Disturbed or "ruderal" vegetation communities occur throughout the valley along roadsides, in neighborhoods, and in other areas where past and present development is located. The footprints of the trail alternatives are predominately within areas where ground disturbance has occurred, such as along roadsides (Alternative A) or within the footprint of the wagon trail, railroad grade, and existing roads and trails (Alternative B). Major vegetation communities are described below (CNHP 2005; NatureServe 2009; USGS 2016, 2017).

- **Colorado Plateau Pinyon-Juniper Woodland** – Occupies the lower and mid segments of the Crystal Valley. It is dominated by Rocky Mountain juniper (*Juniperus scopulorum*), one-seed juniper (*Juniperus monosperma*), and two-needle pinyon (*Pinus edulis*) intermingled with Gambel oak (*Quercus gambelii*) shrublands.
- **Southern Rocky Mountain Dry-Mesic and Mesic Montane Mixed Conifer Forest and Woodlands** – Occurs throughout the entire corridor in upland areas in mosaic with quaking aspen (*Populus tremuloides*), Gambel oak, and pinyon-juniper woodlands. Coniferous dry-mesic forests are lower in elevation than mesic forests, which are found around the McClure Pass and Placita areas. Forests are dominated by white fir (*Abies concolor*) and Douglas fir (*Pseudotsuga menziesii*), and interspersed with Engelmann spruce (*Picea engelmannii*), quaking aspen, blue spruce (*Picea pungens*), ponderosa pine (*Pinus ponderosa*), bigtooth maple (*Acer grandidentatum*), Rocky Mountain maple (*Acer glabrum*), box elder (*Acer negundo*), Gambel oak, mountain snowberry (*Symphoricarpos oreophilus*), thinleaf alder (*Alnus incana*), water birch (*Betula occidentalis*), redosier dogwood (*Cornus sericea*), blueberry (*Vaccinium* spp.), common juniper (*Juniperus communis*), twinberry honeysuckle

Riparian and mesic mixed conifer vegetation along the Crystal River, looking north.

(*Lonicera involucrata*), shrubby cinquefoil (*Dasiphora fruticosa*), mountain mahogany (*Cerocarpus* spp.), and meadow-rue (*Thalictrum* spp.), among other species.

- **Rocky Mountain Gambel Oak-Mixed Montane Shrubland –** Occupies areas along the extent of the corridor, on lower mountain slopes and often interspersed with pinyon-juniper woodlands. The understory is composed of other shrubs including serviceberry (*Amelanchier* spp.), sagebrush (*Artemisia* spp.), snowberry, mountain mahogany, chokecherry (*Prunus virginiana*), and cliffrose (*Purshia* spp.).
- **Rocky Mountain Montane Riparian Woodlands and Shrubland** – Includes vegetated areas along watercourses and water bodies, within floodplains, and near streambanks, where soils and hydrology support riparian vegetation. The riparian corridor within the valley is characterized by dense willow (*Salix* spp.), cottonwood (*Populus* spp.), and conifer vegetation at or near the Crystal River's banks and within its floodplain.
- **Rocky Mountain Herbaceous Wetland** – Occupies areas near the Crystal River where the ground is saturated at least part of the year, wetland vegetation is dominant, and soils are hydric (developed through anaerobic conditions). Patches of wetlands occur throughout the corridor, including at Filoha Meadows, Red Wind Point, Castle, Placita, Redstone, Janeway North, Rose Bud, and McClure Pass.
- **Rocky Mountain Aspen Forest and Woodland** – Occupies Placita and the top of McClure Pass, within a mosaic of shrublands, wetlands, and mesic coniferous forests. Common shrubs include Rocky Mountain maple, serviceberry, sagebrush, common juniper, chokecherry, Woods' rose (*Rosa woodsii*), snowberry, and blueberry. The grasses and forbs in the understory are diverse and dense.
- **Ruderal or Disturbed Areas** – Occurs in areas where disturbance has occurred and where regrowth of native and non-native species is occurring. Present throughout the corridor along the highway, adjacent to and within residential areas, and along the railroad grade.
- **Low- and Medium-Intensity Developed** – Areas with a mixture of constructed materials, including impervious surfaces such as roads and driveways, and native or introduced ornamental vegetation. Present within subdivisions and developed residential or low-intensity commercial sites. Developed areas are characterized by having at least part of their surface developed and impermeable (for example, paved or under buildings or structures).

High-Quality Vegetation Communities

ERO identified high-quality vegetation areas using data from the field review, existing information, the CNHP Floristic Quality Assessment (FQA) Indices (CNHP 2012, 2017b), and CNHP's criteria for ranking ecological system quality (CNHP 2005).

CNHP FQA Indices provide an efficient method for assessing the quality of native plant and ecological communities. Data from the field review was used to evaluate the native plant community quality of a segment using the FQA Index calculator (CNHP 2017b), which ranks species on a scale of 0 to 10 based on their ecological significance. Non-native species are ranked as 0, while very rare, endemic, and sensitive species (including some ESA-listed and FSS species) are given higher scores. High values are assigned to species that are likely to occur in only high-quality areas and cannot tolerate habitat

degradation, while low values are assigned to species with a wide tolerance of human disturbance (CNHP 2007). High-quality vegetation areas were identified where:

- multiple species ranking 7 or higher on the FQA index were present,
- ecological communities were dominated by diverse native species, and/or
- habitat for ESA-listed and/or FSS species was present.

High-quality vegetation areas are described below in Table 1, based on the study segment in which they were found (Figure 2).

Listed, Sensitive, and Rare Plants

ESA-Listed Species

The only ESA-listed plant species with potential to occur within the study area is the threatened Ute ladies'-tresses orchid (*Spiranthes diluvialis*). The orchid grows in small, sporadic microhabitats with calcareous, wet-mesic, temporarily inundated meadows in shallow wetlands. It occurs along riparian edges, gravel bars, old oxbows, high-flow channels, and moist to wet meadows along perennial streams. An orchid population has been observed in the lower wetland portion of Filoha Meadows.

Ute ladies'-tresses orchid (credit: S. Panjabi, CNHP).

FSS Species

USFS Region 2 FSS plant species with the potential to occur in the study area include:

Harrington's penstemon.

Harrington's penstemon (*Penstemon harringtonii*) – Occurs among sagebrush often surrounded by pinon-juniper woodlands and thrives in disturbed areas along roads and trails at elevations between 6,400 and 9,400 feet.

Dwarf raspberry (*Rubus arcticus* ssp. *acaulis*) – Grows in montane willow shrublands and boggy woods, marshes, mountain meadows, and alpine tundra at elevations between 7,000 and 9,720 feet.

American cranberry bush (*Viburnum opulus* var. *americanum*) – Usually found adjacent to reliable water sources, but not restricted to wetland areas, and often found in aspen forests at elevations below 6,000 feet. This species is typically not listed as part of the Colorado flora and is not known to occur in the state, although it is possible that it does occur, and unconfirmed occurrences have been noted.

Table 1. High-Quality Vegetation Communities within the Crystal Valley Trail Corridor

Trail Segment	Vegetation Communities	Description
Andrews Alternative B	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Diverse native upland shrubland/forest dominated by oak, spruce, fir, cottonwood, snowberry, and serviceberry. Shrubs and forbs include meadow-rue, lupine (*Lupinus* sp.), beardtongue (*Penstemon* spp.), Indian paintbrush (*Castilleja* sp.), scarlet gilia (*Ipomopsis aggregata*), and strawberry (*Fragaria* sp.); suitable Harrington's penstemon (FSS) and Grand Mesa penstemon (CNHP) habitat.
Janeway North Alternative B	Rocky Mountain Montane Riparian Woodlands and Shrubland Rocky Mountain Wetland- Herbaceous	Diverse riparian forest and wetlands dominated by cottonwood, twinberry, and alder; species include wintergreen (*Pyrola* sp.), redosier dogwood, starry lily of the valley (*Maianthemum stellatum)*, several orchids (Orchidaceae genuses), and several milkvetches (*Astragalus* spp.); suitable dwarf raspberry (FSS), American cranberry (FSS), park milkvetch (FSS), and Ute ladies'-tresses orchid (ESA) habitat.
Avalanche Alternative B	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland Rocky Mountain Gambel Oak-Mixed Montane Shrubland Colorado Plateau Pinyon-Juniper Woodland	Diverse native montane forest dominated by mixed conifer, aspen, and Gambel oak; suitable Harrington's penstemon (FSS), large flower globemallow (CNHP), and Grand Mesa penstemon (CNHP) habitat.
Narrows Alternative B	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Diverse native montane forest dominated by mixed conifer, aspen, and Gambel oak, with oceanspray (*Holodiscus discolor*) and saxifrage (*Saxifraga* sp.) throughout. The slope is primarily scree and sparsely vegetated; suitable Harrington's penstemon (FSS) and Grand Mesa penstemon (CNHP) habitat.
Filoha Alternative B	Rocky Mountain Wetland- Herbaceous	Disturbed herbaceous wetland area where past occurrences of Ute ladies'-tresses orchid (ESA) have been documented.

Trail Segment	Vegetation Communities	Description
Castle Alternative A	Rocky Mountain Wetland- Herbaceous Rocky Mountain Montane Riparian Woodlands and Shrubland	Diverse riparian forest dominated by cottonwood and narrowleaf willow; suitable dwarf raspberry (FSS), American cranberry (FSS), park milkvetch (FSS), and Ute-ladies' tresses orchid (ESA) habitat within wetland areas.
Castle Alternative B uplands	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Diverse native montane forest dominated by mixed conifer, aspen, Gambel oak, snowberry, and twinberry honeysuckle; monkeyflowers (*Mimulus* sp.) are present on the cliffside seeps along the trail; suitable Harrington's penstemon (FSS) and Grand Mesa penstemon (CNHP) habitat.
Castle Alternative B riparian and wetland	Rocky Mountain Wetland- Herbaceous Rocky Mountain Montane Riparian Woodlands and Shrubland	Subalpine riparian willow carr and bar wetlands with suitable dwarf raspberry (FSS), American cranberry (FSS), park milkvetch (FSS), and Ute ladies'-tresses orchid (ESA) habitat within wetland areas.
Placita Alternative B	Rocky Mountain Wetland- Herbaceous Rocky Mountain Montane Riparian Woodlands and Shrubland	Diverse montane wetland and riparian shrubland dominated by narrowleaf willow; suitable dwarf raspberry (FSS), American cranberry (FSS), park milkvetch (FSS), and Ute ladies'-tresses orchid (ESA) habitat within wetland areas.
Top of McClure Pass Alternative B	Rocky Mountain Aspen Forest and Woodland	Diverse native subalpine aspen forest, with willow and birch understory; bracken fern (*Pteridium aquilinum*) and known Grand Mesa penstemon (CNHP) documented in area.

Park milkvetch (*Astragalus leptaleus*) – Grows in sedge-grass meadows, in swales and hummocks, and among streamside willows at elevations between 6,600 and 9,500 feet. It may often occupy the ecotone between soils saturated with water throughout the growing season and adjacent dry uplands.

Yellow lady's slipper orchid (*Cypripedium parviflorum*) – Grows in a variety of habitats from shady, damp forest understory of mixed deciduous and coniferous forests to open meadows and along streams in acidic soils between 5,800 and 12,600 feet in elevation.

CNHP-Tracked Species

Rare plant species that are known to occur near the study area include:

Large-flowered globemallow (*Iliamna grandiflora*) – Grows in desert, semi-desert, prairies, grasslands, scrub, pinyon-juniper, and sagebrush plant communities and often on dry roadsides, disturbed areas, and dry slopes; known to occur within the Avalanche PCA.

Grand Mesa penstemon (*Penstemon mensarum*) – Occurs among oaks, aspens, and sagebrush, and in meadows; and thrives in disturbed areas along roads and trails; known to occur at McClure Pass and within the Avalanche PCA.

Grand Mesa penstemon

Wetlands and Riparian Communities

Wetlands and in-stream habitats are protected under Section 404 of the CWA. Any anticipated impacts on these resources must be permitted by the U.S. Army Corps of Engineers (USACE). Impacts may include loss of wetland area, stabilization of streambanks, channelization of streams and rivers, and dredging and filling of waters or wetlands. Impacts may be temporary, such as short-term increased sedimentation from construction activities; or permanent, such as bank stabilization or permanent loss of aquatic habitat and function.

A wetland or water body is considered jurisdictional (that is, protected under Section 404 of the CWA) if it has a surface hydrological connection to a traditionally navigable waterway (TNW). The Crystal River, and all its associated tributaries and wetland areas, would be considered jurisdictional because it is a secondary tributary to the Colorado River, which is a TNW. The field review did not include delineation of wetlands or waterways, but it identified areas that would require delineation and permitting if impacts were to take place within them.

Wetlands and Riparian Shrublands and Forests

The field review was focused to evaluate potential wetlands and riparian areas where disturbance from the trail alternatives would be most likely: near potential bridge locations, along the actual footprint of the alignment, and in areas where construction in floodplains and stabilization of streambanks would

potentially occur. Thirty-one wetland and riparian areas were identified, including the high-quality areas described in Table 1 (Figure 6 through Figure 14). Riparian and wetland areas are vital to the functioning of aquatic systems and instream habitat.

Instream and Aquatic Habitat

Existing stream impairments in the valley are generally attributable to roads, the existing railroad grade, and bridges that bisect historical floodplains and limit the potential for bankfull flows into off-channel riparian habitat. Reduction in stream flow from diversions, and loss of effective floodplain width further limit the quality and extent of terrestrial and aquatic habitat (Roaring Fork Conservancy 2016). Several listed and sensitive aquatic and wetland obligate species are known to occur in the Roaring Fork watershed, which includes the Crystal River Valley (Appendix B and Appendix C).

Several recent studies have evaluated the current ecological health of the Crystal River's in-stream and riparian habitats. The 2016 Crystal River Management Plan incorporates findings of the 2014 Crystal River FACStream Assessment. Both are summarized below.

Crystal River Management Plan

The Crystal River Management Plan evaluated the river's functional health with consideration of flow, sediment, water quality, floodplain connectivity, riparian vegetation, debris supply, morphology, stability, physical structure, and biotic structure. Above Placita the Crystal River's function has few impairments. The function of the reaches within the study area—extending from Placita downstream to Potato Bill Creek—becomes increasingly constrained from development and surface water diversions. Some of the key stressors include the loss of floodplain connectivity, channel stability, and riparian vegetation loss (Roaring Fork Conservancy 2016). Considering all variables, the functional condition of the Crystal River is mildly to significantly impaired at Placita, severely impaired at Redstone, mildly to significantly impaired at Avalanche Creek, and significantly to severely impaired downstream to Thompson Creek and Carbondale.

Crystal River FACStream Assessment

The 2014 Crystal River FACStream Assessment examined a range of specific variables that affect riparian and stream health including watershed function (water supply, sediment supply, and chemical supply), riparian function (vegetation and debris supply), and structural/physical function (floodplain connectivity, stream stability, physical structure, and biotic structure). For each variable, individual reaches of the Crystal River were evaluated and assigned a functional score between 100 (high function) and 50 (severely impaired function) (Beardsley and Johnson 2014).

The overall condition assessment scores for the reaches within the study area are summarized in Table **2**. The overall impairment of each reach ranged from negligible to mild when all variables were considered together. For each reach, watershed function impairment ranged from negligible to mild, while riparian function impairment and structural/physical function impairment both ranged from mild to severe. The reaches near Placita (south) and Redstone scored lowest for these variables, with drainage and restriction of the floodplain, clearing of riparian vegetation, channel stabilization, elevated

sediment supply, and noxious weeds and non-native vegetation dominance being noted (Beardsley and Johnson 2014).

Table 2. Crystal River FACStream Assessment Results

Trail Segment	FACStream Reach	Score	Overall Impairment	Notes
Placita (south)	12	87	Mild	Pasture clearing and floodplain drying; straightened channel and floodplain cut off
Placita (north)	13	94	Negligible	Similar to reach 12, but few floodplain impacts
Hayes Falls	14	90	Negligible	Road and ranching impacts on left floodplain area
Hayes Falls	15	86	Mild	Road encroachment and hardening in confined valley; constriction at bridges
Redstone (south)	16	89	Mild	Impacts from valley bottom residential development and bridges
Redstone (north)	17	81	Mild	Similar to reach 16; sediment from Coal Creek; bridges, levee, valley bottom development, and roads
Wild Rose	18	87	Mild	Acute impacts from road encroachment, otherwise minimal impairment
Filoha	19	86	Mild	Pasture clearing and floodplain drying on right side
Narrows	20	92	Negligible	Confined reach with few impacts
Avalanche	21	84	Mild	Floodplain development, including residential, pond, levee, roads, and hardening
Janeway	22	89	Mild	Confined reach with few impacts
Janeway North	23	85	Mild	Road fill, pasture clearing, and floodplain development
Perham	24	83	Mild	Road fill, pasture clearing, floodplain development, and ditch diversion
Andrews	25	85	Mild	Confined reach with few impacts
Red Wind Point	26	82	Mild	Road fill and hardening
7 Oaks	27	81	Mild	Road fill and hardening

Source: Beardsley and Johnson 2014

The Crystal River along SH 133 has been stabilized using riprap, retaining walls, and fill with vegetation. New impacts to stream habitat resulting from the trail alternatives could result from the following:

- Installation of additional narrow bridges, which would further constrict the floodplain
- Installation of piers, retaining walls, riprap or other hardened structures along or within the streambed, which would further constrict stream morphology and function and result in increased channelization
- Removal or fragmentation of high-quality floodplain riparian habitats due to trail construction and hardening
- Further dissection of floodplain connections due to new construction

Based on the proposed alignment locations and typical design standards, the trail segments that could result in impacts to stream habitat and function are summarized in the following table.

Table 3. Possible Impacts to Stream Habitat

Trail Segment or Bridge Option	Type of Impact	Notes
Bridge Option 1	Existing bridge improvements	No new impacts
7 Oaks Alternative A	Wall, riprap, or piers along or within streambed	About 1,300 feet along highway embankment
Crystal River Parcel Alternative A	Wall, riprap, or piers along or within streambed	About 400 feet along highway embankment
Bridge Option 2	New bridge construction, riparian vegetation removal	Bridge width and impacts undefined
Bridge Option 3	New bridge construction, riparian vegetation removal	Bridge width and impacts undefined
Nettle Creek Alternative A	Wall, riprap, or piers along or within streambed	About 1,800 feet along highway embankment
Bridge Option 4	New bridge construction	Bridge width and impacts undefined
Red Wind Point Alternative A	Wall, riprap, or piers along or within streambed	About 1,700 feet along highway embankment
Crystal River Country Estates Alternative A	Wall, riprap, or piers along or within streambed	About 2,000 feet along highway embankment
Bridge Option 5	New bridge construction	Bridge width and impacts undefined
Bridge Option 6	New bridge construction	Bridge width and impacts undefined
Andrews Alternative A	Wall, riprap, or piers along or within streambed	About 1,000 feet along highway embankment
Bridge Option 7	New bridge construction	Bridge width and impacts undefined
Perham Alternative A	Wall, riprap, or piers along or within streambed	About 1,000 feet along highway embankment
Bridge Option 8	New bridge construction	Bridge width and impacts undefined
Janeway North Alternative A	Wall, riprap, or piers along or within streambed	About 300 feet along highway embankment
Janeway North Alternative B	Trail through high-quality floodplain riparian area	About 1,500 feet of impacts through riparian area
Janeway South Alternative A	Wall, riprap, or piers along or within streambed	About 1,500 feet along highway embankment
Bridge Option 9	New bridge construction	Bridge width and impacts undefined
Bridge Option 10	Existing bridge	No new impacts
Avalanche Alternative A	Wall, riprap, or piers along or within streambed	About 1,900 feet along highway embankment
Avalanche Alternative B	New bridge construction across Avalanche Creek, riparian vegetation removal	Bridge width and impacts undefined
Bridge Option 11	New bridge construction	Bridge width and impacts undefined
Bridge Option 12	New bridge construction	Bridge width and impacts undefined
Narrows Alternative A	Wall, riprap, or piers along or within streambed	About 2,200 feet along highway embankment
Filoha Alternative A	Wall, riprap, or piers along or within streambed	About 2,100 feet along highway embankment
Bridge Option 13	Wall, riprap, or piers along or within streambed	Bridge width and impacts undefined

Trail Segment or Bridge Option	Type of Impact	Notes
Wild Rose Alternative A	Wall, riprap, or piers along or within streambed	About 2,300 feet along highway embankment
Bridge Option 14	Wall, riprap, or piers along or within streambed	Bridge width and impacts undefined

Potential In-Stream and Riparian Impacts

Trail construction along Alternative A and in some segments of Alternative B would require some additional stabilization of the Crystal River bank along the highway (Alternative A), and some bridge construction within either of the alternatives. Bridge options depend on the final trail design, which may be a combination of the alternatives. While the Crystal River has already been stabilized with riprap (loose stones and rocks) and walls throughout much of the valley, new impacts would be most significant if they further impacted process-based functions, such as floodplain connectivity, channel stability, and riparian vegetation health, which are discussed above (Fischenich 2003).

Trail design solutions along the Crystal River streambank in Alternative A would include additional slope stabilization along about 11,300 feet of streambank. This could result in additional physical alteration of the streambank, which could further reduce natural channel evolution and riparian succession processes. A USACE review of scientific literature describes the potential impacts of slope stabilization along riverbanks, particularly when riprap is the dominant material used (Fischenich 2003). Impacts to aquatic organisms and in-stream function include:

- **Morphology**: Stabilization generally reduces channel evolution through migration and can reduce riparian succession processes unless they incorporate vegetation as a component of the slope stabilization.
- **Hydrologic balance**: Stabilization generally has little local effect on water storage or exchange processes, and its impact on hydrodynamics is generally associated with change in resistance to water flow.

Riparian vegetation near Red Wind Point, looking south.

- **Sedimentation**: Stabilization generally reduces local bank erosion but can induce local scouring and local sediment deposition, usually on and within riprap material if used.
- **Habitat**: Stabilization often results in a reduction of streamside vegetation, which can result in adverse impacts to riparian flora and fauna. Design features that include vegetation as a key component of the slope stabilization generally have lower impacts. Stabilization may result in adverse impacts to cutthroat trout, which is not known to occur in the Crystal River but is present in the Roaring Fork Valley. Subspecies of cutthroat are both listed and sensitive.
- **Chemical processes**: Stabilization usually has only limited impacts on water quality. Long reaches of continuous riprap can increase stream temperatures due to solar radiation and can diminish nutrient loading because of the elimination of riparian vegetation, but these impacts are generally minor. Nutrient dynamics are less affected in slope stabilization projects when vegetation is used to stabilize the upper slopes.

Intermittent flow deflection structures (such as piers and bridge pilings) that extend outward from the riverbank generally have minor to negligible impacts to aquatic habitat, in-stream processes, and riparian vegetation (Fischenich 2003).

Summary of Instream and Riparian Impacts

The impacts of each alternative (if implemented over the entire length of the study area) on instream and riparian habitats along the Crystal River are summarized below.

Alternative A

Alternative A follows the existing alignment of SH 133 for its entire length. During the field review, limited native vegetation was observed in the highway right-of-way. Anticipated impacts from Alternative A include the following:

- Existing riparian vegetation would likely be removed to make way for the trail bench, with little opportunity for revegetation and mitigation.
- Assuming a narrow trail disturbance width of up to 15 feet from centerline, the trail would disturb up to about 75 acres of vegetation throughout the corridor, most of which would be adjacent to the Crystal River.
- Challenging trail design solutions along the narrow strip between the highway and the streambank would require about 11,300 feet (2.1 miles) of new riprap, walls, piers, or other hardened structures.
- New hardened structures would further incise and degrade stream function in affected areas.
- New construction and excavation along the Crystal River streambank, and in some cases within the channel, would increase erosion and sedimentation and the potential for impacts to water quality and in-stream habitat. While these impacts would be reduced by construction timing, best management practices (BMPs) and engineered solutions, the location and extent of this impact would elevate the risk of impacts.
- Since a significant extent of the streambank is already degraded by past development and stabilization, the overall incremental impact would still be minor.

Alternative B

Assuming that a 25-foot area would be the limits of disturbance from the center of the trail, about 50 acres of ground disturbance would occur from construction. This would be an over-estimation for either trail alternative, as both segments follow existing trails and roads for almost their entirety. Anticipated impacts from Alternative A include the following:

- Several small areas of wetland and riparian vegetation would be disturbed during construction.
- A larger extent of wetland and riparian vegetation in the Janeway North area (about 0.35 acre) would be impacted.
- Assuming a wider trail disturbance of up to 25 feet from centerline, the trail would disturb up to about 120 acres of vegetation throughout the corridor, most of which would be in upland locations.
- Increased drainage and sedimentation would occur along the length of the trail during and immediately following construction, potentially impacting water quality and in-stream habitat. Construction BMPs and the vegetated buffer distance between the trail alignment and the Crystal River in many areas would reduce these impacts.
- Besides the localized wetland impacts described above, the overall incremental impact would be minor.

Bridges

Fourteen potential bridge locations are identified in the study area. Some are new structures, while others are adjacent to or replacements of existing bridges. To the extent that trail alignment options utilize bridges to switch between Alternative A and Alternative B segments, new bridge abutments could result in impacts to wetlands, riparian habitat, or stream function. However, the location, extent, and significance of these impacts is not known at this time, since the exact location and span length of new bridges has not been determined.

Design Measures to Mitigate In-Stream and Riparian Impacts

The riparian vegetation communities along the Crystal River are in many areas fragmented by development, encroached upon by non-native vegetation, and restricted by the highway, roads, and residential areas. Many segments of Trail Alternative A (Table **3**) would require additional riprap, walls, or piers to stabilize the riverbank and establish a platform for the trail (Loris Engineering 2017). Approximately two miles (11,300 linear feet) of the Crystal River along SH 133 would require additional stabilization. These areas, however, are already stabilized, and additional stabilization from Alternative A would not likely result in significant localized impacts to in-stream processes.

In some locations, trail and bridge implementation has the potential to reduce existing impacts or potentially improve stream and habitat conditions (Crystal River Management Plan; Roaring Fork Conservancy 2016; Fischenich 2003). Trail and bridge design measures to minimize impacts or improve stream and riparian conditions include:

- Avoid removal of riparian vegetation whenever possible
- Incorporate riparian and upland vegetation as appropriate into stabilization design to support and increase habitat and hydrologic balance

- Design bridges with the maximum feasible width to minimize floodplain constriction and promote channel migration, hydrologic balance, and riparian habitat succession
- Replace existing narrow bridges with wider structures to withstand bankfull flows and minimize flow deflection
- Avoid and minimize the use of impermeable materials along the riverbank to support hydrologic balance
- Design piers and bridges so that flow deflection from pilings or structures is minimized

Riparian health in the valley may be improved through restoration of native vegetation along the Crystal River, the control and elimination of noxious weeds, and support of riparian succession in areas where fragmentation has occurred. Segments where this may be effective include the Crystal River Parcel, Filoha Meadows, and north of Avalanche Creek.

In addition, there is potential for breaching railroad grade or other confining structures at key locations (such as Red Wind Point), thus reestablishing floodplain connectivity, increasing the potential for channel migration, improving hydrologic balance, and enhancing aquatic and riparian habitat (Roaring Fork Conservancy 2016). The reaches below Red Wind Point where river processes are impaired (Table **2**), for example, may benefit from floodplain restoration at this location. The process for breaching the grade and restoring the floodplain would require additional surveys, compliance with the ESA, and permitting by the USACE.

Wildlife Resources

The overall assessment of potential impacts to wildlife focused on the following components:

- Rare and sensitive wildlife (based on USFWS, USFS, and field reviews)
- High-quality wildlife habitat areas (based on existing documentation and field reviews)
- Seasonal activity areas for bighorn sheep and elk (based on CPW mapping and data)
- Landscape-scale impacts on undisturbed habitat (based on GIS mapping of existing disturbance)
- Review of impacts from trails and recreation, potential for unauthorized secondary trails, and the effectiveness of seasonal closures

Each of these elements is described in the following sections.

Wildlife Assessment Methodology

The Crystal Valley is home to a wide variety of wildlife species that are common to Colorado's montane valleys, forests, and stream corridors. Commonly observed wildlife in the region include large ungulates such as mule deer and elk; carnivores such as black bear, coyote, mountain lion, and fox; and a host of small mammals, birds, amphibians, and aquatic species. While common species are an important part of the Crystal Valley ecosystem, this analysis focuses more specifically on species and habitats that are rare or sensitive, or are otherwise indicators for ecosystem health.

The assessment of wildlife resources and potential impacts to wildlife within the Crystal Valley study area began with a review of existing studies and documents and meetings with local agency staff with CPW and the WRNF. This included reviewing USFWS, CPW, and CNHP databases; reviewing the current USFS Region 2 sensitive wildlife species list; and obtaining additional input from the WRNF wildlife biologist. A multifaceted approach to analyzing wildlife resources and potential impacts was developed based on existing information and resources, field surveys, wildlife cameras, and analyses of potential impacts to wildlife using multiple variables.

Black bear captured by a wildlife camera near Red Wind Point.

Field surveys were conducted from June 19 to 23, 2017, and included a reconnaissance-level review of all trail alternative corridors. The objectives were to:

- confirm existing information on typical and sensitive wildlife habitat,

- identify suitable habitat or occurrences for rare or sensitive wildlife species,
- identify areas with high-quality wildlife habitat attributes, and
- identify areas of potential impact or those that would require more detailed surveys during the design and implementation process.

Field reviews considered wildlife habitat and conditions over a broad area, encompassing most of the Crystal River Valley floor and adjacent slopes.

This reconnaissance-level review was not designed or intended to provide a comprehensive wildlife inventory of the Crystal River Valley. Such inventories are typically geographically specific, are intensive, and can take many months or years to complete. Instead, this review was designed to provide a uniform, baseline understanding of wildlife resources, issues, and potential impacts at a level of detail that is appropriate to support trail planning and evaluation and subsequent USFS NEPA analysis.

The potential impacts to mapped wildlife habitat areas were evaluated based on the trail alternatives and a 100-meter zone of influence. The 100-meter zone of influence distance is based on scientific literature pertaining to the impacts of recreation and human development on wildlife (see *Summary of Impacts from Trails and Recreation* discussion below). The "zone of influence" is the area around a trail or recreation area in which human presence or activity affects wildlife behavior. While the actual zone of influence may vary widely by location, terrain, species, and levels of habituation, 100 meters is a commonly accepted distance and is used as the quantitative standard for this study.

Listed and Sensitive Wildlife

The Crystal Valley contains known or suitable habitat for a number of listed, sensitive, and rare wildlife species (Appendix C). Suitable habitat areas were identified based on field reviews and a review of existing documents to understand where suitable habitat exists for these species or where they are known to occur. The evaluation considered listed, sensitive, and CPW-tracked species. The potential presence of rare and listed wildlife species within the study area is summarized in Table 4.

ESA-Listed Species

ESA-listed species with the potential to occur within the Crystal Valley study area are the Canada lynx (*Lynx canadensis*) and Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), both listed as threatened (USFWS 2017a).

Canada Lynx

Canada lynx was listed as a threatened species on March 24, 2000 (65 Federal Register [FR] 16051). The historic distribution of Canada lynx extends from Alaska across much of Canada (except for coastal forests) and south into parts of the western U.S., the Great Lakes states, and New England. Lynx distribution is aligned with the presence of their primary prey, the snowshoe hare (*Lepus americanus*). (Ruggiero et al. 2000). Between 1999 and 2006, 218 Canada lynx were reintroduced into Colorado by CPW. In 2010, CPW determined that a viable, self-sustaining breeding population of Canada lynx had reestablished in the southern Rockies (Interagency Lynx Biology Team [ILBT] 2013; Theobald and Shenk 2011).

Table 4. Listed and Sensitive Species Habitat and Potential to Occur in the Study Area

Species	Status	Suitable Habitat and Potential to Occur	7 Oaks – Nettle Creek	Red Wind – Andrews	Perham – Janeway South	Avalanche – Narrows	Filoha	Wild Rose	Redstone – Hawk Creek	Hayes Falls – Bear Creek	Placita – McClure
Key: ● indicates that suitable habitat is present ★ indicates that species presence was confirmed											
MAMMALS											
American marten *Martes americana*	FSS	Suitable habitat in subalpine fir-spruce forests		●	●	●			●	●	
Canada lynx *Lynx canadensis*	ESA Threatened Critical Habitat	Suitable winter, denning, and other habitat; primarily movement corridors between higher-elevation areas		●	●	●		●		●	●
Fringed myotis *Myotis thysanodes*	FSS	Suitable roosting and foraging habitat; acoustic monitoring detection in Janeway Meadow	●	●	★	●	●	●	●	●	
Hoary bat *Lasiurus cinereus*	FSS	Roosting and foraging habitat; acoustic monitoring detections in Janeway and Filoha meadows	●	●	★	●	★	●	●	●	●
North American wolverine *Gulo gulo luscus*	ESA Proposed Threatened	No suitable habitat present									
Pygmy shrew *Sorex hoyi montanus*	FSS	Suitable habitat in coniferous forested Crystal River corridor	●	●	●	●	●	●	●	●	
River otter *Lontra canadensis*	FSS	No known populations in the Crystal River									
Rocky Mountain bighorn sheep *Ovis canadensis canadensis*	FSS	Seasonal winter and summer ranges on west-facing slopes		★	●	★	★		●	★	

Species	Status	Suitable Habitat and Potential to Occur	7 Oaks – Nettle Creek	Red Wind – Andrews	Perham – Janeway South	Avalanche – Narrows	Filoha	Wild Rose	Redstone – Hawk Creek	Hayes Falls – Bear Creek	Placita – McClure
Townsend's big-eared bat *Corynorhinus townsendii townsendii*	FSS	Roosting and foraging habitat; known populations above Filoha Meadow and acoustic monitoring detection at Janeway and Filoha	●	●	★	●	★	●	●	●	
BIRDS											
American bittern *Botaurus lentiginosus*	FSS	Suitable habitat in large emergent wetland areas; not known to occur					●				
American peregrine falcon *Falco peregrinus anatum*	FSS	Known and suitable nests in multiple locations on cliffs high above the valley floor	●	●	●	★	●	●	★	●	
Bald eagle *Haliaeetus leucocephalus*	FSS	Suitable winter roosting, foraging, and nesting habitat; historic presence in valley	●	●	●	●	●	●	●	●	
Black swift *Cypseloides niger*	FSS	Suitable breeding habitat at Bulldog Creek above Avalanche Creek and Hayes Falls; suitable foraging habitat in meadows			●	★	●			★	
Boreal owl *Aegolius funereus*	FSS	Suitable forest habitat, but below elevation range; previously documented in Middle Thompson Creek PCA									
Brewer's sparrow *Spizella breweri*	FSS	Very little suitable habitat									●
Flammulated owl *Otus flammeolus*	FSS	Suitable habitat in mature forest areas				●		●	●	●	●
Lewis's woodpecker *Melanerpes lewis*	FSS	Suitable habitat along Crystal River	●	●	●	●	●	●	●	●	
Northern goshawk *Accipiter gentilis*	FSS	Suitable breeding habitat in coniferous forest patches				●		●		●	●

Species	Status	Suitable Habitat and Potential to Occur	7 Oaks – Nettle Creek	Red Wind – Andrews	Perham – Janeway South	Avalanche – Narrows	Filoha	Wild Rose	Redstone – Hawk Creek	Hayes Falls – Bear Creek	Placita – McClure
Northern harrier *Circus cyaneus*	FSS	Suitable habitat in Janeway, Filoha, and Placita meadows and wetlands			●		●				●
Olive-sided flycatcher *Contopus cooperi*	FSS	Suitable breeding habitat in forest patches near Avalanche and Bear Creeks				●				●	
Purple martin *Progne subis*	FSS	Suitable breeding habitat in aspen forest at top of McClure Pass									★
Western Yellow-billed Cuckoo *Coccyzus americanus occidentalis*	ESA Threatened	Suitable habitat in riparian areas in Crystal River Open Space and Janeway North areas	●		●						
INSECTS											
Monarch butterfly *Danaus plexippus*	FSS	Suitable habitat (milkweed) in Crystal River Open Space and Narrows area	●			●					
Western bumblebee *Bombus occidentalis*	FSS	Suitable habitat in Janeway, Avalanche, and Filoha meadows, and along wagon road near Bear Creek			●	●	●			●	
AMPHIBIANS											
Boreal toad *Bufo boreas*	FSS	Suitable habitat in wetlands south of Redstone and north of Placita							●		
Northern leopard frog *Lithobates pipiens*	FSS	Suitable habitat along Crystal River, and in wetlands in Filoha Meadows, Redstone south, and Placita areas	●	●	●	●	●		●	●	

In the southern Rockies, lynx occur largely in conifer stands within the subalpine and upper montane forest zones, typically above 9,500 feet in elevation in Colorado. In the higher elevations, suitable lynx forest habitat is typically dominated by subalpine fir (*Abies lasiocarpa*) and Engelmann spruce that transition to aspen vegetation types (e.g., lodgepole pine/aspen/Douglas-fir). Lynx use riparian habitats during the fall months and occasionally use lower montane forests (e.g., ponderosa pine and pinyon pine/juniper communities) and montane shrublands (ILBT 2013). Lynx normally use coniferous or deciduous vegetation less than 6 feet in height with a closed canopy for traveling (USFS 2002). Females seem to select dense mature forest habitats that contain large woody debris, such as fallen trees or upturned stumps, as denning habitat. Typically, kittens are born between May and July. Den sites tend to be in mature or old-growth stands with a high density of logs (Ruediger et al. 2000; Ruggiero et al. 2000). Foraging areas include early successional forests with a high density of stems and branches that protrude above the snow.

The primary limiting factor for lynx populations is the abundance of snowshoe hare and alternative prey species, which in turn is limited by availability of winter habitat (Ruggiero et al. 2000; Ruediger et al. 2000). Home range sizes vary from 12 to 83 square miles and are influenced by availability of prey, the season, the lynx's gender and age, and the density of the population (USFWS 2017b). Lynx rarely venture into open areas. Movement corridors consisting of continuous coniferous forests are critical for lynx travel and dispersal (Tanimoto 1998).

Critical habitat was revised on September 12, 2014, for the contiguous United States distinct population segment of Canada lynx (USFWS 2014). Approximately 1.1 million acres of suitable denning, winter, matrix, foraging, and linkage habitat for lynx is mapped within the WRNF (USFS 2002c). Lynx is known to occur within the study area, and mapped linkage habitat is identified at McClure Pass (Table 4). There is no critical habitat designated in the WRNF. The valley bottom is primarily used as a movement corridor for the lynx and does not provide denning or foraging habitat (ILBT 2013). Linkage areas are broad areas of habitat where animals can find food, shelter, and security. Linkage areas are relatively unfragmented and provide movement opportunities for lynx. Linkage areas are important because they provide landscape connectivity between blocks of habitat that are separated by intervening areas of non-habitat (USFS 2008a).

Western Yellow-Billed Cuckoo

On October 3, 2014, the USFWS listed the western yellow-billed cuckoo as threatened (79 FR 192). In the United States, the western yellow-billed cuckoo is known to occur in Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Texas, Utah, Washington, and Wyoming. This species is a large late-breeding migratory bird, usually arriving to Colorado in July and departing between late July and early September. The western yellow-billed cuckoo nests almost exclusively in multistoried, densely vegetated riparian woodlands composed of cottonwood, willow, and occasionally tamarisk that are 12 acres (5 ha) or greater in extent. The western yellow-billed cuckoo's elevation range is generally below 6,000 feet within arid to semiarid landscapes, although it may occur at elevations up to 8,500 feet (Hughes 1999). It is a foliage gleaner of large insects.

Larger habitat patches are necessary for breeding, although breeding pairs have been observed in in smaller habitat patches (NatureServe 2017). Dense riparian understory foliage is an important factor in

nest site selection, while cottonwood trees are an important component of foraging habitat (USFWS 2011). Stopover habitat may include smaller patches of riparian habitat such as those found in the Crystal River Open Space Parcel and in Janeway North.

The decline of the western yellow-billed cuckoo population is primarily attributable to habitat loss, degradation, and fragmentation resulting from human activities. Overgrazing, encroachment of tamarisk and non-native plants on native riparian woodland species, river management (including altered flow and sediment regimes), and flood control practices (such as channelization and bank protection) are identified as major causes of population declines (USFWS 2001).

Western yellow-billed cuckoo is not known to occur in the Crystal Valley or the WRNF, but known populations occur to the south in the North Fork Valley near Paonia (Table 4). Suitable cuckoo habitat exists in two areas within the study area: at the Crystal River Open Space Parcel and in Janeway North.

FSS Species

FSS species include a number of mammal, bird, amphibian, and insect species that are known to occur or have suitable habitat within the Crystal Valley (Table 4 and Appendix C). Habitat for these species was evaluated and the presence of several species in the study area was confirmed during the field review. Species for which targeted surveys were completed, or which had presence confirmed during the field surveys, are briefly discussed below. Peregrine falcon is discussed in greater depth because it is both a FSS species and a Colorado species of concern.

Bats

The survey area was assessed for FSS bat habitat during the field review, and acoustic surveys for bats were conducted over three nights in suitable habitat at Janeway South and Filoha Meadows in July 2017. Hoary bat, Townsend's big-eared bat, and fringed myotis were all confirmed as present at Janeway South. Hoary bat and fringed myotis were confirmed at Filoha Meadows. Bat sign was recorded at Filoha Meadows within an existing cabin structure. Habitat and occurrences of these species are described below.

- Fringed myotis occur primarily at middle elevations in desert, riparian, grassland, and woodland habitats, but have been known to occur at elevations up to 8,200 feet. They roost in caves, mines, cliff faces, rock crevices, old buildings, bridges, snags, and other sheltered sites. In Colorado, most maternity roosts have been observed in crevices of rock faces, sometimes in abandoned mines or abandoned cabins. In spring and summer, males roost separately and are rarely found in nursery colonies. Winter habits are poorly known; hibernacula include caves, mines, and buildings (NatureServe 2016). Fringed myotis suitable habitat is present between Placita and 7 Oaks.
- Hoary bat suitable habitat primarily consists of deciduous and coniferous forests and woodlands, including areas altered by humans. Foraging habitat includes various open areas, including spaces over water and along riparian corridors. Individuals may forage around lights in rural settings. Roost sites are usually in large deciduous or coniferous trees, near the end of branches 10 to 60 feet above ground, with dense foliage above and open flying room below,

often at the edge of a clearing and commonly in hedgerow trees. Sometimes these bats roost in rock crevices or other sites, but rarely in caves. Individuals have a low level of roost fidelity. Hibernating individuals have been found in a variety of locations including tree trunks, tree cavities, in a squirrel's nest, and in a clump of Spanish moss (NatureServe 2017). Hoary bat suitable habitat is present throughout the study area.

- Townsend's big-eared bat prefers relatively cold places for hibernation, often near entrances of structures and caves and in well-ventilated areas. It uses caves, buildings, and tree cavities for night roosts. Throughout much of its known range, this bat commonly occurs in mesic habitats characterized by coniferous and deciduous forests (NatureServe 2016). Townsend's big-eared bat suitable habitat is present in the study area between Placita and 7 Oaks.

The trail alternatives are not likely to result in impacts to bat species as their roosting habitat would not be impacted. Caves and structures would not be altered, and tree removal would be avoided when possible and would not occur if bats were determined to be roosting. The trail is not likely to result in loss of foraging habitat.

Nesting Birds

Black swifts forage over forests and in open areas and nest in dark, inaccessible sites with unobstructed flight paths, such as nests behind or next to waterfalls and wet cliffs, and occasionally in limestone caves (NatureServe 2016). Black swift suitable habitat is present at Janeway South, above Avalanche Creek at Bulldog Creek, at Filoha Meadows, and at Hayes Falls. Black swifts were observed near Avalanche Creek and at Hayes Falls.

Purple martins occupy a wide variety of open and partly open habitats, frequently near water in mature aspen stands. Birds nest in abandoned woodpecker holes in trees. In Colorado, purple martins are semicolonial, with multiple pairs of martins nesting in the same tree stand. They feed in open areas, especially near water (NatureServe 2016). Purple martins were confirmed as present at McClure Pass, where suitable nesting habitat occurs.

Owls and Raptors

Assessment of habitat for boreal owls and flammulated owls was completed during the field review. The study area is below the elevation range for boreal owls, which generally occur in forested habitat at elevations above 10,000 feet in Colorado (Hayward and Hayward 1993). Flammulated owl habitat includes open montane mid-elevation conifer forests containing mature coniferous and mixed coniferous forests with some brush or saplings, in cooler semiarid climate, with a high abundance of nocturnal arthropod prey and some dense foliage for roosting. It nests in abandoned tree cavities in large-diameter pine, Douglas-fir, or aspen trees between April and June (NatureServe 2016).

Suitable habitat for flammulated owls was observed at Avalanche, at the Narrows, and from Hawk Creek to McClure Pass. The study area is below the elevation at which boreal owls occur. One night of surveys for owls was completed in suitable habitat at McClure Pass and Bear Creek; no owls were detected. The field review occurred after the owl survey season, and the survey was not adequate to confirm presence or absence.

American Peregrine Falcon

Peregrine falcons use cliffs from 160 feet to 660 feet in height for nesting (White et al. 2002) and primarily nest on the upper half of vertical cliffs with the nest site having a southerly exposure (Craig and Enderson 2004; Wickersham 2016). An estimated 77 to 99 percent (by frequency of species eaten, not biomass) of the peregrine falcon diet consists of smaller passerine birds and small geese. Occasionally small mammals and rarely amphibians, fish, and insects are eaten (White et al. 2002). Cliff-dwelling white-throated swifts, rock pigeons, and mourning doves are the most important prey items for falcons in Colorado (Craig and Enderson 2004; Wickersham 2016). Most prey is captured in the air while the falcon is in flight, also from surface of water or on the ground (White et al. 2002). Thompson (2017) suggests that all habitat within 10 miles of a nesting cliff needs to be considered essential hunting habitat. However, the large hunting range of peregrine falcons indicates that they use many different plant communities opportunistically within foraging ranges, and no single local hunting area is thought to be critical to the existence of any individual pair of birds (Craig and Enderson 2004).

Peregrine nest sites are located within the Crystal River Valley, and historic presence is documented. The Crystal River Valley provides abundant hunting and nesting habitat for peregrine falcons on both sides of the river and adjacent to SH 133, as documented in Thompson (2017). The large cliff faces, with proximity to the Crystal River, have been known to support falcon nesting in the past and present. CPW data shows that one peregrine falcon nesting area occurs near Hayes Falls and Hawk Creek. A nesting area includes suitable nesting sites and contains one or more active or inactive nest locations. Nesting area boundaries are mapped based on professional judgment to include most known nesting habitat in the vicinity, which usually includes a 0.5-mile buffer surrounding cliffs (CPW 2017a).

Filoha Meadows, looking north at bat, peregrine falcon, and bighorn sheep habitat.

One peregrine falcon potential nesting area (at Potato Bill Creek) occurs within 0.5 mile of the trail, and two additional potential nesting areas (east of the Redstone Open Space and west of the KOA campground) occur within 2 miles of the trail. Potential nesting areas include the necessary components for peregrine falcon nesting but contain no known active or inactive nest sites (CPW 2017a). No falcon activity was observed at the Potato Bill Creek, Hayes Falls, or Redstone Open Space sites during the field review. A complete raptor survey was not conducted

and is recommended for spring 2018 at locations where the trail alternatives intersect or are near potential nesting areas. Falcons often use different ledges on the same cliff band for nesting year-to-year.

During the field review, and during a follow-up visit on August 21, 2017, wildlife biologists observed a pair of peregrine falcons perching and flying on cliffs on the west side of SH 133 approximately 0.3 miles northwest of the Penny Hot Springs pull-off, and 5 miles north of the CPW-mapped nesting area at Hayes and Hawk Creek. The birds were observed using the middle to upper cliff bands across from a pull-off and near a known rock climbing area on the east side of SH 133. An active nest was not located, but it is likely that one exists since the birds were seen on multiple days in the same area. A large concentration of white-throated swifts was observed directly south of the birds on the upper cliffs, providing a potential localized food source. Rock climbing anchors and ropes were observed several hundred feet south of the area the birds were using. Existing disturbances include SH 133, the road pull-off, Penny Hot Springs pull-off, and rock climbing evidence in proximity.

Mule deer captured by a wildlife camera in the Narrows, looking south.

Pairs of birds vary greatly in their responsiveness to human activities, depending on individual characteristics, period of their breeding cycle, and environmental circumstances (Cade 1960 in White et al. 2002). Pairs of birds in remote locations are most reactive, while pairs in urban or frequently visited areas become habituated to close human activities (White et al. 2002). Therefore, it is possible that this pair has some tolerance to existing disturbance.

The WRNF Resource Management Plan (USFS 2002) recommends that human activities be restricted within ½ mile of occupied peregrine falcon areas between March 15 and July 31 for nest sites, or July 1 to September 15 for hack sites (artificial nesting sites where young are trained to hunt). Distances may vary depending on local topography, potential for disturbance, and the location of important habitat requirements.

CPW (2008) recommends the same restrictions around occupied habitat. It is likely that potential disturbance from intermittent pedestrian or bike traffic on a trail across the SH 133 and the Crystal River would be negligible due to the existing disturbances and to the vertical distance between the valley floor and the height at which the birds were observed (300 to 500 feet). The trail would not be expected to cause abandonment of a nest site.

Peregrine falcons are protected by the Migratory Bird Treaty Act, which prevents the direct killing of young or individuals, but does not protect their habitat nor address disturbance from human activities

unless it results in killing birds. Spatial and seasonal buffers are used to address the sensitivity of raptors to disturbances, thereby reducing the chances of affecting peregrine breeding activities.

CPW-Tracked Species

In addition to the listed and sensitive species described above, the primary wildlife species of conservation and management interest within the Crystal Valley are bighorn sheep and elk, which use areas within or adjacent to the trail alternative corridors for seasonal (winter and spring) range. Other species tracked by CPW were also evaluated based on CPW mapping, including mule deer, moose, black bear, wild turkey, bald eagle, and peregrine falcon (discussed above). Wildlife cameras placed by OST at Red Wind Point, the Narrows, and Filoha Meadows show that mule deer, bears, turkeys, coyotes, and elk are present in these locations.

Seasonal ranges for bighorn sheep and elk are areas of concern, and potential impacts were specifically evaluated based on input from CPW and previous documentation. Evaluation of potential impacts to both species was based on the overlap of seasonal habitat areas and a 100-meter zone of influence from the potential trail alternatives. Impact findings also considered positive and negative influences of the landscape context, existing seasonal closures, and concerns documented by previous studies and experts. For both species, the following discussion includes a brief background on their habitat requirements and documented facts about the local herds. In addition, specific locations where trail alternatives could potentially impact these species are described.

Bighorn Sheep

Rocky Mountain bighorn sheep (*Ovis canadensis*) range from central British Columbia to Mexico, and from California east to western North Dakota and New Mexico. Bighorn sheep is both a FSS species and a CPW-tracked species. Colorado is home to the largest population of the species (CPW 2009). In Colorado, bighorn sheep prefer steep, high-visibility habitat dominated by grass, low shrubs, rock cover, and topographic relief (Armstrong et al. 2011). Bighorn are primarily grazers, feeding in meadows, open woodlands, and alpine tundra. They forage on grasses and forbs in summer. Grasses eaten by bighorn sheep include bluegrass, sedges, wheat grass, bromes, and fescues (USFS 1997). Suitable escape terrain that bighorn sheep use to avoid predators (e.g., cliffs and talus slopes) is an important feature of habitat (CPW 2009; NatureServe 2017). Sheep use primarily alpine tundra and associated rocky cliff areas during summer. In winter, they use lower-elevation open, grassy benches and southerly slopes, with some herds wintering on windswept ridges at high elevations. Most sheep have different summer ranges, while some stay in south-facing winter range all year (CPW 2009).

In Colorado, the statewide bighorn population has been steady at about 7,000 animals in 79 herds (CPW 2009). Across the west, the main reason for bighorn sheep population declines has been bacterial pneumonia (also called “pasteurellosis”). These infections, which stem primarily from exposure to domestic sheep and goats on summer ranges, can cause die-offs of sheep of all ages, as well as low lamb recruitment. Bighorn sheep often appear to habituate fairly well to human activity. However, stress associated with human or other disturbances could increase the susceptibility to diseases in individual animals, contributing to epidemics in some situations (CPW 2009).

West Snowmass Herd

The bighorn herd in the study area is within the Snowmass, West management unit (S25). This herd encompasses the West Elk Mountain Range to the east of the Crystal River, including the slopes of Mount Sopris and the upper Avalanche Creek basin. Summer range is concentrated on the high-elevation slopes in the upper Avalanche Creek basin, while winter range is concentrated on the west and south-facing slopes above the Crystal River, Redstone, and Marble (Figure 3) (CPW 2016). Conditions for bighorn populations throughout Colorado, including the West Snowmass Herd, are described in the statewide management plan for the species (CPW 2009). Nine local populations in Colorado have herd-specific management plans. CPW does not have a herd-specific management plan for this herd.

The West Snowmass population is believed to be in poor condition, primarily due to disease and exposure to domestic sheep on summer ranges. Disease has resulted in high lamb mortality (up to 95 percent) (Groves 2017). Population estimates since 1986 show a downward population trend, with about 200 animals in 1992 declining to about 125 in 2006 and 75 in 2007 (CPW 2009). The most recent population estimate was in 2012, and the current herd size is estimated to be about 45 to 50 animals (Groves 2017).

Habitat in the Crystal Valley

Within the lower elevations of the Crystal Valley, most of the west- and southwest-facing slopes above the valley floor are considered winter range for bighorn sheep. These slopes generally consist of steep, rocky slopes with high winter sun exposure and favorable escape terrain for bighorn. CPW has identified Severe Winter Range and Winter Concentration Areas at several specific sites, including the slopes above Red Wind Point, Avalanche Creek, Filoha Meadows, and Redstone. Production (lambing) areas have been identified on the slopes above Red Wind Point and the Crystal River Estates Subdivision, Avalanche Creek, Wild Rose Subdivision, and Redstone. Mineral licks used by bighorn to supplement dietary intake have been identified above Avalanche Creek, along the river at Filoha Meadows, and high on the slopes southeast of Redstone (CPW 2016).

The amount of mapped seasonal habitat for bighorn within the Crystal Valley study area is summarized in Table 5, and is shown on Figure 3. Habitat within specific trail segments is shown on Figures 6 through 14. Note that the study area is defined to be within ½ mile of the trail alternative corridors.

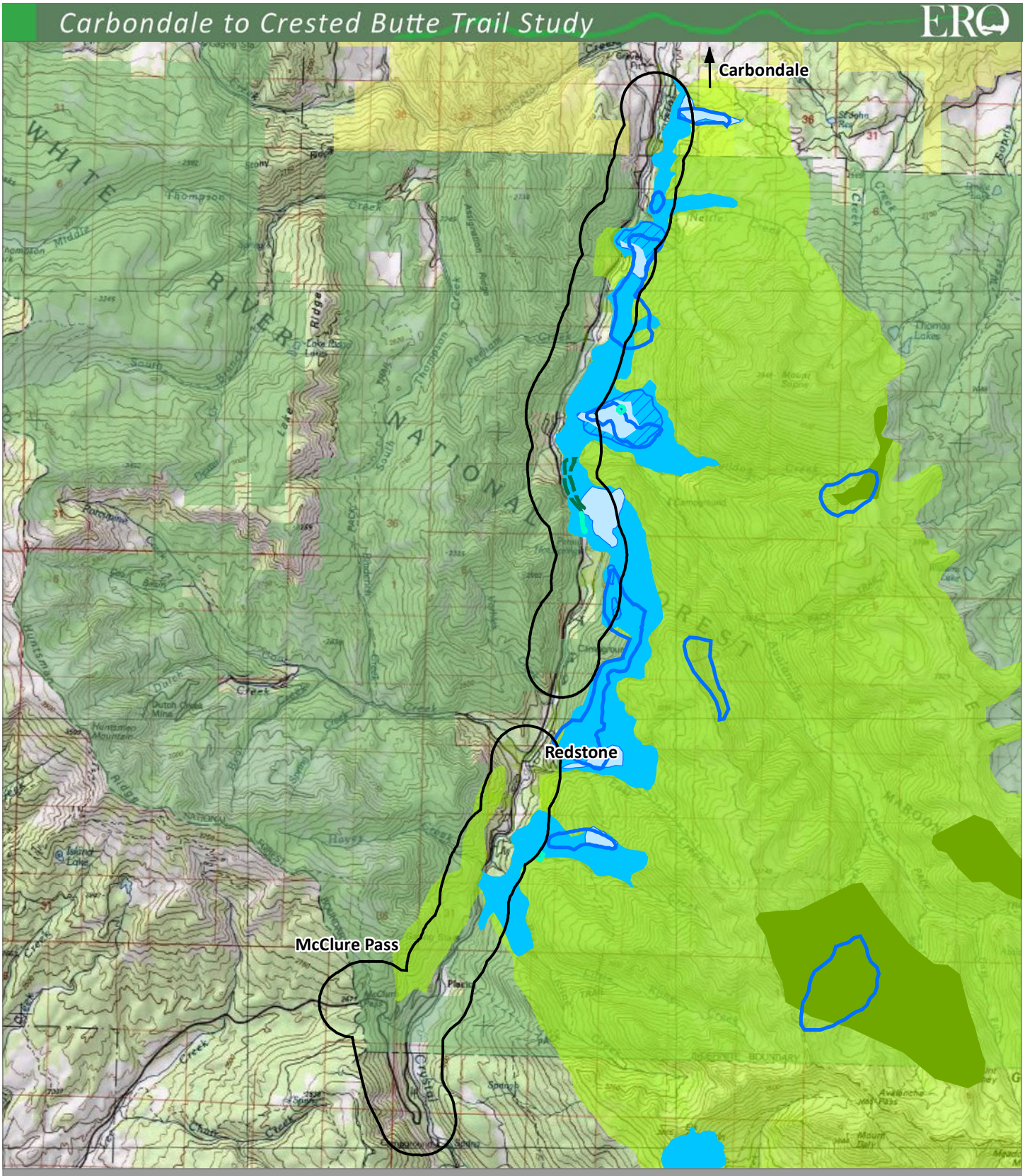

Figure 3. CPW Bighorn Sheep

Table 5. Bighorn Sheep Habitat Areas within the Study Area

Seasonal Habitat Area – Bighorn Sheep	Total Acres	Location
Production Area	433	Rocky, west-facing slopes between Red Wind Point and Redstone
Winter Range	2,340	Valley floor and west-facing slopes
Winter Concentration Area	477	Slopes above Red Wind Point, Avalanche Creek, and Filoha Meadows
Severe Winter Range	289	Slopes above Red Wind Point, Avalanche Creek, and Filoha Meadows
Migration Corridor	n/a	Lower slopes between Avalanche Creek and Filoha Meadows
Mineral Lick	4	East riverbank near Penny Hot Springs and Filoha Meadows

Source: CPW 2017b

Areas of Concern

The following specific locations have been identified as areas of concern, where trail alternative corridors intersect or may come into proximity to mapped or known bighorn habitat areas. These locations are:

- Red Wind Point – Production and Winter Concentration Areas
- Avalanche Creek – Winter Concentration Area and Severe Winter Range
- Narrows – Migration Corridor
- Filoha Meadows – Migration Corridor, Production Area, Winter Concentration Area, and Mineral Lick

Elk

Rocky Mountain elk occupy most habitat types in the Colorado mountains, ranging from shrublands to semi-open forests, meadows, and alpine areas. In general, elk prefer open woodlands and avoid dense, unbroken forests (Armstrong et al. 2011). Elk are considered generalist feeders (grazers and browsers), foraging on a variety of grasses, forbs, and shrubs throughout the year. Forage preferences vary among seasons, habitats, and years and are influenced by plant species availability, phenology, and palatability. Winter snow conditions can have a major influence on forage availability. As snow depth increases, elk decrease their use of low-growing herbs and shrubs and increase their use of tall shrubs, conifers, and arboreal lichens. In spring, elk shift their foraging to grasses, forbs, and low shrubs (Cook 2002). Breeding in Colorado occurs during mid-September to mid-October, with females giving birth in late May to early June the following spring. Females with calves tend to isolate themselves from the herd for the first two to three weeks, seeking solitude in dense forest or shrubland areas (Armstrong et al. 2011).

Elk in the project area are within the Avalanche Creek Elk Data Analysis Unit (DAU) E-15. This DAU encompasses all of the Crystal Valley, the eastern slopes of the Thompson Divide, and the Roaring Fork Valley south of Highway 82. The most recent (2013) population estimate was about 4,500 elk; CPW's population objective ranges between 3,600 and 5,400 animals (CPW 2013).

A limiting factor for this population is the availability of winter range. Winter range within the DAU E-15 is considered to be in poor condition due to vegetation changes and land development. Vegetation changes have resulted from long-term fire suppression and limited habitat management that has resulted in older, denser, and less productive forage for elk. In addition, higher populations in recent decades have resulted in heavy browsing of shrubs, though warmer and drier winters in recent years have allowed elk to use mid-elevation habitats that were historically transitional range in the early and late winter, reducing the intensity on traditional winter range (CPW 2013).

Human development has been another major factor contributing to the loss of winter range. While most of the DAU is public land (76 percent), about half of the lower-elevation winter range is private and continues to be lost to development. With the development has come an increasing demand for trails and outdoor recreation, which adds to the disturbance of elk throughout their range, but particularly in winter and transitional ranges. The combined effect of reduced winter range and increased human disturbance has threatened the quality and quantity of habitat in the region (CPW 2013).

Within the Crystal Valley study area, nearly all of the valley floor is winter range for elk, creating a narrow sliver of habitat extending south from the Crown/Carbondale/Thompson Divide areas. Winter Concentration Areas and Severe Winter Range are found in the Janeway/Avalanche Creek, Filoha Meadows, Redstone, and Placita areas. Production (calving) habitat is found on the higher-elevation slopes above Avalanche Creek, Redstone, and Bear Creek. Existing seasonal habitat areas published by CPW are described in Table 6 and are shown on Figure 4.

In addition, at least two areas have been reported to provide calving or rearing habitat for elk:

- Riparian areas on Filoha Meadows were reported to be used to shelter young calves in 2003 and 2004 (Pitkin County 2009).
- Just south of Redstone, conifer-dominated habitat and islands have also been reported by locals to be a common location for elk cows to shelter their young after calving (McCormick 2017).

These areas are not identified in CPW mapping, but both are identified as High-Quality Wildlife Habitat Areas for these and other habitat attributes (see discussion below).

Table 6. Elk Seasonal Habitat Areas in the Study Area

Seasonal Habitat Area - Elk	Total Acres	Location
Production Area	562	Upper slopes above Avalanche Creek, Redstone, and Bear Creek
Winter Range	9,281	Entire Crystal Valley study area
Winter Concentration Area	946	Slopes above Janeway Meadow and Avalanche Creek, Filoha Meadow, slopes above Redstone, and slopes above Placita
Severe Winter Range	719	Slopes above Avalanche Creek, Filoha Meadow, slopes above Redstone, and slopes above Placita
Highway Crossing	n/a	Highway 133 near Filoha Meadow and Placita

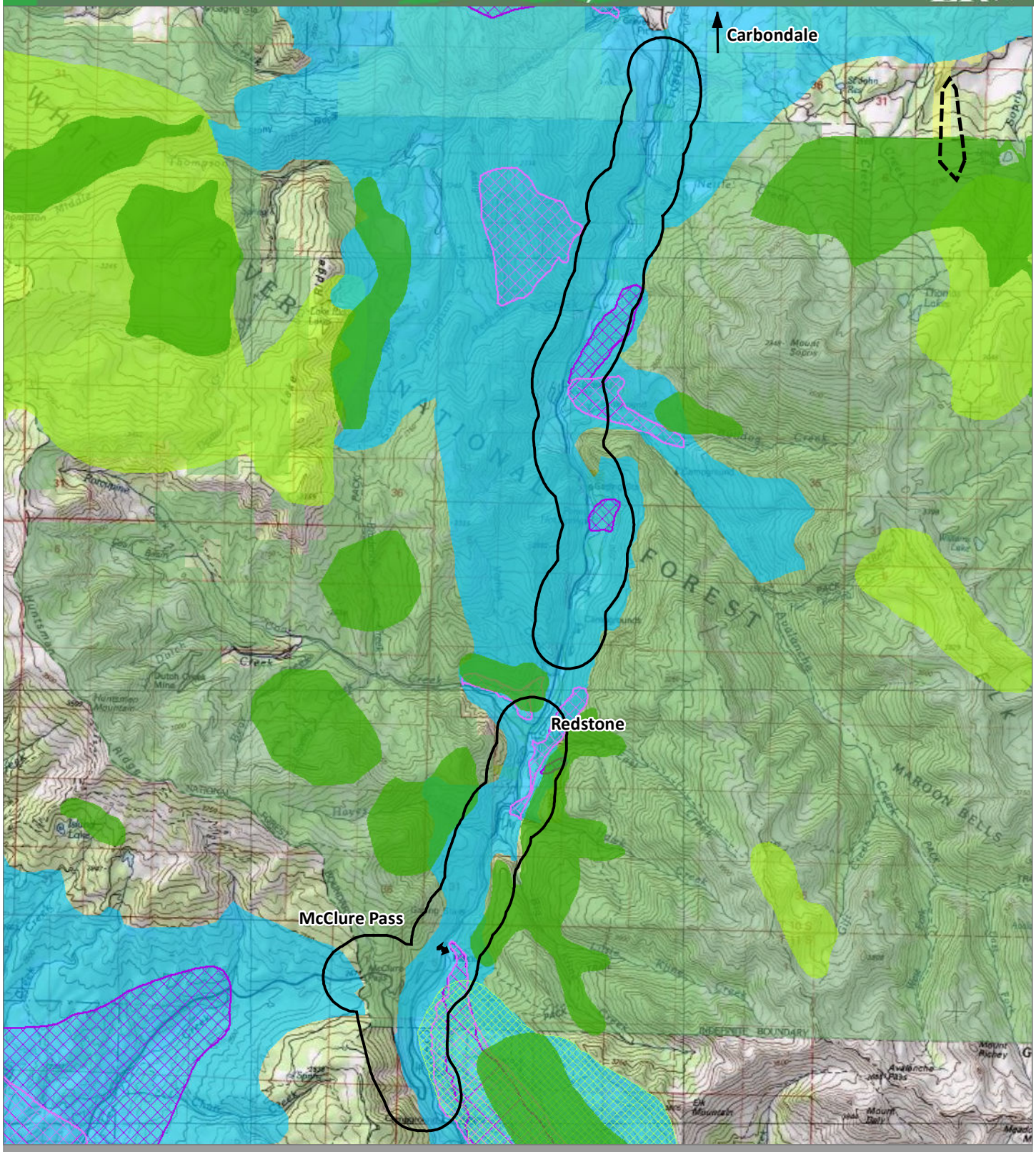

Figure 4. CPW Elk

- Trail Study Area
- Elk Migration Corridor
- Elk Production Area
- Elk Resident Population Area
- Elk Severe Winter Range
- Elk Winter Concentration Area
- Elk Winter Range
- Elk Summer Concentration Area
- BLM
- USFS
- Pitkin County Open Space

0 5,000 10,000 feet

October 5, 2017

High-Quality Wildlife Habitat Areas

Based on field observations, ERO ecologists identified eight distinct habitat patches within the study area that possess high-quality habitat value. These areas were identified based on the following factors:

- Species composition, vegetative cover, distance from disturbance, and vegetative structure of habitat that is favored by rare or tracked wildlife species
- Landscape setting that favors wildlife use (e.g., transitional habitat or movement corridors)
- Field observations of wildlife use (e.g., scat, game trails, nests)
- Contiguous, intact patch of habitat possessing the above attributes

Each area and the rationale for its identification are briefly described in Table 7.

Table 7. High-Quality Habitat Areas and Attributes

Segment	Wildlife Habitat Attributes
Crystal River Open Space Parcel	Broad, multistoried riparian habitat supported by ditches and the Crystal River; suitable habitat for yellow-billed cuckoo; large cottonwoods with cavities for nesting/roosting; existing social trails and human use.
Janeway North	Large area of multistoried riparian habitat between the Crystal River, cliff areas, and upland hillsides; diverse understory with high-quality wetlands and oxbows; suitable habitat for yellow-billed cuckoo and other species; frequent signs of wildlife use, minimal evidence of human use.
Avalanche South	Undisturbed valley with diverse vegetation communities; good habitat for bird and bat foraging; for lynx, ungulate, and bear corridors; and for several USFS sensitive species such as Northern goshawk and flammulated owl.
Filoha Wetlands A	Large, undisturbed wetlands on the lower terraces adjacent to the Crystal River; diverse plant species and wildlife use supported by warm springs; beaver use and high insect diversity supports birds, bats, waterfowl, and other wildlife.
Filoha Wetlands B	Large, undisturbed wetlands on the lower terraces adjacent to the Crystal River; diverse plant species and wildlife use supported by warm springs; beaver use and high insect diversity supports birds, bats, waterfowl, and other wildlife.
Redstone North	Broad floodplain, with natural habitat structure of multiple channels, islands, and benches and unique conifer wetlands; reported use as elk rearing area on islands; multiple big game trails cross the road and go down to the river.
Placita Wetlands	Broad floodplain with diverse wetland and riparian habitat; beaver-supported wetlands; known habitat for amphibians, waterfowl, heron, moose, and many others.
McClure Pass	Large, undisturbed aspen forest; habitat for birds including Cooper's hawk, sharp-shinned hawk, Northern goshawk, and flammulated owl; habitat for Canada lynx, ungulates, and bear; movement corridor between Huntsman Ridge and Raggeds.

Possible impacts to these areas were evaluated based on the potential for direct disturbance that would result from a potential trail alignment as well as disturbance to areas within a 100-meter zone of influence from the trail.

Landscape Disturbance

A landscape-scale analysis of existing human development and disturbance in the Crystal Valley was conducted to understand where human development and presence currently impacts or influences wildlife habitat, and where wildlife habitat is truly free from human disturbance. Habitat areas that have low levels of human use and disturbance are considered to be more vulnerable to new impacts resulting from trail alternatives. The evaluation of impacts to undisturbed habitat, moderately disturbed habitat, and undisturbed river frontage are factors that contributed to the overall assessment of impacts to wildlife.

Understanding Existing Wildlife Habitat Disturbance

This analysis is based on the understanding that rural fringe, or "exurban" development has direct impacts to wildlife use, patterns, and diversity in the surrounding habitat. These impacts include habitat loss and alteration in the immediate homesite and surrounding area (e.g., driveways, outbuildings, yards, landscape areas), and secondary impacts due to habitat fragmentation, human occupation and presence, and disturbance or predation from domestic pets. While developed areas tend to favor common species that are easily habituated to humans or find benefits (food and refuge) in developed areas, sensitive species or those with specialized habitat requirements are adversely impacted (Odell and Knight 2001; Hansen et al. 2005; Maestas et al. 2003; Theobald et al. 1997; Goad et al. 2014; NRCS 2007). The distance in which these impacts from developments occur can vary from 50 to 500 meters or greater, based on species, habitat type, and other factors (Theobald et al. 1997; Odell and Knight 2001; Hansen et al. 2005). For this analysis, an impact buffer from development of 100 meters was used to account for the potentially greater level of habituation associated with long-established subdivisions, and to be consistent with the impact buffer used for new impacts, described below under *Summary of Impacts from Trails and Recreation*.

Existing human disturbance areas were identified based on a GIS analysis of high, moderate, and low disturbance areas. For the high and moderate disturbance areas, a 100-meter buffer of influence was applied to identify the areas within which wildlife habitat is compromised or wildlife behavior is altered due to human development.

- **High Disturbance Areas** – Existing homes/subdivisions, campgrounds, and highway (plus 100-meter zone of influence). These are areas where human development and use is frequent and heavy, wildlife habitat and behavior are substantially altered, and new impacts from trail development would be minimal.
- **Moderate Disturbance Areas** – Private parcels, secondary roads, trails, and concentrated recreation areas (plus 100-meter zone of influence). These are areas where human use or occupation is prevalent but less intense, wildlife habitat is intact but is somewhat altered or degraded, and new impacts from trail development may further degrade habitat quality.
- **Low Disturbance Areas** – National forest lands, open space, and other areas not otherwise classified. These are areas where human use or occupation is low, and wildlife habitat and behavior is largely uninhibited by humans. New impacts from trail development would be greater in these areas.

Existing disturbance areas are shown on Figure 5. Note that this analysis is based on Pitkin County GIS data sets, including existing structures, roads, trails, and other features identified specifically for this project. While most data errors have been accounted for, some anomalies may exist. In addition, landscape factors such as vegetation, topography, and the "refuge effect" of the Crystal River are not accounted for. This analysis does, however, provide a high-level indication of areas that are currently influenced by human disturbance and occupation, and areas that may be more vulnerable to new disturbances.

Existing Low Disturbance Areas

Based on the landscape analysis described above, the following areas were identified as having low levels of human disturbance. These areas could be more susceptible to new wildlife impacts resulting from trail development and use.

- **Janeway North** – The meadow and wetland complex at the northern end of the Janeway area is a low to moderate disturbance area, at the interface between the Crystal River and extensive national forest land. The railroad grade through this area is a publicly accessible route, but human access is limited in the northern half of the meadow.
- **Avalanche South** – Despite the presence of the historic Rock Creek County Road, the valley south of Avalanche Creek currently has little to no human disturbance or occupation.
- **Filoha Meadows** – While the existing railroad grade and trail is subject to seasonal human access and use, this area otherwise provides extensive, undisturbed habitat from the banks of the Crystal River to upper ridges to the east.

New Disturbance Analysis

The evaluation of potential wildlife impacts included an analysis of new impacts that would be created from each of the trail alternatives. This is based on new impacts to undisturbed and moderately disturbed habitat areas, also assuming a 100-meter zone of influence from the trail. In addition, the analysis considered impacts to undisturbed river frontage, where broad areas of undisturbed habitat interface with the Crystal River.

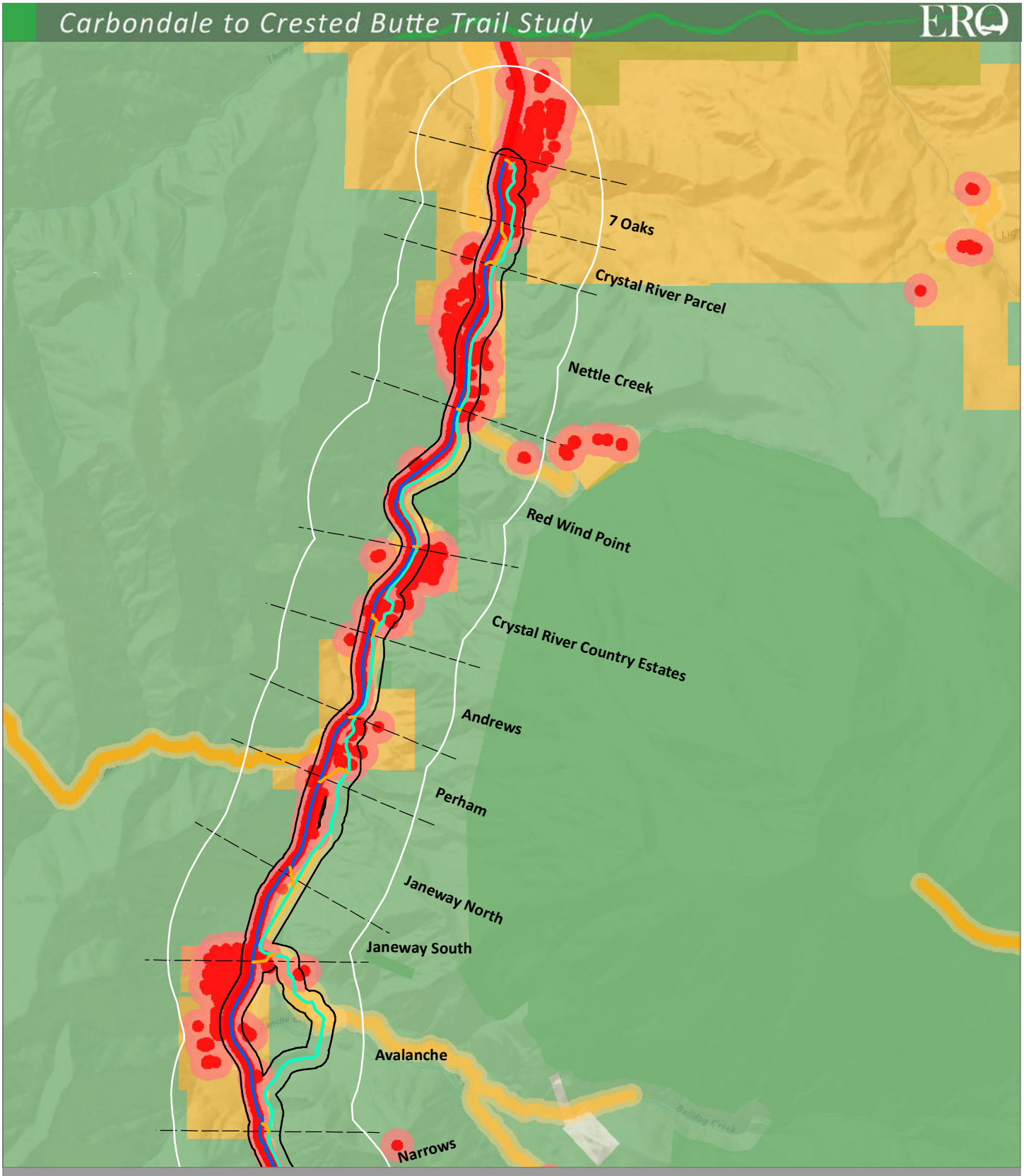

Figure 5. Landscape Disturbance

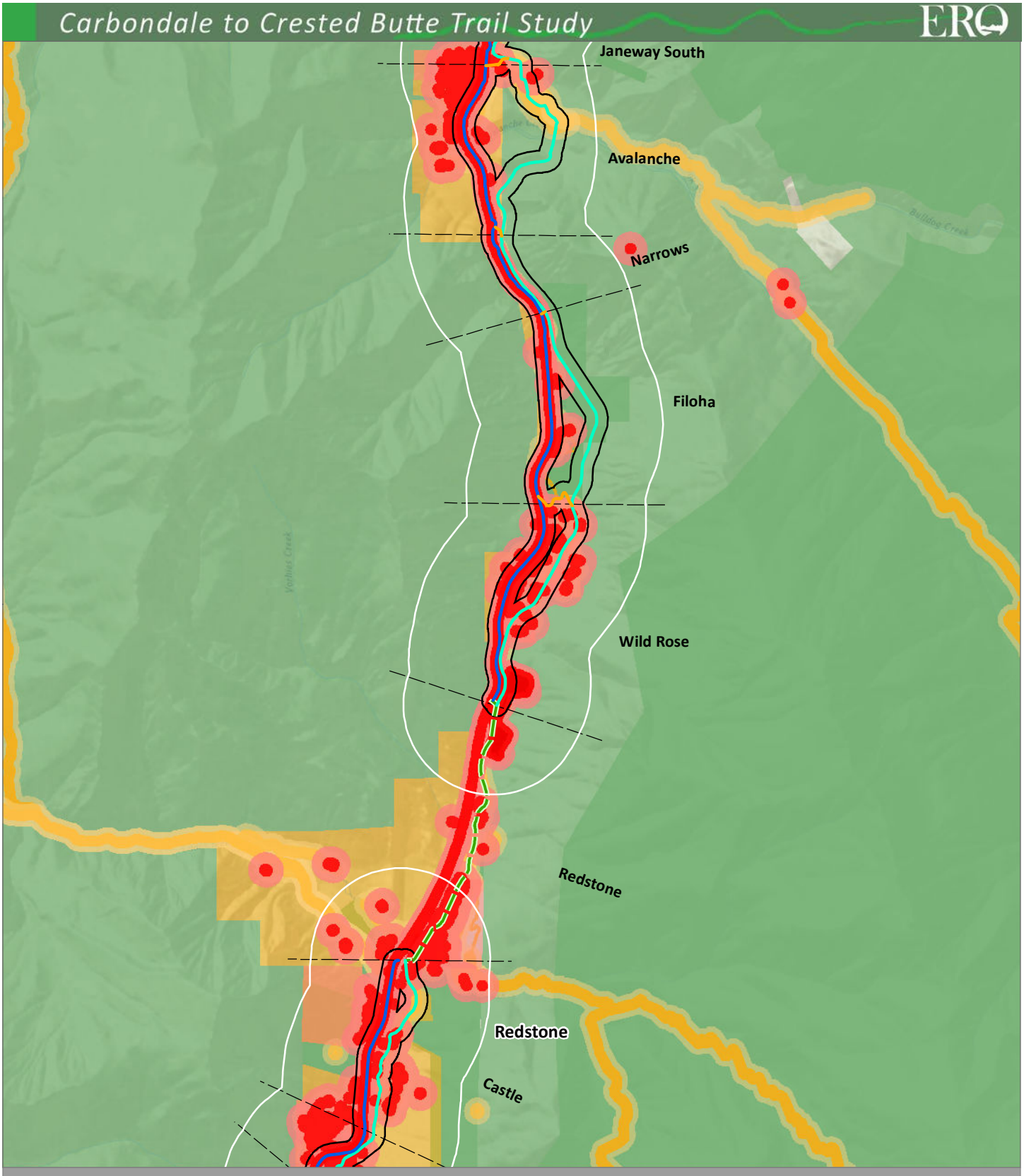

Figure 5. Landscape Disturbance

0 2,000 4,000 feet

October 9, 2017

- Trail Study Area
- Bridge Option
- Option A Alignment
- Option B Alignment
- Existing Redstone Trail Alignment
- 100m Trail Impact Area
- High Disturbance
- Medium Diisturbance
- Low Disturbance

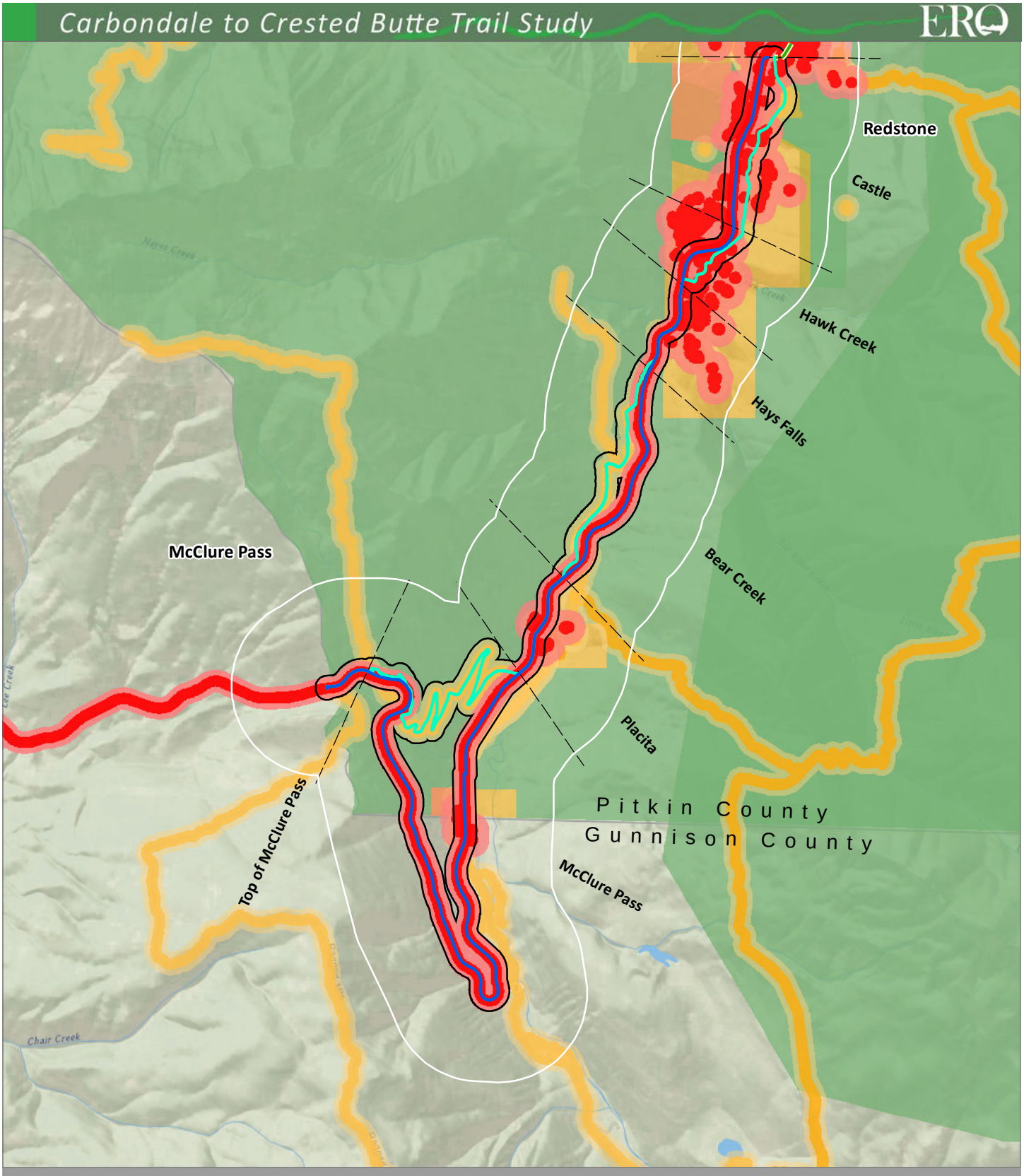

Figure 5. Landscape Disturbance

Summary of Impacts from Trails and Recreation

Outdoor recreation in natural areas provides a broad range of human benefits that are gained by interacting with the natural world. These benefits include the enjoyment of solitude and natural quiet, opportunities for exercise and physical challenge, opportunities to observe wildlife and learn about the environment, and opportunities to enjoy the outdoors with friends and family. However, all forms of outdoor recreation in the natural environment inherently result in some level of impacts to natural resources due to the construction of trails and facilities and to the presence of humans in the natural environment. These impacts range from localized trampling of vegetation to the abandonment of habitat areas by certain wildlife species (Knight and Cole 1995; Jordan 2000).

One of the purposes of this study is to recognize and understand these tradeoffs, so that the community can make informed decisions about implementing a regional trail connection that minimizes impacts while providing desired recreational access and experiences. Recognizing these values and goals, the following concepts were considered in the development and evaluation of potential trail alternatives.

Habitat Fragmentation – Large, contiguous blocks of undisturbed habitat are important for the long-term conservation of many plant and wildlife species. Habitat fragmentation reduces the size and overall integrity of these areas and may be detrimental to some species (Noss and Cooperrider 1994). Fragmentation can occur as a result of large-scale land conversion, urban or industrial development, transportation corridor development, or smaller-scale disturbances, including the construction and use of recreational trails.

Disturbance Impacts of Trails – The presence of humans along trail corridors can have the greatest impact on wildlife by creating a "zone of influence" within which human disturbance may alter wildlife behavior. The effects vary by species and individual animal and can range from no effect, to interruption of activity, to flight, to abandonment of breeding or foraging sites. This zone of influence can range from 30 to 400 meters or more, depending on terrain, context, species, and levels of use and habituation (Miller et al. 2001; Taylor and Knight 2003; Stankowich 2008; Cassirer et al. 1992; George and Crooks 2006).

The actual zone of influence, and subsequent impact on wildlife, varies widely based on several factors, including the following:

- **Development context** – Levels of existing human development and trail use can greatly influence wildlife responses. In areas with high levels of human development or existing trails and recreational uses, most wildlife are habituated to predictable and recurrent human use patterns and no longer see those activities as a threat (Knight and Cole 1995; Taylor and Knight 2003; George and Crooks 2006). In many developed "front country" settings, wildlife in otherwise natural habitats will not react to recreationists along existing trails, sometimes within 10 meters of the trail. In more remote "back country" settings, wildlife are alert to human presence at a much greater distance (up to 400 meters or more) and will perceive any human intrusion or approach as a threat.

- **On-trail vs. off-trail use** – Human presence along existing trails will typically affect wildlife less than off-trail activity, since that use is predictable and recurrent and wildlife in the area are habituated to those patterns (Knight and Cole 1995; Whittaker and Knight 1999; Taylor and Knight 2003; Naylor et al. 2009; Malone and Emerick 2003). This is also true for the predictability of vehicles along roads and highways. However, off-trail or off-road travel or visitors who stop and approach wildlife will often elicit a flushing response, since an otherwise predictable encounter can become threatening (Stankowich 2008; Knight and Cole 1995; Spahr 1990; Jordan 2000).
- **Terrain and vegetation** – The relative openness or density of terrain and vegetation can influence wildlife responses to human disturbance (Knight and Cole 1995; Taylor and Knight 2003). Areas with substantial topographic relief (such as canyons or undulating ridges), terrain features (such as broad rivers), or dense vegetation are generally less prone to disturbance, due to the visual screening and separation. Conversely, open terrain such as large meadows or alpine tundra are more prone to disturbance, since human intrusions are evident and may pose a threat to wildlife at a greater distance.
- **Species, groups, and individual animals** – The response of wildlife to human intrusion also varies widely by species, species groups, and individual animals (Knight and Cole 1995). In general, large mammals and carnivores are affected at a greater distance from disturbance, while the sensitivity to disturbance of many birds and small mammals is limited to a smaller area (Malone and Emerick 2003). However, as discussed previously, in many areas large mammals are habituated to predictable and recurrent human use of trails and developments, while some specialized bird species remain sensitive to repeated disturbance.
- **Season** – Many wildlife species, particularly ungulates, are more sensitive to disturbance during the winter and spring. Birds are most sensitive during the nesting seasons (spring to early summer). Larger mammals, including midsized carnivores and ungulates, are vulnerable to increased stress during the winter period, when the preservation of energy reserves can influence survival, and fleeing from a perceived threat can expend those resources (Freddy et al. 1986; Canfield et al. 1999; Olliff et al. 1999; Knight and Cole 1995)
- **Type of human use** – While some variation in wildlife response between recreation types (e.g., hiking, biking, equestrian use, wildlife viewing, ORV use) has been documented (Taylor and Knight 2003; George and Crooks 2006; Stake 2000; Stankowich 2008; Naylor et al. 2009; Knight and Cole 1995), the overall effect of human visitation is more important than the nuances of different user behaviors. One distinction that is important to note is the presence of domestic dogs as a recreation partner. It is well documented and understood that the effects of human use on wildlife are likely to be exacerbated by the presence of dogs (Lenth et al. 2008; Miller et al. 2001; Reed and Merenlender 2008; Bekoff and Ickes 1999).

Wildlife flight distances, or the "zone of influence," are discussed in numerous studies on this topic. Considering the myriad of variables involved, the findings vary by species, location, and context. Examples include the following:

- Naylor et al. (2009) observed a zone of influence up to 500 meters for hikers and over 1,000 meters for mountain bikers in an enclosed research reserve with otherwise limited recreation (i.e., limited habituation).
- Cassirer et al. (1992) found that flight distances for wintering elk in Yellowstone National Park ranged from 400 meters in remote areas to 15 meters in developed areas.
- Taylor and Knight (2003) found a flight distance of 150 meters from hikers and 120 meters from bikers in a controlled study of mule deer, pronghorn, and bison on Antelope Island in Utah.
- Miller et al. (1998) found the zone of influence of trails in Boulder open space to be about 75 meters for several bird species.
- Sisk (1989) observed that mule deer in their natural habitat outside Boulder, Colorado, would flush at a distance of about 30–40 yards.
- Miller et al. (2001) found the flight distance from pedestrians on-trail to be about 34 meters for mule deer and 31 meters for western meadowlark in open space near Boulder.
- Malone and Emerick (2003) estimated a zone of influence of 30 meters for birds, small mammals, and carnivores at three sites within the Roaring Fork Valley.

Considering this range of impact distances, the existing development and topographical context of the Crystal River Valley, and the factors described above, a zone of influence of **100 meters** is used as the quantitative standard for wildlife impacts in this analysis. This standard applies to impacts from existing use and development, as well as new impacts that may occur as a result of trail implementation and use.

Potential Impacts from Secondary Trail Development

During the public and stakeholder outreach processes, concerns were raised about the potential wildlife impacts resulting from the development and use of secondary, non-system trails that could spur from the Crystal River Trail alternatives. These concerns are typically associated with the development of unsanctioned mountain bike routes but could also be extended to rock climbing access, mountain climbing access, or local neighborhood access. Considering the topography of the valley, which is bounded by steep slopes, loose rocky terrain, and cliffs, few secondary trails have been established in the past in places where access is available.

While the possibility, location, and impacts of future non-system trail development are speculative, this analysis attempts to identify areas where new impacts from such trail connections have the potential to occur. These include trail segments that are:

- Directly adjacent to public lands, primarily WRNF
- Currently inaccessible or difficult to access for the public, and would be "opened up" by trail development

Specific areas where new trail development could facilitate non-system secondary trails are described below, along with additional factors that could facilitate or limit the potential for unsanctioned secondary trail development. Conversely, potential secondary trail development corridors that are

currently readily accessible are not listed, since their development (and subsequent impacts) would not be contingent on the implementation of any Crystal Valley Trail segments.

- **Crystal River Parcel/Nettle Creek** – At this location, Trail Alternative B crosses County OST land that abuts WRNF land. The WRNF ownership extends for miles along the north slopes of Mount Sopris. Several informal trails exist in this area but are generally used by neighboring residents since access is through private subdivision roads. Steep, rocky slopes in this area would impede if not preclude the development of a substantial new trail connection. This area is winter range for both bighorn sheep and elk.
- **Andrews** – At this location, Alternative B crosses a narrow section of WRNF land, which is contiguous to other forest lands and wilderness area. This band of WRNF land is very steep and rocky and is generally not favorable for trail development. This area is winter range for bighorn sheep and elk and is also a production area for bighorn.
- **Janeway North** – In this area, Alternative B is entirely on WRNF land but could provide easier access to a narrow side canyon that could provide a route up the southwest slopes of Mount Sopris. (This area is currently accessible to the public via Avalanche Creek Road and Janeway Meadow, but the access is difficult.) While this small canyon is narrow, steep, and densely vegetated and would not be suitable for trail development, it could be enticing as a climbing route on Mount Sopris. This area is winter range for bighorn sheep and elk and is a winter concentration area for elk. It is also subject to a USFS seasonal closure.
- **Avalanche South** – In this area, Alternative B crosses Avalanche Creek to provide access to the valley at the base of Elephant Mountain. (This area is currently accessible to the public via Filoha Meadows or a low-water ford of Avalanche Creek, but these access routes are long or difficult.) The slopes above this valley are very steep and rocky and would not be appealing for new recreational routes. This area is winter range for both bighorn and elk.

Background on Existing Seasonal Closures

Considering the seasonal sensitivity of wildlife to recreational access and use—particularly for bighorn sheep and elk—the presence and effectiveness of seasonal trail closures is an important topic for this study. Several areas within the Crystal Valley study area are currently subject to administrative seasonal closures to public recreational access, as follows:

- **Red Wind Point** – The existing railroad grade is managed as a county open space trail and is subject to a seasonal closure from December 1 to April 30. The upper slopes of the open space property are permanently closed to public access.
- **Janeway Meadow** – All national forest lands north of Avalanche Creek Road, including the Janeway Meadow, are closed to all human occupancy from November 23 to April 30. County OST access from the road matches this restriction.
- **Avalanche Creek** – All national forest lands on both sides of Avalanche Creek Road are closed to dogs from November 23 to April 30. (The road itself is closed to vehicles but remains open to non-motorized access, without dogs, during this period.)
- **Filoha Meadows** – The existing railroad grade is managed as a county open space trail and is subject to a seasonal closure from December 1 through June 30. During the open period,

pedestrian access is limited to the trail itself, with the exception of guided interpretive access. Dogs and bike access are prohibited year-round.

During the public and stakeholder outreach process, some community members questioned the effectiveness of seasonal closures as a tool to limit impacts to wildlife. Based on the following examples from the Crystal and Roaring Fork Valleys, seasonal closures have been effective in locations where access points are limited and not easily accessed by the public, and where they are clearly and consistently enforced. Closures in areas where there is limited enforcement capacity or multiple access points from private land (Red Wind Point and Avalanche Creek) have been less effective. While closures are not impervious to violations, the County has demonstrated the ability to effectively implement seasonal closures on its properties and trails.

Rio Grande Trail Wildlife Monitoring Report

Beginning in 2007, the Roaring Fork Transportation Authority (RFTA) implemented a robust program to monitor the ecological management of the Rio Grande Trail corridor along the Roaring Fork River between the Catherine Store Bridge and the Rock Bottom Ranch. Monitoring has included field surveys and deployment of motion-sensitive cameras.

This area is subject to a seasonal closure from December 1 through April 30. Dogs are prohibited on this section of trail year-round. Violations of the closure do occur, and some are documented in the wildlife cameras. While the number of dogs and people recorded by the cameras during the winter closure has increased, the total annual number of violations remains relatively low.

The report states that the results of the 7-year monitoring effort suggest current management strategies are exceeding expectations in minimizing the effects of recreation on wildlife. Herons, other waterbirds, songbirds, deer, elk, and other mammals all seem to have adapted to the increased recreational activity and are benefiting from the winter closure. The report further states that wintering animals are benefiting from the reduction in human disturbance due to the trail closure (Lowsky 2014).

Red Wind Point Closures

The existing railroad grade trail at Red Wind Point is subject to a seasonal closure, while the remainder of the property is closed permanently. County OST staff report that trail closure violations are infrequent but do occur. In addition, illegal access to the upper sections of the property has been observed, originating from the adjacent subdivision (Groves 2017).

Avalanche and Janeway Closures

Seasonal closures of USFS lands north of Avalanche Creek Road have been established by the USFS. The area is closed to dogs year-round. While enforcement is limited, the seasonal closure north of the road appears to be effective, largely due to steep terrain and dense vegetation. The restriction on dogs, however, has been less effective. The area south of the road functions as a local dog run and appears to be used year-round for this purpose.

Filoha Meadows Closures

The seasonal closure of Filoha Meadows is in place December 1 through June 30. This closure is clearly marked at the only public access point and is strictly enforced by Pitkin County and CPW. These factors, in addition to the visibility from SH 133, have made this closure successful with few violations (Thompson 2017).

Sky Mountain Park

Sky Mountain Park is seasonally closed for the protection of wildlife from December 1 through May 15. OST monitors the closure with five different wildlife cameras to track wildlife use and any closure violations. Violations average less than 10 per year and are usually within the first 2 weeks and last 2 weeks of the closure. OST will issue tickets based on images from the cameras. The property is closed year-round to dogs and seems to have minimal violations.

North Star Nature Preserve

The back side of North Star, west of the river, is completely closed to the public unless part of a permitted educational tour. About a once a winter, skiers coming down from Aspen Mountain are caught on the back side of North Star. Summers are nearly free of violators. North Star is bordered by private property to the north and south. Documented violations from the private property are rare. North Star is closed to dogs year-round and has minimal violations.

Glassier Open Space

Glassier Open Space is seasonally closed for the protection of wildlife from December 1 through May 15. The adjacent BLM property has a shorter closure. OST monitors the trails with two cameras. Almost all closure violations are in the spring within 2 to 3 weeks of the opening date. The difference in closure timeframes between the OST and BLM lands does create confusion, and better signage is in development. Glassier is closed to dogs year-round. Dog violations are minimal and are seen when the property is open.

Cultural Resources

The Crystal River Valley has a rich history and has served as an important transportation corridor both prehistorically by native groups such as the Ute Indians and historically by European settlers; many of the historic trails and roads likely followed trails established by native peoples. The river provided water for ranching and agriculture. Coal and later marble became important resources in the development of historical settlement in the valley. John Cleveland Osgood, the founder of the Colorado Fuel and Iron Company, created Redstone as a company town to house and support company miners who worked the coal mines in Coalbasin, located to the west of Redstone. Marble from Marble, Colorado, also led to settlement and development in the northern portion of the valley. All of these activities are represented by the cultural resources documented during the 2017 fieldwork.

The National Register of Historic Places (NRHP) defines an archaeological site as "the place or places where the remnants of a past culture survive in a physical context that allows for the interpretation of these remains" (Little et al. 2000). Cultural resources may consist of buildings, structures, objects, or sites; can include districts, cultural landscapes, and traditional cultural properties; and are typically 50 years or older.

The NRHP summarized significant cultural resources as representing American history, architecture, archaeology, and culture, which is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association. Significant cultural resources

a) are associated with events that have made a significant contribution to the broad patterns of our history; or
b) are associated with the lives of persons significant in the past; or
c) embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic value, or represent a significant or distinguishable entity whose components may lack individual distinction; or
d) are likely to yield information important in prehistory or history.

Certain kinds of properties are not usually considered for listing in the NRHP: "religious properties, moved properties, birthplaces and graves, cemeteries, reconstructed properties, commemorative properties, and properties achieving significance within the past fifty years" (National Park Service 1998). In order for a property to be eligible under a criteria consideration, the property must still qualify for one of the four criteria and must possess integrity. Historical sites representative of the built environment (i.e., buildings, structures, and engineered features) typically are considered significant.

If a site is significant under one of these criteria, it must also possess physical integrity. For example, if a historic road has been completely upgraded (widened and/or paved), it is unlikely to be considered significant even if it is associated with important historic events.

Cultural Review Methodology

A file search for known documented cultural resources was completed before the field review. During the field review, all cultural resources that overlap the trail alternatives were documented regardless of

significance. The survey for cultural resources provides compliance under Section 106 of the National Historic Preservation Act (NHPA) by undertaking a "reasonable and good faith effort" to identify historic properties (defined as listed in or eligible for listing on the NRHP) within the defined area of potential effect (APE). Identification and documentation standards conform to the federal land managing agency and secondly to those stipulated for by the State Historic Preservation Officer (SHPO).

Cultural resources are documented according to a standardized approach. In the age of digital photography, site overview photographs are taken from multiple perspectives, and all significant tools, diagnostic artifacts, and features are photographed to scale. Individual sites are mapped. Elements of the site map include all cultural features, field specimens, artifact concentrations, major vegetation breaks and contour topography, and modern features and disturbances.

Thirteen cultural resources along the trail alternative corridors were documented. All are historical, and most are products of late 1800s/early 1900s Euro-American activity in the Crystal River Valley. Six historic transportation corridors are located within or cross the trail alternatives: the Rock Creek County Wagon Road, the Crystal River and San Juan Railroad, SH 133, a segment of SH 133 no longer used as a highway, Redstone Boulevard, and the Road to Redstone Castle. The Wagon Road, railroad grade, and old segments of SH 133 are used today as trails at various portions of the valley and between Hayes Falls and McClure Pass. Other resources include a bridge, a hydroelectric station, three ditches, a stage stop, and a trash dump. Although proposed trail alignment goes through the Janeway townsite, no evidence of structures or features were found within the survey corridor.

Archaeologist conducting a field inventory.

Significant Sites

Six of the 13 recorded sites are significant:

- **The Rock Creek County Wagon Road** appears to be the first formalized transportation corridor in the Crystal River Valley that extended from Carbondale to Marble and was built in the 1880s. Portions of this alignment are only visible as a slight swale; other portions are now part of county and private roads that have been enlarged and graded and are still in use by pedestrians and vehicular traffic. Some sections of this line were replaced by the railroad in the early 1890s.

Other sections are now part of SH 133 and the north portion of Redstone Boulevard. Sections that have been upgraded have little physical integrity and are not significant. Sections that are intact or have intact features are considered significant.

- **The Crystal River and San Juan Railroad** is a railroad grade that extended from the Denver & Rio Grande depot in Carbondale up the Crystal River Valley to the base of McClure Pass. It was built after the wagon road and followed the same general corridor, obliterating the road at some points. The section of grade to Penny Hot Springs was completed by March 1893 by the Crystal River Railway. By 1898, the rails reached Redstone and Placita. It was used until 1942, at which point it was dismantled and no longer used as a railroad corridor. Outside of the grade, no significant features of the railroad remain. The majority of the trail alternatives that are not within the SH 133 right-of-way follow the railroad grade.
- **Road to Redstone Castle** extends from the Redstone Inn south to Cleveholm (Redstone Castle; J. C. Osgood's third residence); a section that is no longer used for vehicle travel continues south of the castle to Osgood's first residence, the Crystal River Ranch. The road is associated with J. C. Osgood, who was probably the most important person in the development of the railroad, mining, and settlement in the Crystal River Valley and was the founder of Redstone.
- **The East Mesa and Bane & Thomas Ditches** are active water conveyance resources that are maintained and still in use. The East Mesa Ditch was built around 1894, and the Bane & Thomas Ditch was built around 1886; both likely contributed to early settlement and agriculture in the valley. These resources are earthen U-shaped ditches.
- **The Filoha Meadows (or Penny Hot Springs) stage stop** was first built by H. D. Penny in the 1880s; some of the buildings were built later in the 1940s. During the 2017 site visit, only the bunkhouse and barn were revisited; all other structures were well outside of the project area to the west. The bunkhouse, which is the closest feature of the site to trail Alternative B, has collapsed since the 1999 documentation of the site. This feature is located approximately 75 feet west of the trail alternative. The barn is still standing but deteriorated; the center of the roof is sagging. This feature is located about 200 feet west of the trail alternative.

Impacts to Cultural Resources

Impacts to cultural resources can be anything that alters the characteristics of a site that make it significant. This includes physical destruction of the resource, alterations that are not consistent with its history, removal from its original location, change in the character of its use or setting, or introduction of any elements that negatively impact the integrity of the site. For the three transportation cultural resources (Rock Creek County Wagon Road, the Crystal River and San Juan Railroad, and the Road to Redstone Castle), paving sections of these resources that have not been previously upgraded and paved would not be consistent with their historic integrity.

Summary of Potential Impacts by Segment

Impacts to environmental resources are analyzed below by segment and by the trail alignment alternative. Impacts are assessed for each segment and alternative, considering the vegetation, wildlife, and cultural resources described in the previous sections. For each segment, an overall assessment level is presented as the combined summary of the individual resource factors considered. The levels of impacts are defined as follows:

- **Minor Impacts** are those that are detectable, but would not result in long-term degradation to resources at a local scale or within the overall Crystal Valley study area
- **Moderate Impacts** are those that would result in detectable impacts to sensitive resources at a local scale, but would not result in long-term degradation or changes to resources within the overall Crystal Valley study area
- **High Impacts** are those that would result in substantial, long-term impacts to sensitive resources, significant degradation to local areas, or adverse impacts to resources throughout the Crystal Valley study area

Depending on the resource and the availability of data, impacts were assessed using both quantitative and qualitative information. In addition, several design measures and management parameters are assumed to be part of the trail implementation and management. These are described below.

General Design and Implementation Measures

Design measures that are intended to eliminate or reduce the severity of impacts are considered in the analysis of environmental impacts. The County uses restrictions on OST areas that reduce impacts to wildlife and vegetation (such as the seasonal closures discussed above), as well as best management practices (BMPs) when conducting construction or maintenance of OST property. General design measures and BMPs include:

- Clearance surveys for listed, sensitive, and rare species before any ground-disturbing activities or construction takes place
- Specific BMPs for construction, which include storm water control during construction activities and weed management after ground-disturbing activities
- Seasonal construction windows in wildlife habitat to eliminate impacts during critical times of year when habitat is occupied
- Enforcement of existing seasonal closures in areas where critical and important wildlife habitat is present
- Enforcement of existing restrictions in areas that are designated as dog-free or bike-free
- Avoidance of wetland areas whenever possible, and mitigation of impacts if avoidance is not possible
- Minimization of vegetation removal, especially in riparian corridors and in high-quality native vegetation communities
- Design of trails and OST infrastructure so that environmental resources are conserved and preserved

These design measures and BMPs are integrated into the impact analysis. For example, areas that have a high degree of seasonal wildlife impact but are subject to existing seasonal closures would have a reduced impact determination due to the closures. Additional measures to reduce or mitigate impacts are identified at the end of this section, under *Impact Mitigation Measures*.

7 Oaks to Nettle Creek

Table 8. Summary of Impacts: 7 Oaks to Nettle Creek

	Vegetation	Wildlife	Cultural Resources
Segment: 7 Oaks			
Alternative A	No significant vegetation impacts Additional stabilization along about 1,300 feet of the Crystal River	Minor impact to elk and mule deer winter range	No impact
Alternative B	No significant vegetation impacts	Minor impact to elk and mule deer winter range	Minor impacts to Rock Creek County Road
Bridge #1	No significant vegetation impacts	Minor impact to elk winter range	No impact
Bridge #2	Minor impact to riparian vegetation	Minor impact to high-quality riparian habitat	Moderate impact to railroad grade
Segment: Crystal River Parcel			
Alternative A	No significant vegetation impacts Additional stabilization along about 400 feet of the Crystal River	Minor impact to elk and mule deer winter range	No impact
Alternative B	Moderate impact to riparian and wetland vegetation May impact FSS Harrington's penstemon and Grand Mesa penstemon habitat	Minor impact to high-quality habitat and undisturbed river frontage (impacts reduced by design measures)	Moderate impact to the railroad grade, Rock Creek County Road, and the Bane & Thomas Ditch
Bridge #3	Minor impact to riparian vegetation	Minor impact to elk winter range	Moderate impact to railroad grade
Segment: Nettle Creek			
Alternative A	No significant vegetation impacts Additional stabilization along about 1,800 feet of the Crystal River	Minor impact to elk winter range	No impact
Alternative B	No significant vegetation impacts	Minor impact to elk winter range	Unknown; not surveyed
Bridge #4	No significant vegetation impacts	Minor impact to elk winter range	Minor impact to railroad grade

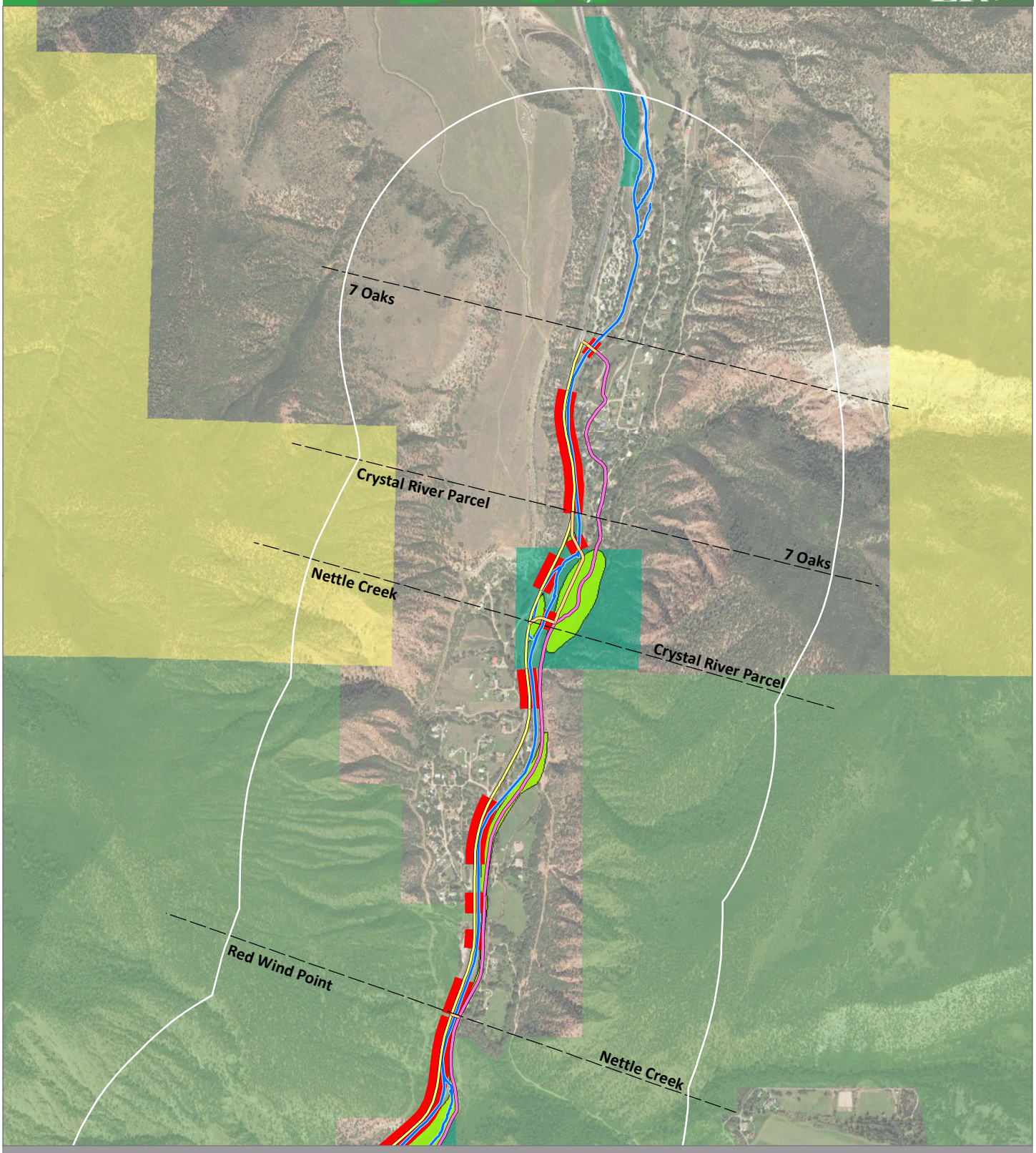

Figure 6. 7 Oaks to Nettle Creek

0 750 1,500 feet

December 5, 2017

- Trail Study Area
- Bridge Option
- Option A Alignment
- Option B Alignment
- Existing Redstone Trail Alignment
- Potential River Impacts
- High Quality Riparian
- Other Riparian
- High Quality Vegetation
- Crystal River
- Pitkin County Open Space
- BLM
- State of Colorado
- USFS

Vegetation and In-Stream Impacts

Alternative A follows the existing road where vegetation is disturbed or ruderal, and no new impacts to vegetation communities would occur. Impacts to in-stream habitat and riparian vegetation are possible, as the streambed would require additional stabilization along approximately 3,500 feet of the Crystal River/highway embankment. The bank is already stabilized, and no additional constraints on the physical characteristics of the river are anticipated. Some removal of riparian vegetation is possible but would be minimized.

Alternative B follows existing social trails or roads where vegetation is disturbed and no new impacts to vegetation communities would occur, including to riparian vegetation. In the Crystal River Open Space Parcel, Alternative B would pass through an upland area with a diverse native plant community, where a social trail currently exists. The fringe wetlands along the ditch may be avoided using bridges or other trail design criteria. The alignment may cross through FSS Harrington's penstemon and Grand Mesa penstemon habitat, but there is a low risk of impacts to these species. No new impacts to in-stream habitat, riparian areas, or wetlands along the Crystal River are expected.

Bridge 1 would be a replacement of the existing bridge and would have no impact; Bridges 2 and 3 may result in some removal of riparian vegetation. Bridge 4 is currently in use as a dirt road and would have no impact.

Wildlife Impacts

Within the 7 Oaks subdivision area, both alternatives are located along existing road corridors with high levels of existing human disturbance and use, and no new impacts to wildlife would occur. Likewise, both alternatives through the Nettle Creek area would have minor impacts to elk winter range.

Alternative B through the Crystal River Open Space parcel would fragment high-quality wildlife habitat potentially supporting the federally listed yellow-billed cuckoo. This area has existing social trails and recreational use from nearby subdivisions, which may diminish its value to (and impacts on) some species. The impact to the high-quality habitat area, with a 100-meter impact buffer, would affect the entire habitat area.

Cultural Resource Impacts

The proposed location for Alternative A for all three of these sections of trail is on the east side of SH 133. Because the highway has been systematically upgraded since its first construction, it is recommended not significant to the history of the valley because it no longer retains physical integrity. Construction of the trail along the side of the highway would not constitute an impact to cultural resources.

Alternative B through the 7 Oaks subdivision would follow an existing dirt subdivision road (South Bill Creek Road). Sections of this road may have once been part of the Rock Creek County Road or the Crystal River Railroad. No physical evidence of an association with either of these linear resources could be definitively determined with the exception of a small undeveloped portion of the Rock Creek County Road at the extreme southern end that is currently in use as a social trail from the subdivision into the Crystal River Parcel. No impact to cultural resources is expected for the section of Alternative B that

follows the current developed South Bill Creek Road. Paving or widening of the intact portion of the Rock Creek County road would be considered an impact.

The proposed trail joins the abandoned railroad grade in the Crystal River Parcel and follows the grade through Nettle Creek. The grade is intact through this section although no railroad ties or rails remain; this area has existing social trails and recreational use from nearby subdivisions. No expansion of the grade is planned; however, paving the grade would be considered an impact. The railroad grade crosses over the Bane & Thomas Ditch via an existing culvert with 4-by-4 milled lumber supports. The culvert appears to be an old crossing and may have historical significance; its replacement is a potential impact to the railroad grade. Additional new crossings over the ditch are also potential impacts to the ditch.

Bridge 1 would have no impact; Bridges 2 and 3 would impact the railroad grade. The railroad grade at Bridge 4 is currently in use as a dirt road; impacts would be minor.

Red Wind Point to Andrews

Table 9. Summary of Impacts: Red Wind Point to Andrews

	Vegetation	Wildlife	Cultural Resources
Segment: Red Wind Point			
Alternative A	No significant vegetation impacts Additional stabilization along about 1,700 feet of the Crystal River	Minor impact to elk winter range	No impact
Alternative B	No significant vegetation impacts; wetlands would be avoided where possible, and any impacts would be mitigated	Impact to undisturbed habitat and river frontage, and proximity to bighorn production area	Moderate impact to East Mesa Ditch and the railroad grade
Bridge #5	No significant vegetation impacts	Minor impact to elk winter range	Minor impact to railroad grade
Segment: Crystal River Country Estates			
Alternative A	No significant vegetation impacts Additional stabilization along about 2,000 feet of the Crystal River	Minor impact to elk winter range	No impact
Alternative B	No significant vegetation impacts	Minor impact to elk winter range	No impact
Bridge #6	Minor impact to native vegetation community	Minor impact to elk winter range	Minor impact to railroad grade
Segment: Andrews			
Alternative A	No significant vegetation impacts Additional stabilization along about 1,000 feet of the Crystal River	Minor impact to elk winter range	No impact
Alternative B	Habitat for FSS Grand Mesa penstemon is present, and Harrington's penstemon is likely within the alignment; mitigation for impacts to FSS species, if present, would reduce impacts	Minor impact to undisturbed river frontage	Moderate impact to railroad grade
Bridge #7	Bridge may result in removal of riparian vegetation on east side of river	Minor impact to elk winter range	Minor impact

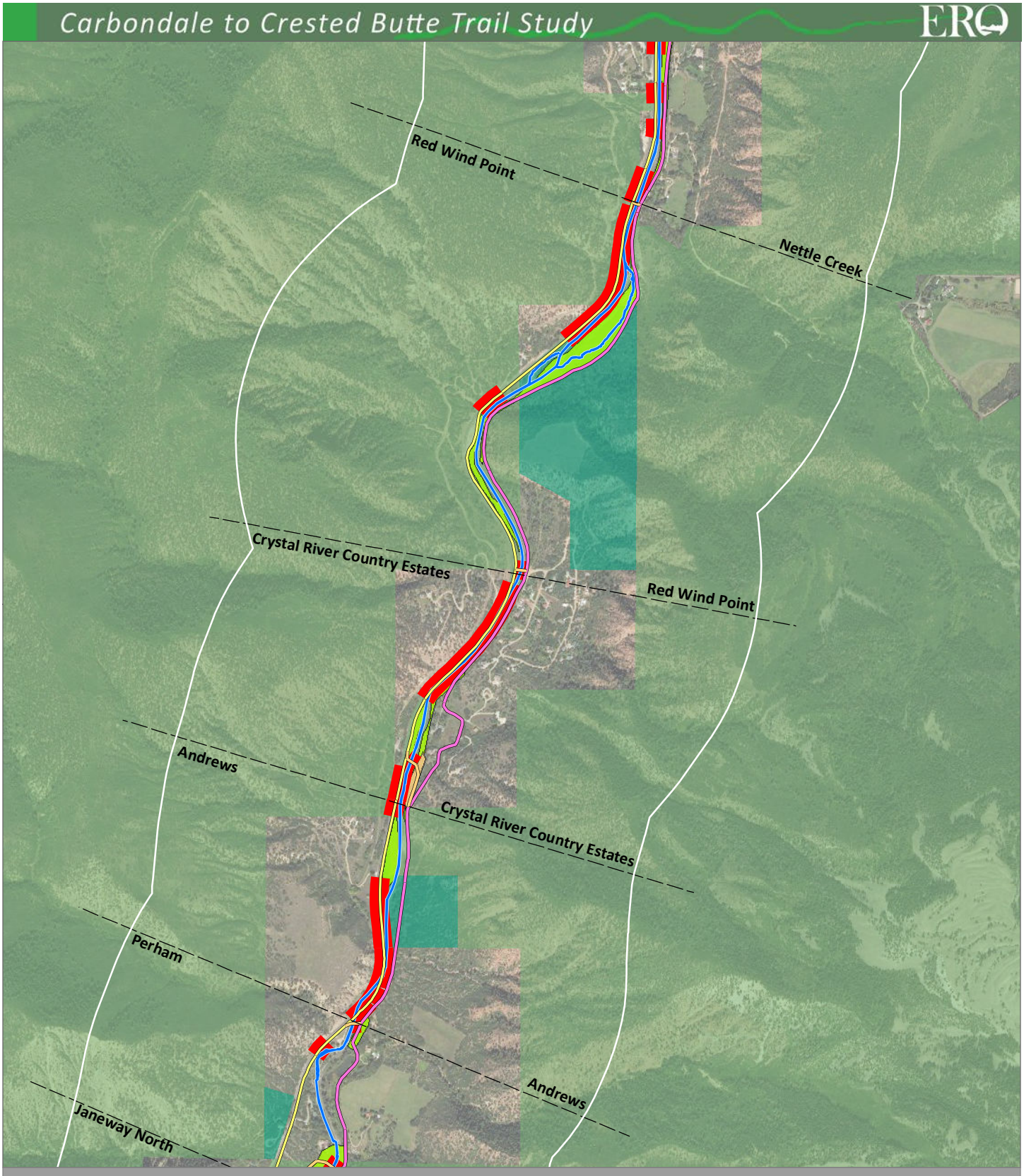

Figure 7. Red Wind Point to Andrews

Vegetation Impacts

Alternative A follows existing road where vegetation is disturbed, and no significant new impacts to vegetation communities would occur. Impacts to in-stream habitat and riparian vegetation are possible, as the streambed would require additional stabilization along approximately 4,700 feet of the Crystal River/highway embankment. The bank is already stabilized, and no additional constraints on the physical characteristics of the river are anticipated. Some removal of riparian vegetation is possible but would be minimized.

Alternative B follows existing trail/railroad grade, and the construction footprint would be limited to the trail when possible. Minimal native and riparian vegetation would be removed. Weed control BMPs would reduce the risk of noxious weeds spreading. Wetlands would be avoided where possible, and any impacts would be mitigated. Removal of trees would be avoided if possible. Riparian vegetation is adjacent to the alignment but would not be disturbed. Habitat for FSS Grand Mesa penstemon is present, and it is likely that Harrington's penstemon is present within the alignment at the Andrews Open Space Parcel. Surveys and mitigation for impacts to FSS species, if present, would reduce impacts.

Bridges would use existing right-of-way where vegetation is disturbed or ruderal, and no new impacts to vegetation communities would occur. Bridge 6 would cross an undisturbed treed area with sparse vegetation and no wetlands or riparian vegetation. Tree removal would be minimized to the extent possible, and the area may be replanted with native trees after construction if necessary. The eastern bank of the river is a high-quality diverse native vegetation community (Andrews Alternative B).

Wildlife Impacts

Red Wind Point Bighorn Impacts. Most of the impacts in this area would relate to bighorn seasonal habitat near Red Wind Point. For bighorn, the greatest concern is related to proximity to winter range, winter concentration areas, and severe winter range. The area of possible impact, based on a 100-meter zone of influence on the trail alternatives, ranges from 4 to 15 percent of the habitat within the planning segment. However, continuation of the existing seasonal closure to April 30 would significantly reduce these impacts.

For the bighorn production area (or lambing habitat) at Red Wind Point, there is no overlap between the 100-meter zone of influence of Alternative B (railroad grade) and the production area mapped by CPW. (The distance from the trail alignment to the production area is about 175 meters.) However, CPW and others have expressed concerns about the interface between a trail along the railroad grade and the production area, for three primary reasons:

- The Red Wind Point area is heavily used by bighorn from mid-November through spring, with lambing typically from mid-May through about June 20 (Groves 2017); even with the seasonal closure in place, this presents a 7-week gap where impacts could occur.
- Some bighorn have been reported to use the lower areas and railroad grade during the winter, presumably to access surface water (Pitkin County 2005; Groves 2017)
- Unauthorized access above the trail or during seasonal closures could increase impacts during bighorn lambing season

In terms of the proximity of this impact, it is important to consider the topography of Red Wind Point. Trail Alternative B follows the railroad grade and is about 170 vertical feet below the top of the bluff and about 575 feet (155 meters) laterally from the edge of the production area. The north-facing slopes of the bluff are dominated by dense conifer and riparian woodland vegetation, which is generally not favored by bighorn, while the south-facing slopes are dominated by sparse pinyon-juniper woodland and rock outcrops, which is favored by bighorn. In 2017, the County installed a wildlife camera along the railroad grade north of the bluff between June 1 and July 31; no bighorn use was documented during this period.

Considering the above factors, the presence of the trail along the railroad grade (Alternative B) is not expected to result in significant disturbance to bighorn production habitat, largely due to the vertical, lateral, and visual separation between those areas. In essence, trail users would not be visible to bighorn on the top of the bluff, and their sense of security and access to escape cover would be preserved. However, implementation of the trail along the railroad corridor could disrupt access to water in the Crystal River during the late lambing season, a period of about 7 weeks. While access to free water is not a limiting factor for bighorn survival, some individual ewes may be adversely impacted by this disturbance and alter their behavior or seek alternate water sources. For this reason, Alternative B is considered to potentially have a moderate impact to bighorn.

Human encroachment onto the upper slopes of Red Wind Point is a current problem, which could be exacerbated by new trail implementation. If Alternative B is implemented, additional mitigation and enforcement measures should be implemented to discourage unauthorized access and improve compliance with closures. These measures would reduce impacts of violations and could improve effectiveness of closures compared to existing conditions.

Other Impacts. Both Alternatives A and B would equally impact winter range for elk throughout this section, while Alternative B would also have a minor impact to mule deer winter range. However, the seasonal closure for Alternative B in the Red Wind Point area would significantly reduce the impact to elk and deer winter range. At a landscape scale, Alternative B at Red Wind Point and the Andrews Open Space area would result in new impacts to moderately disturbed wildlife habitat and river frontage.

Cultural Resource Impacts

The proposed location for Alternative A for all three of these sections of trail is on the east side of Highway 133. Because the highway has been systematically upgraded since its first construction, it is recommended not significant to the history of the valley because it no longer retains physical integrity. Construction of the trail along the side of the highway would not constitute an impact to cultural resources.

Alternative B through the Red Wind Point and Andrews sections would follow undeveloped portions of the railroad grade; the grade is intact through this section although no railroad ties or rails remain. Both of these sections have existing social trails and recreational use from nearby subdivisions. Modifying and paving the grade would be considered an impact. The railroad grade parallels and crosses over the East Mesa Ditch. Additional new crossings or expansion of existing crossings over the ditch are potential impacts to the ditch.

A large portion of Alternative B through the Crystal River Country Estates section follows the railroad grade; this section of grade has been converted into a dirt road for the subdivision and is no longer physically intact.

Bridges 5, 6, and 7 would have minor impacts to the railroad grade.

Perham to Janeway South

Table 10. Summary of Impacts: Perham to Janeway South

	Vegetation	Wildlife	Cultural Resources
Segment: Perham			
Alternative A	No significant vegetation impacts Additional stabilization along about 1,000 feet of the Crystal River	Minor impact to elk winter range	No impact
Alternative B	No significant vegetation impacts	Minor impact to elk winter range	Minor impact to railroad grade
Bridge #8	Bridge may result in minimal removal of riparian vegetation on both sides of river	Minor impact to elk winter range	Minor impact to railroad grade
Segment: Janeway North			
Alternative A	No significant vegetation impacts Additional stabilization along about 300 feet of the Crystal River	Minor buffer impacts to elk and bighorn winter range	No impact
Alternative B	Impact to high-quality, diverse riparian forest with habitat for federally listed and FSS species. Impacts to wetlands would be avoided if possible and mitigated if necessary. Removal of trees and native species is likely, and the trail would result in permanent loss of riparian vegetation.	Impact to high-quality, undisturbed habitat including potential T&E/FSS species	Moderate impact to railroad grade, potential impact to Rock Creek County Road
Bridge #9	No significant vegetation impacts	No impact	Moderate impact to the Rock Creek County Road and minor impact to railroad grade.
Segment: Janeway South			
Alternative A	No significant vegetation impacts Additional stabilization along about 1,500 feet of the Crystal River	Minor buffer impacts to elk and bighorn winter range	No impact
Alternative B	Minor new vegetation impacts (reduced by design criteria)	Minor impact to undisturbed habitat and river frontage	Moderate impact to railroad grade
Bridge #10	No significant vegetation impacts	No impact	No impact

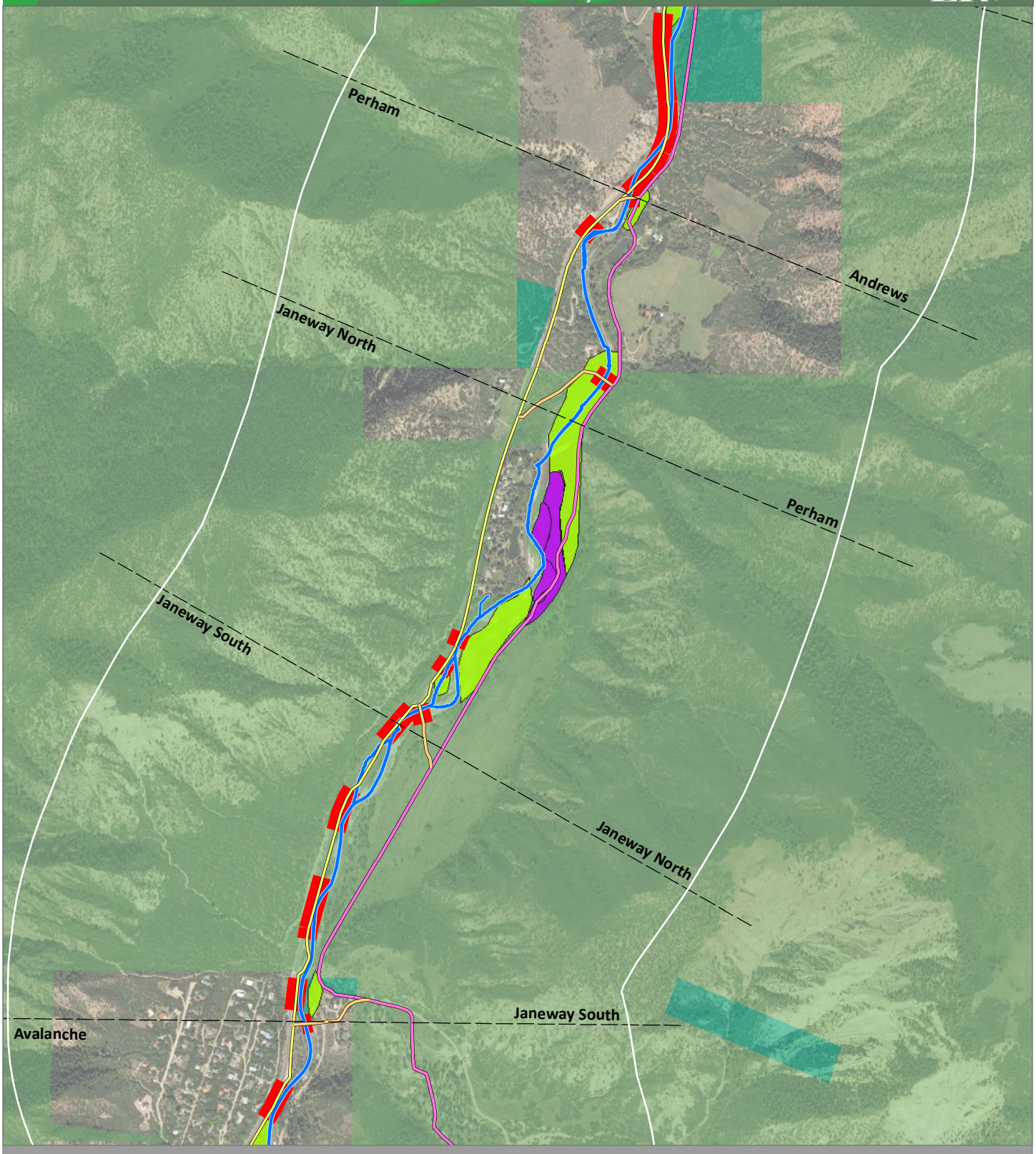

Figure 8. Perham to Janeway South

0 600 1,200 feet

December 5, 2017

- Trail Study Area
- Bridge Option
- Option A Alignment
- Option B Alignment
- Existing Redstone Trail Alignment
- Potential River Impacts
- High Quality Riparian
- Other Riparian
- High Quality Vegetation
- Crystal River
- Pitkin County Open Space
- BLM
- State of Colorado
- USFS

Vegetation Impacts

Alternative A follows existing road where vegetation is disturbed, and no new impacts to vegetation communities would occur. Impacts to in-stream habitat and riparian vegetation are possible, as the streambed would require additional stabilization along approximately 2,800 feet of the Crystal River/highway embankment. The bank is already stabilized, and no additional constraints on the physical characteristics of the river are anticipated. No removal of riparian vegetation is likely.

Alternative B at Janeway North intersects a high-quality, diverse riparian forest with habitat for federally listed and FSS species. The footprint of the trail would be limited to the existing trail/railroad grade, and disturbance to wetlands would be avoided. Impacts on wetlands would be avoided if possible and mitigated if necessary. Removal of trees and native species is likely, and the trail would result in permanent loss of riparian vegetation along the trail width. Tree removal would be avoided to the extent possible. Weed control BMPs would reduce the risk that noxious weeds would increase from construction or trail use.

Sunrise in Janeway Meadow.

At Janeway South, Alternative B is adjacent to a riparian area on the south side but would not result in new impacts to vegetation. No wetlands are within the alignment. The plant community is diverse and dominated by natives, with noxious weeds present. Design criteria would reduce or eliminate impacts by containing the trail footprint and construction activities to the existing railroad grade.

Bridges may result in minimal removal of riparian vegetation on both sides of the river. Design criteria would include limiting new disturbance to the footprint of the trail, removing vegetation only when necessary, and weed control. Bridge 9 would cross upland dominated by a mix of native and non-native species. Design criteria would include limiting new disturbance to the footprint of the trail, removing vegetation only when necessary, and weed control.

Wildlife Impacts

Within the Perham area, impacts would be limited to minor additional disturbance to elk winter range along both trail alternatives.

Most of the wildlife impacts through this area would occur in the Janeway North area. This large wetland/riparian complex has been identified as a high-quality habitat area with suitable habitat for yellow-billed cuckoo and other sensitive or tracked wildlife species. The trail corridor through this area would bisect the habitat patch, resulting in an indirect wildlife impact to most of the riparian area.

Implementation of Alternative B through the Janeway North area would have high impacts to wildlife habitat in this area, which are among the greatest possible impacts observed in the entire study area.

The slopes above Janeway Meadow are Winter Range for bighorn sheep, while those slopes and the meadow itself provide elk Winter Range and are documented to be a Winter Concentration Area for elk. These areas are within the 100-meter zone of influence for Alternative B, which includes the railroad grade, and trail alignment is along the edge of these mapped habitat areas. However, the continuation of existing seasonal closures through April 30 would significantly reduce these impacts.

From a landscape disturbance perspective, Alternative B through the Janeway area would result in new disturbance and fragmentation of habitat and wildlife access to the east bank of the Crystal River. Alternative B though both Janeway North and South areas would result in 0.28 mile of new disturbance, impacting about 22 acres of wildlife habitat (with a 100-meter zone of influence, affecting the entire habitat area) and creating a new barrier to the river for some species. Those impacts would be partially reduced by seasonal closures but would continue to impact other species through the remainder of the year. Implementation of Alternative B in Janeway South only would substantially reduce this impact.

The impacts to wildlife habitat in the Janeway North area from Alternative B would be severe for some individual habitat elements and would be moderate overall. Other impacts through this area, from both alternatives, would be minor.

Cultural Resource Impacts

The proposed location for Alternative A for all three of these sections of trail is on the east side of Highway 133. Because the highway has been systematically upgraded since its first construction, it is recommended not significant to the history of the valley because it no longer retains physical integrity. Construction of the trail along the side of the highway would not constitute an impact to cultural resources.

Alternative B through all three sections would follow the railroad grade; the grade is intact through this section although no railroad ties or rails remain. Aerial imagery indicates that the railroad grade through the Perham section has been converted into a dirt road for the subdivision and is no longer physically intact. The proposed trail would have no impact.

The railroad grade through the Janeway North and Janeway South sections has not been modified since its abandonment in 1942; it is currently used for recreation. A small portion of the grade (approximately 500 feet) has been washed away by the river. Modifying and paving the grade would be considered an impact. An intact, significant portion of the Rock Creek County Road is located downslope to the northeast of Alternative B in the southern portion of Janeway South; impacts to this portion of the resource could easily be avoided.

Bridges 8 and 9 would have minor impacts to the railroad grade as a result of connecting new trail to the railroad grade. Bridge 9 would cross over an intact portion of the Rock Creek County Road. The road through this area is a slightly raised grade approximately 12 feet wide and is significant. Construction of a 4- to 5-foot-long section of trail that bisects the site would constitute an impact to the resource. Bridge 10 would not require new construction and would not impact cultural resources.

Avalanche to Narrows

Table 11. Summary of Impacts: Avalanche to Narrows

	Vegetation	Wildlife	Cultural Resources
Segment: Avalanche			
Alternative A	No significant vegetation impacts Additional stabilization along about 1,900 feet of the Crystal River	Minor impact to elk winter range and potential lynx habitat	No impact
Alternative B	No new vegetation impacts north of Avalanche Creek. Impacts south of Avalanche Creek in a diverse and mostly-native plant community with several CNHP species and a variety of forbs, shrubs, and trees. High-quality habitat for native species and for FSS Harrington's penstemon and Grand Mesa penstemon, as well as the rare plant large flower globemallow, is present throughout the area.	Impact to elk winter range, bighorn migration corridor, and undisturbed high-quality habitat	Moderate impact to railroad grade and Rock Creek County Road
Bridge #11	Bridge would cross riparian area, and it is likely that some vegetation would be removed. The native plant community supports habitat for FSS Harrington's penstemon and Grand Mesa penstemon, as well as the rare plant large flower globemallow.	Minor impact to elk winter range and potential lynx habitat	Minor impact to railroad grade

	Vegetation	Wildlife	Cultural Resources
Segment: Narrows			
Alternative A	No significant vegetation impacts Additional stabilization along about 2,200 feet of the Crystal River	Minor impact to elk winter range	No impact
Alternative B	Alignment would follow the existing trail/railroad grade, and construction footprint would be limited to the existing trail. Habitat for FSS Harrington's penstemon and Grand Mesa penstemon is present, but it is not likely that these species, if present, would be impacted.	Impact to winter ranges, bighorn migration corridor, and undisturbed habitat	Moderate impact to railroad grade and Rock Creek County Road
Bridge #12	Bridge would cross riparian area, and it is likely that some vegetation would be removed	Impact to edge of bighorn winter range and migration corridor	Minor impact to railroad grade

Vegetation Impacts

Alternative A follows existing road where vegetation is disturbed, and no new impacts to vegetation communities would occur. Impacts to in-stream habitat and riparian vegetation are possible, as the streambed would require additional stabilization along approximately 4,100 feet of the Crystal River/highway embankment. The bank is already stabilized, and no additional constraints on the physical characteristics of the river are anticipated. Some removal of riparian vegetation is possible but would be minimized.

Alternative B north of Avalanche Creek is in an area that is currently heavily disturbed by mud flows, social trails, mining activity, and recreational use, and would not result in new disturbance. Alternative B south of Avalanche Creek intersects a diverse and mostly native plant community with several CNHP species and a variety of forbs, shrubs, and trees. High-quality habitat for native species and for FSS Harrington's penstemon and Grand Mesa penstemon, as well as the rare plant large flower globemallow, is present throughout the area.

Alternative B along the Narrows would follow the existing railroad grade, and the construction footprint would be limited to the existing disturbance. High-quality vegetation, which is characterized by sparse native shrubs and trees, is present along the alignment but would not be removed or disturbed. Weed control BMPs would be used to reduce the risk of noxious weeds spreading. Habitat for FSS Harrington's penstemon and Grand Mesa penstemon is present, but it is not likely that these species, if present, would be impacted by the trail.

Bridge 10 would use existing right-of-way where vegetation is disturbed, and no new impacts to vegetation communities would occur. Bridge 11 would cross a riparian area, and it is likely that some vegetation would be removed. The native plant community supports habitat for FSS Harrington's

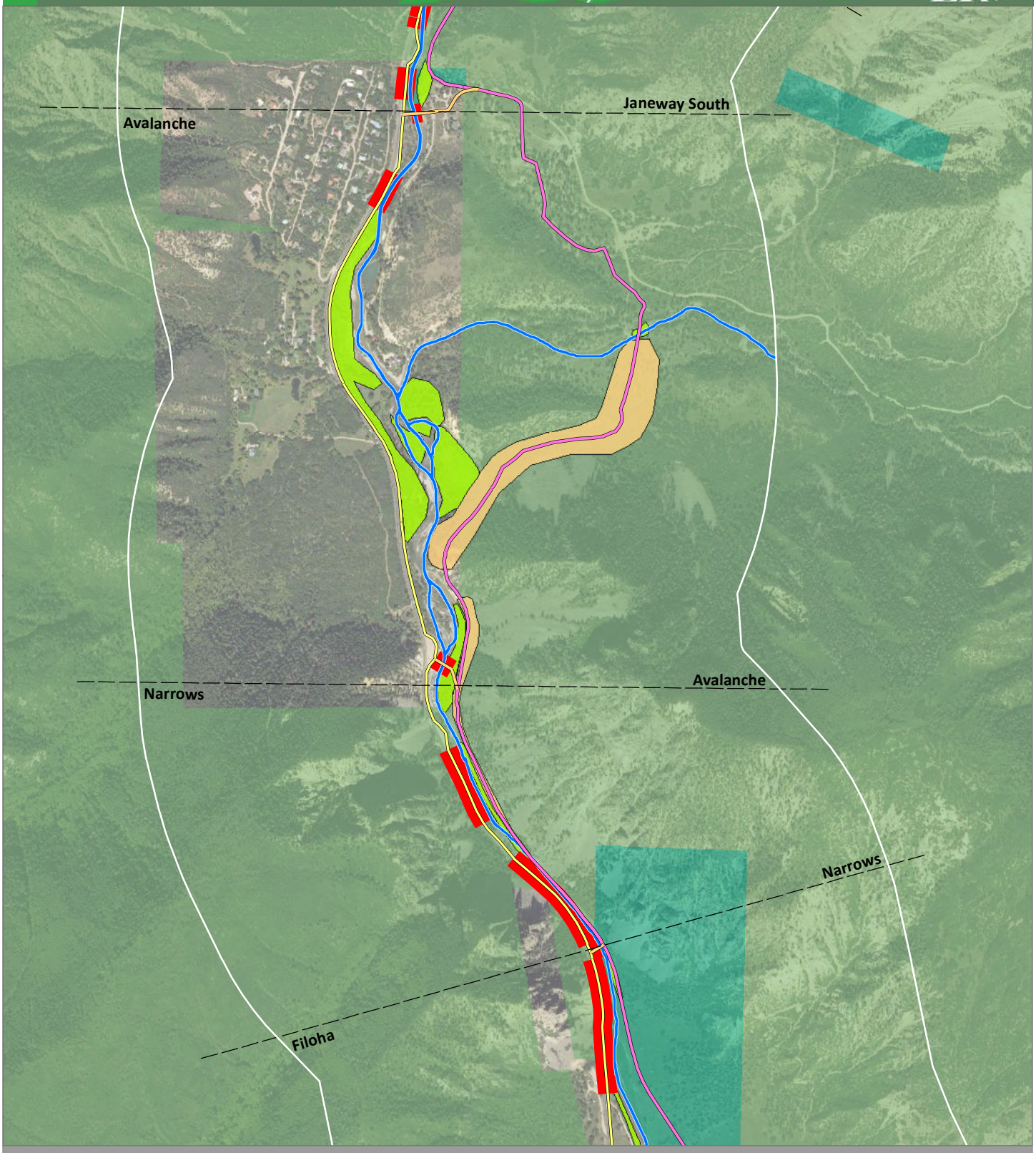

Figure 9. Avalanche to Narrows

0 600 1,200 feet

December 5, 2017

- Trail Study Area
- Bridge Option
- Option A Alignment
- Option B Alignment
- Existing Redstone Trail Alignment
- Potential River Impacts
- High Quality Riparian
- Other Riparian
- High Quality Vegetation
- Crystal River
- Pitkin County Open Space
- BLM
- State of Colorado
- USFS

penstemon and Grand Mesa penstemon, as well as the rare plant large flower globemallow. Design criteria would include limiting new disturbance to the footprint of the trail, removing vegetation only when necessary, and weed control.

Wildlife Impacts

Within this segment, Alternative B would have a substantial impact on bighorn sheep winter range and a migration corridor, with smaller impacts (up to 3 percent of the habitat within the 100-meter zone of influence) to other bighorn seasonal ranges. Impacts to elk Winter Range, Winter Concentration Area, and Severe Winter Range in this area would be greater, affecting up to half of the mapped sensitive ranges within the 100-meter impact zone. The area north of Avalanche Creek currently has year-round recreational access and use, except for dog closures that are currently in place.

South of Avalanche Creek, the undisturbed valley at the base of Elephant Mountain has been identified as a high-quality habitat area. Alternative B would pass through and fragment this area, impacting up to about 26 acres of high-quality habitat (with the 100-meter zone of influence). These impacts would also possibly affect lynx habitat and FSS species including Northern goshawk, flammulated owl, and olive-sided flycatcher.

Existing railroad grade through the Narrows, looking south.

Bighorn Habitat in the Narrows Area. The Narrows area is where the Crystal River, Highway 133, and historic railroad grades pass through a tight canyon for about ¾ mile along the base of Elephant Mountain. Trail Alternative B follows the existing railroad grade and consists of two parallel and vertically offset grades. For bighorn, this area is within the mapped Winter Range and is also known to be a migration corridor between other habitats to the south (Filoha Meadows) and to the north (Avalanche Creek area). Bighorn use of the railroad grade (located at the lower edge of the migration corridor) has been reported to be greatest through the winter (through April 30) with the greatest ram use during the early winter (November 15 to December 31) (Thompson 2017). Human access to this area is currently limited by seasonal closures at Filoha Meadows, December 1 through June 30. Pitkin

County installed a wildlife camera along this corridor between June 1 and July 31, 2017. No bighorn use was documented during this period.

Alternative B is along railroad grade, which is the bighorn migration corridor, and new human use of this corridor could disrupt bighorn use and movement patterns. Such impacts would be the greatest in the late fall (November) and early spring (May) when typical bighorn and human use periods overlap. However, those impacts would generally not occur during sensitive winter seasons and, if they did, would occur at the base of the corridor, allowing bighorn to retain access to abundant and secure escape terrain (steep slopes, cliffs, and talus fields), which is favored by the species.

Potential impacts to bighorn habitat in the Narrows area could be reduced or mitigated with additional design and management considerations:

- Establishment and enforcement of seasonal closures (December 1 through April 30). This would reduce all human access in the area, would mitigate for impacts to Winter Range, and would minimize impacts to bighorn migration patterns.
- Construction of the trail along the lower railroad grade. This would reduce disturbance to bighorn by placing human use on a lower terrace and retaining a corridor and escape terrain for bighorn on the upper railroad grade, which is topographically and visually separated from much of the trail.

Other Impacts. From a landscape perspective, Alternative B would result in substantial new impacts to an otherwise undisturbed area south of Avalanche Creek. These impacts, combined with the loss of undisturbed wildlife access to both the Crystal River and Avalanche Creek, would be a major impact to landscape habitat contiguity in this area.

The overall combined impacts of Alternative B on elk winter range, bighorn migration corridor, and undisturbed high-quality habitat would be high, mainly due to the new disturbance to the area south of Avalanche Creek. These impacts would be among the highest in the entire study area. The impacts to wildlife within the Narrows area would be moderate, resulting primarily from disturbance of a bighorn migration corridor and an impact to undisturbed river frontage. The impacts of Alternative A on wildlife habitat would be minor.

Cultural Resource Impacts

The proposed location for Alternative A is on the east side of Highway 133. Because the highway has been systematically upgraded since its first construction, it is recommended not significant to the history of the valley because it no longer retains physical integrity. Construction of the trail along the side of the highway would not constitute an impact to cultural resources.

Alternative B through the portion of the Avalanche section north of Avalanche Creek follows the alignment of the Rock Creek County Road; this portion of the road has been upgraded and widened and no longer retains historical integrity. The proposed trail would have no impact. Alternative B through the portion of the Avalanche section south of Avalanche Creek follows an undeveloped portion of the Rock Creek County Road that retains physical integrity; modifications and paving of this section would constitute an impact to the resource.

At the southern end of the Avalanche section and through the Narrows, the proposed trail follows the railroad grade; modifying and paving the grade would be considered an impact. Bridges 11 and 12 would have minor impacts to the railroad grade as a result of connecting new trail to the railroad grade.

Filoha

Table 12. Summary of Impacts: Filoha

	Vegetation	Wildlife	Cultural Resources
Segment: Filoha			
Alternative A	No significant vegetation impacts Additional stabilization along about 2,100 feet of the Crystal River	Minor impact to elk winter range and highway crossing	No impact
Alternative B	Previous disturbances and the alignment's distance from wetlands and riparian areas would minimize impacts to vegetation community	Impact to undisturbed habitat and bighorn mineral lick	Moderate impact to Rock Creek County Road and stage stop
Bridge #13	Bridge construction may require removal of riparian vegetation	Minor impact to undisturbed habitat and elk highway crossing	No impact

Vegetation Impacts

Alternative A follows existing road where vegetation is disturbed, and no significant new impacts to vegetation communities would occur. Impacts to in-stream habitat and riparian vegetation are possible, as the streambed would require additional stabilization along approximately 2,100 feet of the Crystal River/highway embankment. The bank is already stabilized, and no additional constraints on the physical characteristics of the river are anticipated. Removal of riparian vegetation is not likely.

Alternative B follows existing trail/railroad grade through degraded vegetation community dominated by non-native species and noxious weeds. Previous disturbances and the alignment's distance from wetlands and riparian areas would minimize impacts to the vegetation community. Weed control BMPs would be used, and any revegetation or restoration after construction activities would use native vegetation. This may have the potential to improve vegetation community characteristics from the current condition.

Bridge construction may require removal of riparian vegetation, but the area is not a high-quality riparian community. Design criteria would include minimizing construction and bridge alignment footprint and weed control.

Wildlife Impacts

Filoha Meadows is recognized for its wildlife value and is currently managed by Pitkin County to protect those values. This management includes an extensive seasonal closure from December 1 to June 30. Both Alternatives A and B avoid impacts to the high-quality habitat areas associated with the wetlands and riparian areas along the Crystal River. With that avoidance, the primary impact concerns are related to seasonal ranges for bighorn sheep and elk and to landscape connectivity.

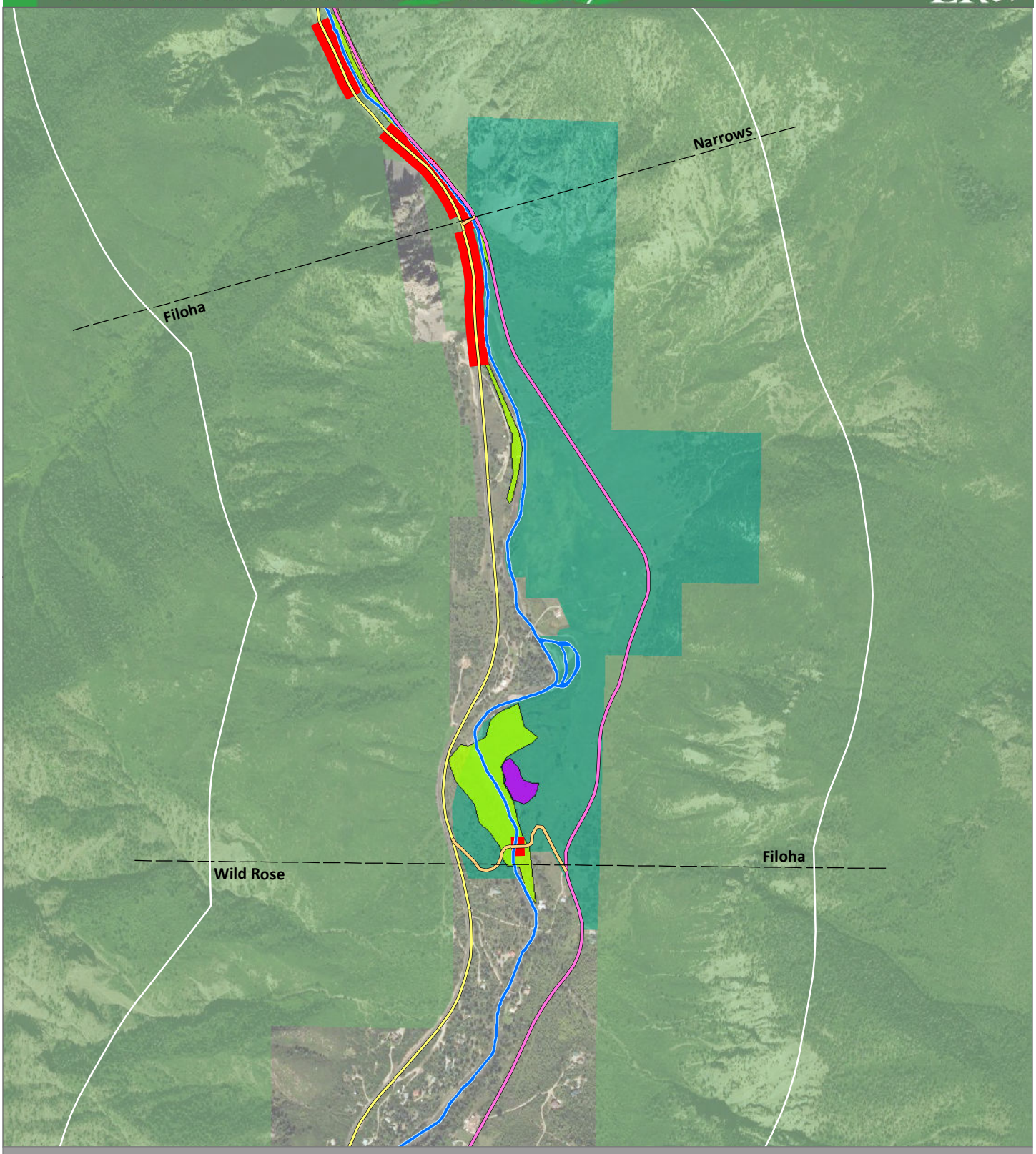

Figure 10. Filoha

0 600 1,200 feet

December 5, 2017

- Trail Study Area
- Bridge Option
- Option A Alignment
- Option B Alignment
- Existing Redstone Trail Alignment
- Potential River Impacts
- High Quality Riparian
- Other Riparian
- High Quality Vegetation
- Crystal River
- Pitkin County Open Space
- BLM
- State of Colorado
- USFS

Bighorn Impacts. All of Filoha Meadows is Winter Range for bighorn, while the upper southwest-facing slopes above the meadows are considered Winter Concentration Area and Severe Winter Range. The warm springs along the banks of the Crystal River in the northwest corner are used as a mineral lick, and bighorn are known to congregate in the meadow through much of the winter and spring.

Besides general winter range, the trail alignment does not intersect any seasonal ranges or production areas for bighorn, though the 100-meter zone of influence does overlap with Severe Winter Range/Winter Concentration Area and a Mineral Lick area. Bighorn use of Filoha is the greatest in the winter and spring, during the seasonal closure period. Continued successful enforcement of this closure significantly reduces the potential impact of Alternative B on bighorn.

Elk Impacts. Proposed trail alignment B along the railroad grade would intersect Winter Range and Winter Concentration Area for elk in Filoha Meadows. In addition, Bridge Option 13 and its approaches would potentially impact potential elk rearing habitat along the Crystal River and a known highway crossing corridor. However, except for the highway crossing, the continuation of the existing seasonal closures (December 1 to June 30) substantially reduce the potential for impacts to elk.

Landscape Disturbance. Implementation of Alternative B though Filoha Meadows would introduce a new disturbance to the area, fragmenting a large section of relatively undisturbed habitat between the Crystal River and the high mountain ridge to the east. This impact would be considered high. Proposed Bridge 13 would also have habitat fragmentation impacts, but at a much smaller and more localized scale. These impacts would not be substantially reduced by the existing seasonal closures.

The overall combined impacts of Alternative B on would be moderate, considering the negative impacts on landscape-scale habitat and the benefits of existing seasonal closures. The impacts of Alternative A and Bridge 13 on wildlife habitat would be minor.

Cultural Resource Impacts

The proposed location for Alternative A is on the east side of Highway 133. Because the highway has been systematically upgraded since its first construction, it is recommended not significant to the history of the valley because it no longer retains physical integrity. Construction of the trail along the side of the highway would not constitute an impact to cultural resources.

Alternative B through Filoha Meadows follows the railroad grade; modifying and paving the grade would be considered an impact. The Filoha Meadows Stage Stop is located adjacent to and west of the railroad. A formal trail would likely increase visitor impacts to the site. Bridge 13 would follow a small (approximately 100 feet) intact portion of the Rock Creek County Road and would constitute an impact.

Wild Rose

Table 13. Summary of Impacts: Wild Rose

	Vegetation	Wildlife	Cultural Resources
Segment: Wild Rose			
Alternative A	No new vegetation impacts Additional stabilization along about 2,300 feet of the Crystal River	Minor impact to elk highway crossing and potential lynx habitat	No impact
Alternative B	No significant vegetation impacts	Minor impact to elk winter range and potential lynx habitat	Minor impact

Vegetation Impacts

Both alternatives follow existing roads where vegetation is disturbed, and no new impacts to vegetation communities would occur.

Alternative A may have impacts to in-stream habitat and riparian vegetation, as the streambed would require additional stabilization along approximately 2,300 feet of the Crystal River/highway embankment. The bank is already stabilized, and no additional constraints on the physical characteristics of the river are anticipated. Some removal of riparian vegetation is possible but would be minimized.

Wildlife Impacts

Both trail alternatives are along existing road corridors adjacent to subdivisions. New impacts to wildlife would be localized and would be limited to an elk highway crossing area (Alternative A) and elk winter range (Alternative B). Overall wildlife impacts of both are minor.

Cultural Resource Impacts

The proposed location for Alternative A is on the east side of Highway 133. Because the highway has been systematically upgraded since its first construction, it is recommended not significant to the history of the valley because it no longer retains physical integrity. Construction of the trail along the side of the highway would not constitute an impact to cultural resources.

Alternative B follows the railroad grade; the grade has been converted into a dirt road for the subdivision and no longer retains historical physical integrity. The proposed trail would have minimal impact.

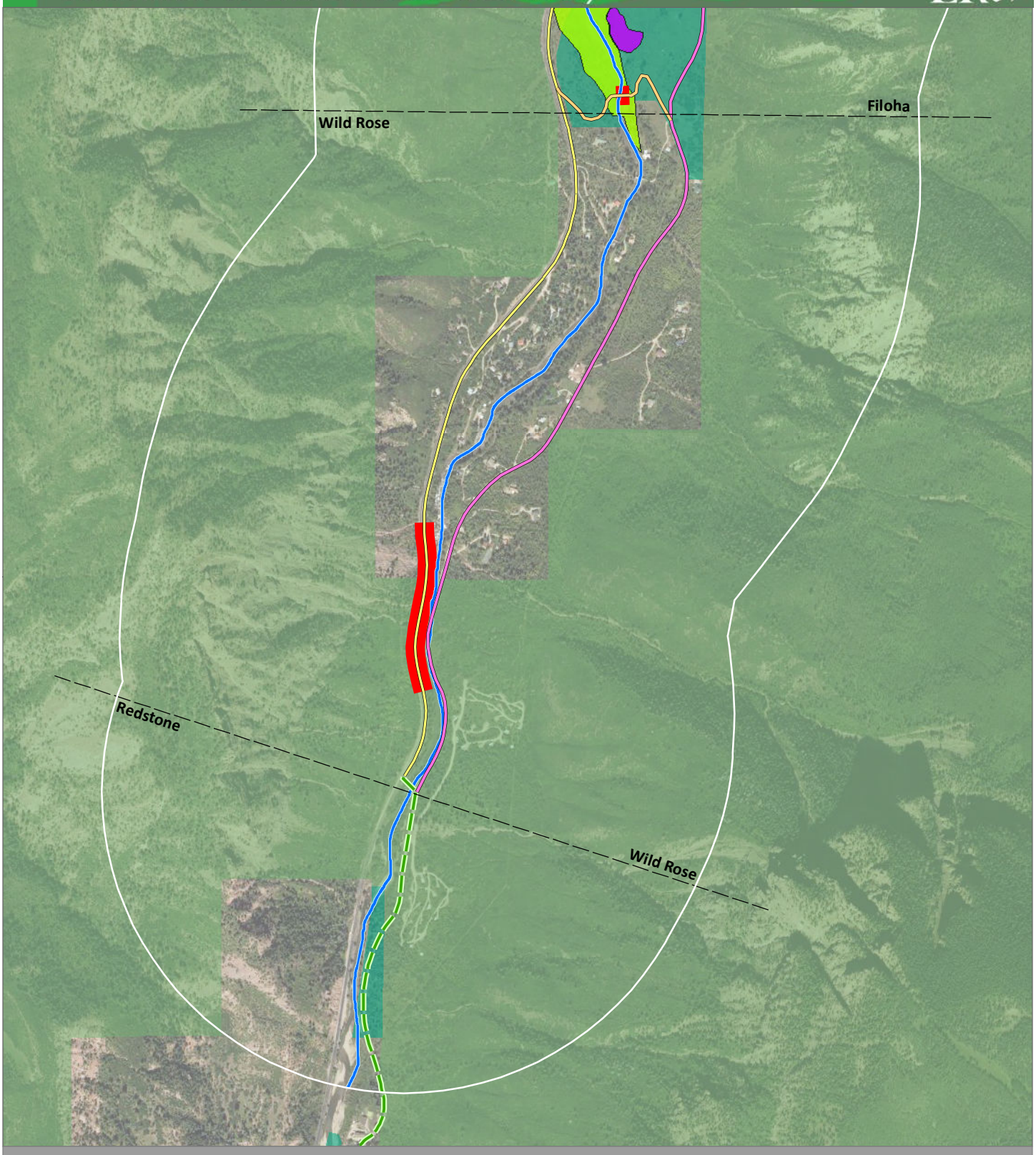

Figure 11. Wild Rose

0 600 1,200 feet

December 5, 2017

- Trail Study Area
- Bridge Option
- Option A Alignment
- Option B Alignment
- Existing Redstone Trail Alignment
- Potential River Impacts
- High Quality Riparian
- Other Riparian
- High Quality Vegetation
- Crystal River
- Pitkin County Open Space
- BLM
- State of Colorado
- USFS

Redstone to Hawk Creek

Table 14. Summary of Impacts: Redstone to Hawk Creek

	Vegetation	Wildlife	Cultural Resources
Segment: Castle			
Alternative A	No significant vegetation impacts	Minor impact to elk winter range and potential lynx habitat	No impact
Alternative B	No significant vegetation impacts	Minor buffer impact to high-quality habitat area	Minor impact Road to Redstone Castle
Bridge #14	Bridge would span an area where wetlands are present, but would be designed to avoid impacts	Minor impact to elk winter range	No impact
Segment: Hawk Creek			
Alternative A	No significant vegetation impacts	Minor impact to elk winter range and potential lynx habitat	No impact
Alternative B	No significant vegetation impacts	Minor impact to elk winter range and potential lynx habitat	No impact

Vegetation Impacts

Alternative A follows existing road where vegetation is disturbed, and no new impacts to vegetation communities would occur. No impacts to in-stream habitat and riparian vegetation are likely, as the alignment follows the existing highway and crosses to the west side of the highway and away from the Crystal River after Redstone. No riparian vegetation removal is anticipated. A willow riparian area is located adjacent to the trail south of Redstone but would not be impacted. Impacts would be minimized or avoided through trail design.

Alternative B follows existing road and existing trail/wagon road grade for most of its length. It parallels but avoids wetlands along the river. The alignment is adjacent to a high-quality area near the Castle, but because it would be contained within the existing road and trail, new disturbance would be minimal. No tree and minimal vegetation removal would be required for trail construction.

Wildlife Impacts

Both alternatives through this area follow existing trails, roads, or other disturbances. Alternative A is located along the highway, while Alternative B is located along existing roads and trails. Both alternatives are near high-quality riparian habitat in the Crystal River floodplain, and the 100-meter zone of influence would potentially affect these areas. However, given the location of the trail alternative alignments along existing disturbance corridors and likely habituation of wildlife to those human use patterns and corridors, new impacts to this area would be minor.

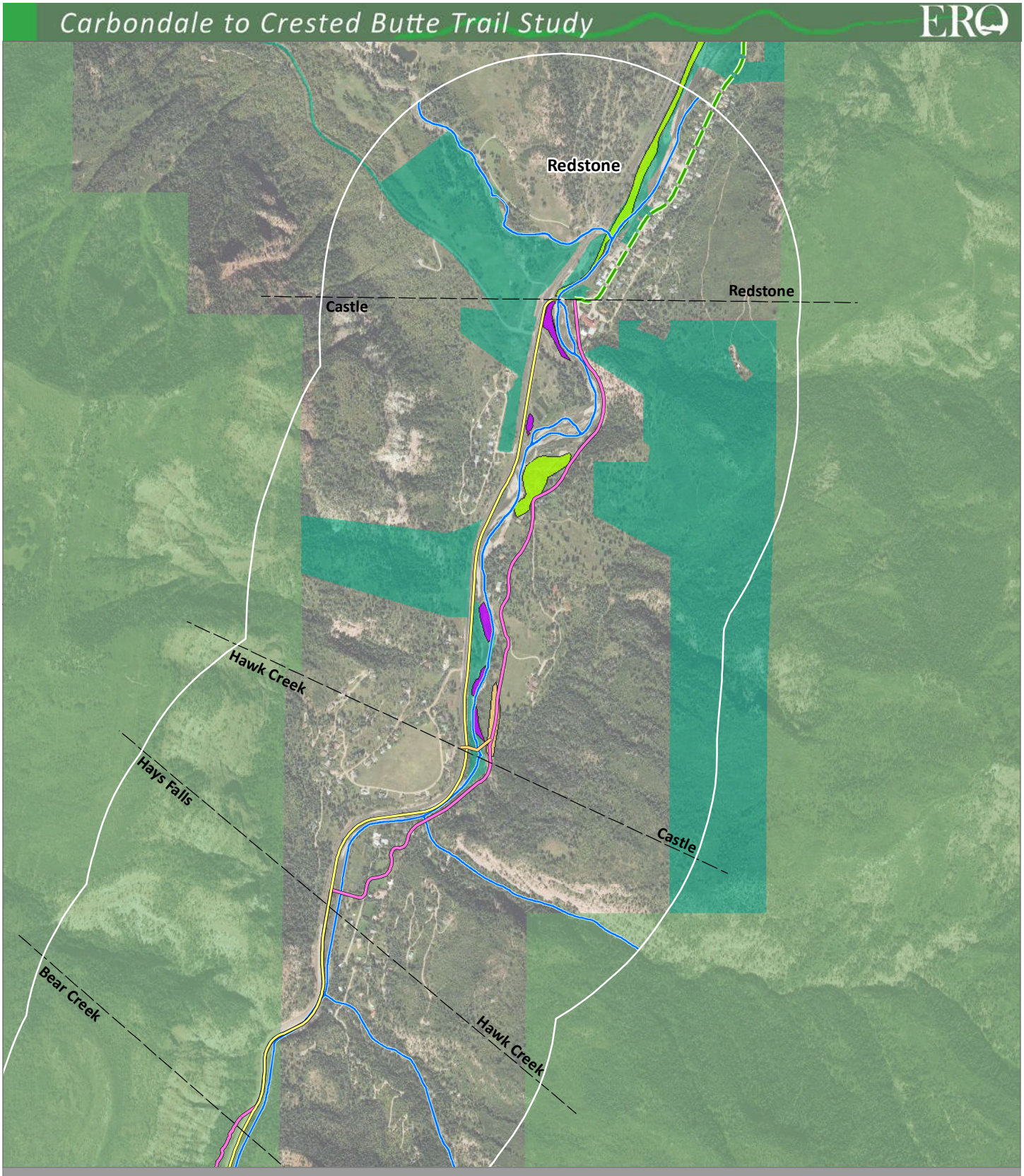

Figure 12. Redstone to Hawk Creek

0 750 1,500 feet

December 5, 2017

- Trail Study Area
- Bridge Option
- Option A Alignment
- Option B Alignment
- Existing Redstone Trail Alignment
- Potential River Impacts
- High Quality Riparian
- Other Riparian
- High Quality Vegetation
- Crystal River
- Pitkin County Open Space
- BLM
- State of Colorado
- USFS

Both alternatives would result in disturbance impacts (within the 100-meter zone of influence) to Winter Range, Winter Concentration Area, and Severe Winter Range for elk. These seasonal ranges are located on the forested slopes above the east bank of the Crystal River. Actual impacts from Alternative A are not likely since the alignment is along the existing highway right-of-way. Actual impacts from Alternative B may be diminished since the trail corridor currently exists and currently has some recreational use, and most of the seasonal habitat ranges are separated from the trail corridor by development (e.g., Redstone Castle) or sheer cliffs above the trail corridor. Nonetheless, Alternative B is considered to have a moderate impact on elk due to these impacts (but minor impacts to wildlife overall).

Cultural Resource Impacts

The proposed location for Alternative A is on the east side of Highway 133. Because the highway has been systematically upgraded since its first construction, it is recommended not significant to the history of the valley because it no longer retains physical integrity. Construction of the trail along the side of the highway would not constitute an impact to cultural resources.

Alternative B follows the Road to Redstone Castle; the road retains historical physical integrity. The proposed trail would be single-track dirt trail and would have minimal impact to the resource.

Hayes Falls to Bear Creek

Table 15. Summary of Impacts: Hayes Falls to Bear Creek

	Vegetation	Wildlife	Cultural Resources
Segment: Hayes Falls			
Alternative A	No significant vegetation impacts	Minor impact to elk winter range and potential lynx habitat	No impact
Segment: Bear Creek			
Alternative A	No significant vegetation impacts	Minor impact to elk winter range and potential lynx habitat	No impact
Alternative B	Alignment follows existing grade through a diverse vegetation community where habitat for FSS Harrington's penstemon is present. Disturbance would be limited, and little if any vegetation would be removed.	Buffer impact to potential lynx/FSS habitat (reduced by design measures/surveys)	Minor impact

Vegetation Impacts

Alternative A follows existing road where vegetation is disturbed, and no new impacts to vegetation communities would occur. No impacts to in-stream habitat and riparian vegetation are likely, as the alignment follows the west side of the existing highway, away from the Crystal River. No riparian vegetation removal is anticipated.

At Bear Creek, Alternative B follows existing social trail/road through a diverse vegetation community where habitat for FSS Harrington's penstemon is present (but no individuals were observed during surveys). Disturbance would be limited to the existing trail footprint, and little if any vegetation would be removed.

Wildlife Impacts

Alternative A is along the existing highway corridor. While it would intersect habitat for elk, lynx, and other species, new impacts to those species would be minimal since it is along an existing highway corridor.

Alternative B follows the historic Rock Creek County Wagon Road, on the forested bench to the west of (and above) the Crystal River. The wagon road is currently used as a single-track trail route and would require minimal new trail construction. Implementation of this trail alignment would entail minor tread improvements and a general increase in human use of the corridor.

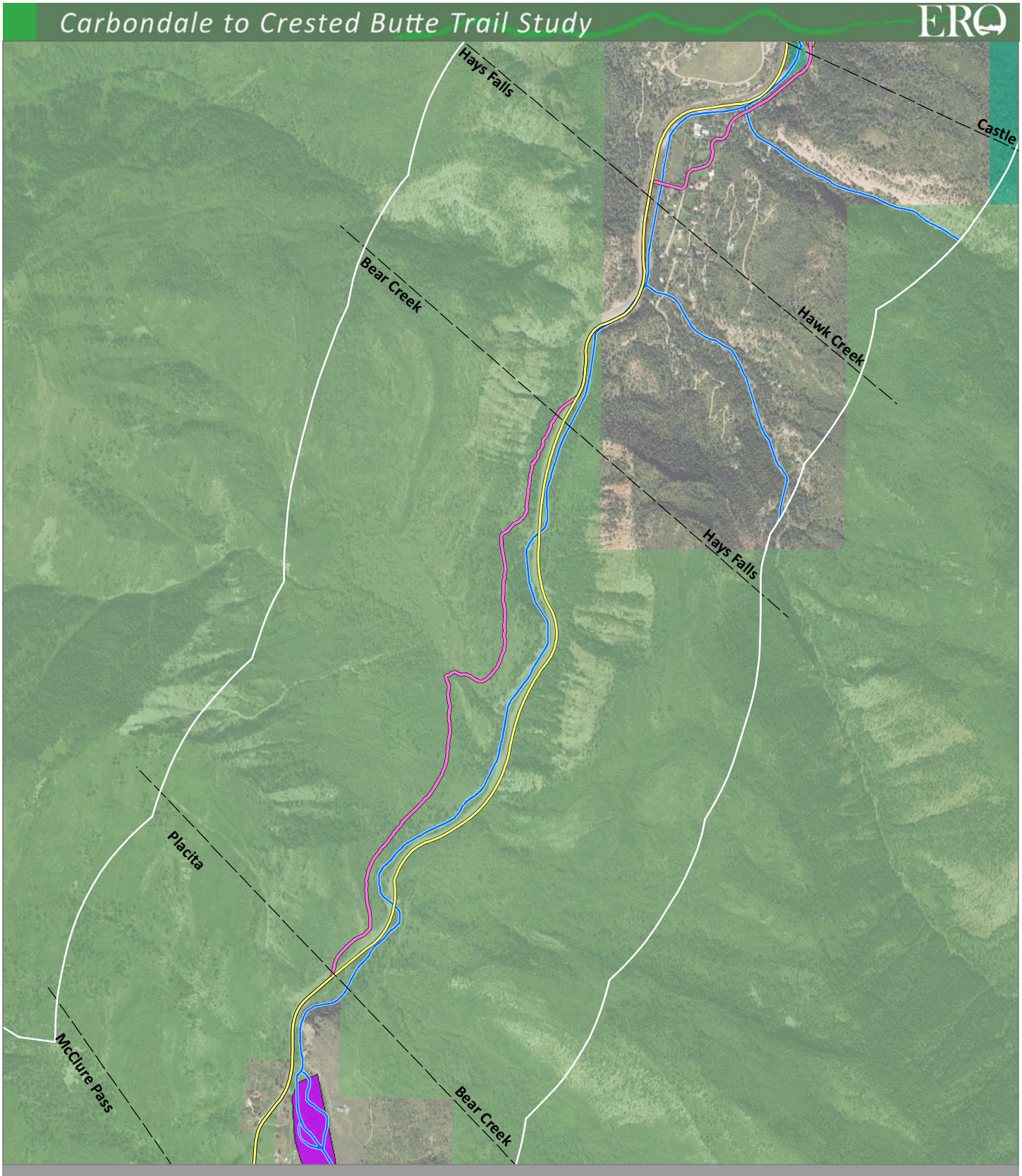

Figure 13. Hays Falls to Bear Creek

0 750 1,500 feet

December 5, 2017

- Trail Study Area
- Bridge Option
- Option A Alignment
- Option B Alignment
- Existing Redstone Trail Alignment
- Potential River Impacts
- High Quality Riparian
- Other Riparian
- High Quality Vegetation
- Crystal River
- Pitkin County Open Space
- BLM
- State of Colorado
- USFS

Both alternatives intersect winter range for elk, resulting in moderate impacts. Actual impacts would be greater for Alternative B (wagon road) because it is less disturbed and less frequently used than the highway corridor. In addition, Alternative B passes through suitable habitat for lynx, as well as for several FSS species including hoary bat, peregrine falcon, flammulated owl, and Northern goshawk. Depending on the presence and location of sensitive species in those habitats, Alternative B could result in a moderate impact. However, considering the presence of the existing trail/use corridor along the wagon road, and the likelihood that winter use of the trail would be limited, the overall new impacts to wintering elk and other sensitive species would be minor.

Cultural Resource Impacts

The proposed location for Alternative A is on the east side of Highway 133. Because the highway has been systematically upgraded since its first construction, it is recommended not significant to the history of the valley because it no longer retains physical integrity. Construction of the trail along the side of the highway would not constitute an impact to cultural resources.

Alternative B follows the Rock Creek County Road; the road retains historical physical integrity. The wagon road is currently used as a single-track trail route and would require minimal new trail construction. The proposed trail would have minimal impact to the resource.

Placita to Top of McClure Pass

Table 16. Summary of Impacts: Placita to Top of McClure Pass

	Vegetation	Wildlife	Cultural Resources
Segment: Placita			
Alternative A	No significant vegetation impacts	Minor impact to elk winter range and migration corridor and potential lynx habitat	No impact
Segment: McClure Pass			
Alternative A	No significant vegetation impacts	Minor impact to potential lynx habitat	No impact
Alternative B	No significant vegetation impacts	Minor impact to elk migration corridor and potential lynx habitat	No impact
Segment: Top of McClure Pass			
Alternative A	No significant vegetation impacts	Minor impact to habitat for lynx and FSS species	No impact

Vegetation Impacts

Alternative A follows existing road where vegetation is disturbed, and no new impacts to vegetation communities would occur. No impacts to in-stream habitat and riparian vegetation are likely, as the alignment follows the existing highway, which turns away from the Crystal River after Placita. No riparian vegetation removal is anticipated.

At Placita, Alignment B follows existing trail/wagon road grade for most of its length. It would cross Harrington's penstemon habitat (none were observed during surveys). Impacts would be minimized or avoided by trail design criteria.

Wildlife Impacts

Alternative A is along the existing highway corridor. While it would intersect habitat for elk, lynx, and other species, new impacts to those species would be minimal.

Alternative B largely follows the old McClure Pass road, which climbs with multiple switchbacks up the slopes above Placita. The old pass road is currently used as a single-track trail route and would require minimal new trail construction. Similar to the previous segment, implementation of this trail alignment would entail minor tread improvements and a general increase in human use of the corridor.

Both alternatives intersect winter range for elk, resulting in moderate impact. Actual impacts would be greater for Alternative B (old pass road) because it is less disturbed and less frequently used than the highway corridor. In addition, Alternative B passes through suitable habitat for lynx. Considering the presence of the existing trail/use corridor along the old pass road, and the likelihood that winter use of

the trail would be limited, the overall new impacts to wintering elk and other sensitive species would be minor.

Cultural Resource Impacts

The proposed location for Alternative A is on the east side of Highway 133. Because the highway has been systematically upgraded since its first construction, it is recommended not significant to the history of the valley because it no longer retains physical integrity. Construction of the trail along the side of the highway would not constitute an impact to cultural resources.

Alternative B follows an abandoned section of McClure Pass road. The section is not recommended as a significant resource; there are no impacts.

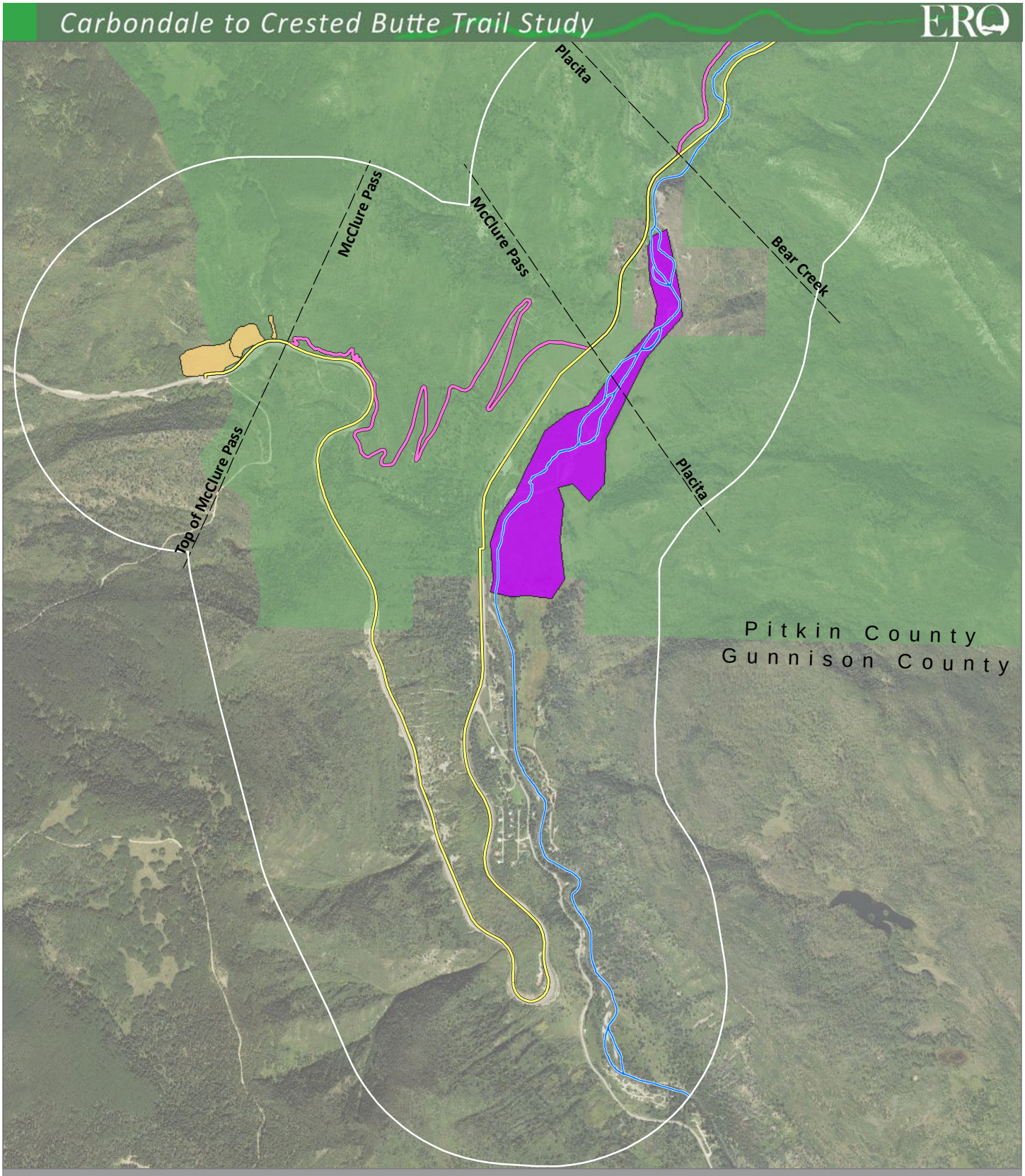

Figure 14. Placita to Top of McClure Pass

0 1,000 2,000 feet

December 5, 2017

- Trail Study Area
- Bridge Option
- Option A Alignment
- Option B Alignment
- Existing Redstone Trail Alignment
- Potential River Impacts
- High Quality Riparian
- Other Riparian
- High Quality Vegetation
- Crystal River
- Pitkin County Open Space
- BLM
- State of Colorado
- USFS

Summary of Impacts by Trail Segment

Table 17. Summary of Impacts by Segment

Segment	Vegetation Impacts	Wildlife Impacts	Cultural Resource Impacts
7 Oaks			
Alternative A	Minor Impact	Minor Impact	No Impact
Alternative B	Minor Impact	Minor Impact	Minor Impact
Bridge Option #1	Minor Impact	Minor Impact	No Impact
Bridge Option #2	Minor Impact	Minor Impact	Moderate Impact
Crystal River Parcel			
Alternative A	Minor Impact	Minor Impact	No Impact
Alternative B	Minor Impact	Moderate Impact	Moderate Impact
Bridge Option #3	Minor Impact	Minor Impact	Minor Impact
Nettle Creek			
Alternative A	Minor Impact	Minor Impact	No Impact
Alternative B	Minor Impact	Minor Impact	*Not surveyed*
Bridge Option #4	Minor Impact	Minor Impact	Minor Impact
Red Wind Point			
Alternative A	Minor Impact	Minor Impact	No Impact
Alternative B	Minor Impact	Moderate Impact	Moderate Impact
Bridge Option #5	Minor Impact	Minor Impact	Minor Impact
Crystal River Country Estates			
Alternative A	Minor Impact	Minor Impact	No Impact
Alternative B	Minor Impact	Minor Impact	Minor Impact
Bridge Option #6	Minor Impact	Minor Impact	Minor Impact
Andrews			
Alternative A	Minor Impact	Minor Impact	No Impact
Alternative B	Minor Impact	Minor Impact	Minor Impact
Bridge Option #7	Minor Impact	Minor Impact	Minor Impact
Perham			
Alternative A	Minor Impact	Minor Impact	No Impact
Alternative B	Minor Impact	Minor Impact	*Not surveyed*
Bridge Option #8	Minor Impact	Minor Impact	Minor Impact
Janeway North			
Alternative A	Minor Impact	Minor Impact	No Impact
Alternative B	Moderate Impact	Moderate Impact	Minor Impact
Bridge Option #9	Minor Impact	Minor Impact	Minor Impact
Janeway South			
Alternative A	Minor Impact	Minor Impact	No Impact
Alternative B	Minor Impact	Minor Impact	Minor Impact
Bridge Option #10	Minor Impact	Minor Impact	No Impact
Avalanche			
Alternative A	Minor Impact	Minor Impact	No Impact
Alternative B	High Impact	High Impact	Moderate Impact
Bridge Option #11	Moderate Impact	Minor Impact	Minor Impact

Segment	Vegetation Impacts	Wildlife Impacts	Cultural Resource Impacts
Narrows			
Alternative A	Minor Impact	Minor Impact	No Impact
Alternative B	Moderate Impact	Moderate Impact	Moderate Impact
Bridge Option #12	Minor Impact	Minor Impact	Minor Impact
Filoha			
Alternative A	Minor Impact	Minor Impact	No Impact
Alternative B	Minor Impact	Moderate Impact	Moderate Impact
Bridge Option #13	Minor Impact	Minor Impact	Minor Impact
Wild Rose			
Alternative A	Minor Impact	Minor Impact	No Impact
Alternative B	Minor Impact	Minor Impact	Minor Impact
Castle			
Alternative A	Minor Impact	Minor Impact	No Impact
Alternative B	Minor Impact	Minor Impact	Moderate Impact
Bridge Option #14	Minor Impact	Minor Impact	Minor Impact
Hawk Creek			
Alternative A	Minor Impact	Minor Impact	No Impact
Alternative B	Minor Impact	Minor Impact	No Impact
Hayes Falls			
Alternative A	Minor Impact	Minor Impact	No Impact
Bear Creek			
Alternative A	Minor Impact	Minor Impact	No Impact
Alternative B	Minor Impact	Minor Impact	Minor Impact
Placita			
Alternative A	Minor Impact	Minor Impact	No Impact
McClure Pass			
Alternative A	Minor Impact	Minor Impact	No Impact
Alternative B	Minor Impact	Minor Impact	Minor Impact
Top of McClure Pass			
Alternative A	Minor Impact	Minor Impact	No Impact

Impact Mitigation Measures

Existing railroad grade at the base of Red Wind Point, looking north.

As described previously, several design measures and BMPs are integrated into the trail alignment alternatives and are considered in the impact determinations. These include adherence to existing seasonal closures and trail use restrictions, listed and sensitive species clearance surveys, minimization of vegetation removal and ground disturbance in native plant communities, and other BMPs. In addition to design measures, there are measures that would reduce or mitigate environmental impacts that may occur as a result of trail implementation and use. These potential mitigation measures are listed below, by resource topic.

Vegetation Mitigation and Enhancement

- Site trails, bridges, and other developed facilities to utilize existing ground disturbances and minimize new impacts to native communities.
- Actively monitor and manage noxious weeds throughout the corridor, and adjacent to new ground disturbing activities (for several years following construction).
- Re-seed and revegetate disturbed areas with appropriate native vegetation.
- Identify opportunities to restore and enhance native riparian communities within and adjacent to the active floodplain.
- Avoid wetland and riparian areas wherever possible, and mitigate for wetland and riparian loss if impacts occur. Delineations of wetland areas and consultation with the USACE would be required if impacts are anticipated.
- Restore floodplain connectivity, wetlands, and riparian habitat along the Crystal River. Specific restoration activities may include:
    - Breaching the railroad grade near Red Wind Point to re-establish floodplain connectivity.
    - Expanding the floodplain in the Janeway area to improve riparian habitat and overall species diversity.
    - Evaluating floodplain conditions in the Redstone Castle and Placita areas to identify additional opportunities for floodplain and riparian protection and enhancement.

- Improve native vegetation communities and habitat quality through restoration of areas adjacent to the trail.
- Avoid impacts to listed species and mitigation of impacts to sensitive or rare species.

Wildlife Mitigation and Enhancement

- Work with and support CPW and USFS in efforts to protect and enhance habitat for bighorn sheep and elk, and to improve population health and stability. Specific efforts may include*:*
    - Habitat enhancement projects, including forest thinning and prescribed fire.
    - Further limiting or eliminating interface between bighorn and domestic sheep on private grazing allotments on USFS land.
    - Translocations, or other population management tools to improve bighorn herd stability.
- Work with and support CPW and USFS in efforts to plan for, monitor, and manage bighorn sheep. Specific activities may include*:*
    - Assisting or supporting the development of a management plan for the West Snowmass Herd (S25).
    - Assisting with or supporting improved bighorn monitoring, including GPS collars, visual monitoring of lambing activity, and other techniques.
    - Adapting long-term management to new information.
- Work with CPW and USFS to improve enforcement of, and compliance with, existing seasonal closures. Specific activities may include*:*
    - Monitoring, and actively enforcing seasonal closures on OST and USFS lands.
    - Improving signs at Avalanche Creek to clarify closures, closed areas, and penalties.
    - Installing signs near Red Wind Point (along the railroad grade and behind the subdivision) affirming closures and penalties.
- Avoid impacts and improve of bighorn sheep habitat at and near Red Wind Point through:
    - Permanently closing upper bluffs to humans.
    - Installing a stock tank to provide supplemental water for bighorn.
    - Expanding seasonal closures to match other areas with similar management concerns (closed to people December 1 to May 1).
- Improve open space management in sensitive wildlife areas through monitoring and collecting additional wildlife presence and disturbance data, including:
    - Monitoring annual patterns of use by bighorn sheep ewes and lambs at Red Wind Point and reevaluating and revising closures and restrictions based on data. Continuing or expanding closures if ewes with lambs use the area, or relax seasonal closures if they do not.
    - Assisting CPW with the development and implementation of a management plan for the West Snowmass bighorn sheep herd.
    - Exploring possible avenues to research and improve the condition and health of bighorn sheep and elk populations in the Crystal Valley.

Stream Mitigation and Enhancement

- Site trail and bridge locations using existing disturbances outside of the active stream channel, wherever possible.

- Minimize new impacts to high quality riparian habitat and avoid the removal of riparian vegetation wherever possible.
- Design new bridges with the maximum feasible width to minimize floodplain constriction and to promote channel migration, hydrological balance, and riparian habitat succession.
- Replace existing narrow bridges with wider structures to withstand bankfull flows, facilitate channel migration, and promote riparian habitat succession. Specific efforts may include:
    - 7 Oaks subdivision access bridge
    - Bridge near Nettle Creek
    - Crystal River Country Estates access bridge
    - Avalanche Creek Road bridge
    - Redstone Blvd (south) bridge
- Identify opportunities to restore and enhance native riparian communities within and adjacent to the active floodplain. Specific efforts may include:
    - Red Wind Point - Breaching the existing railroad grades and installing culverts or bridges to re-establish the historic floodplain and the potential for channel migration and habitat improvement.
    - Janeway - Identifying opportunities to broaden the floodplain and allow for increased channel migration and riparian habitat restoration.
- For trail segments within or adjacent to the active river channel (many of the Alternative A segments), incorporate design measures to minimize new river impacts:
    - Minimize the need for new retaining walls, structures, or riprap along the river bank or within the active channel.
    - Minimize the use of impermeable materials along the river bank.
    - Design piers and bridges so that flow deflection from pilings or structures is minimized.
- Implement low-flow/in-channel stream habitat enhancements to improve hydraulic function and aquatic habitat.
    - Combine projects with other infrastructure improvements (e.g., new bridges, bridge replacements, retaining walls) to integrate stream design, engineering, and permitting.
    - Specific locations for in-channel habitat improvement projects have not been identified.

Cultural Resource Impact Mitigation

- Avoid impacts to cultural resources through limiting visitors to the trail footprint where significant cultural resources are present and vulnerable.
- Reduce potential impacts from increased visitation by stabilizing or restoring significant historic features that would be impacted by visitation.
- Preserve resources that have integrity through a combination of interpretive signage and more detailed documentation (which could include measured drawings of significant features and high-quality photographs).

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Appendix A: Plant Species Observed during Field Review

Scientific Name	Common Name	Status	Type	FQA Value
Abies concolor	white fir	Native	Tree	5
Acer glabrum	rocky mountain maple	Native	Tree	7
Acer negundo	boxelder maple	Non-native	Tree	0
Achillea millefolium	common yarrow	Native	Forb	4
Achnatherum hymenoides	Indian ricegrass	Non-native	Grass	5
Agropyron cristatum	crested wheatgrass	Non-native	Grass	0
Agropyron desertorum	desert wheatgrass	Non-native	Grass	0
Allium spp.	wild onion	Native	Forb	Unknown
Alnus incana	thinleaf alder	Native	Tree	6
Amelanchier utahensis	serviceberry	Native	Shrub	6
Anaphalis margaritacea	western pearly everlasting	Native	Forb	4
Anemone cylindrica	anemone	Native	Forb	5
Apocynum cannabinum	Indian hemp	Native	Forb	2
Arctium minus	common burdock	Noxious	Forb	0
Arnica cardifolia	heart-leafed arnica	Native	Forb	7
Artemisia frigida	prairie sagewort	Native	Forb	4
Artemisia ludoviciana	white sagebrush	Native	Shrub	4
Artemisia tridentada	big sagebrush	Native	Shrub	4
Asclepias speciosa	showy milkweed	Native	Forb	3
Asclepias spp.	milkweed	Native	Forb	Unknown
Asparagus officinalis	wild asparagus	Non-native	Forb	0
Astragulus miser	timber milkvetch	Native	Forb	6
Astragulus spp.	milkvetch	Native	Forb	Unknown
Betula glandulosa	resin birch	Native	Tree	9
Betula occidentalis	water birch	Native	Tree	8
Bromus inermis	smooth brome	Non-native	Grass	0
Bromus japonicum	Japanese brome	Non-native	Grass	0
Bromus tectorum	downy brome	Noxious	Grass	0
Calamagrostis canadensis	bluejoint	Native	Grass	6
Camelina microcarpa	littlepod false flax	Non-native	Forb	0
Carduus nutans	musk thistle	Noxious	Forb	0
Carex mycroptera	smallwing sedge	Native	Grass	5
Carex spp.	sedge	Other	Grass	Unknown
Carex aquatilis	water sedge	Native	Forb	6

Scientific Name	Common Name	Status	Type	FQA Value
Castilleja chromosa	colorful Indian paintbrush	Native	Forb	7
Ceanothus fendleri	Fendler's ceanothus	Native	Shrub	7
Cercocarpus montanus	mountain mahogany	Native	Shrub	6
Chamerion angustivolium	fireweed	Native	Forb	4
Chenopodium album	lambsquarters	Native	Forb	0
Chrysanthemum leucanthemum	oxeye daisy	Noxious	Forb	0
Chrysothamnus greenii	Greene's rabbitbrush	Native	Shrub	6
Cirsium arvensis	Canada thistle	Noxious	Forb	0
Cirsium spp.	thistle	Unknown	Forb	Unknown
Cirsium undulatum	wavy-leaf thistle	Native	Forb	5
Clematis spp.	clematis	Unknown	Vine	Unknown
Comandra umbellata	bastard-toadflax	Native	Forb	5
Conioselinum scopulorum	Rocky mountain hemlock parsley	Native	Forb	7
Conium maculatum	poison hemlock	Non-native	Forb	0
Cornus sericea	redosier dogwood	Native	Tree	7
Cynoglossum officianale	hound's tongue	Noxious	Forb	0
Dactylis glomerata	orchard grass	Non-native	Grass	0
Dasiphora fructicosa	shrubby cinquefoil	Native	Shrub	4
Delphinium spp.	Larkspur	Native	Forb	Unknown
Distichlis stricata	Indian saltgrass	Native	Grass	4
Dracocephelum spp.	dragonhead	Non-native	Forb	3
Echinacea spp.	coneflower	Native	Forb	0
Elaeagnus angustifolia	Russian olive	Noxious	Tree	0
Elymus elemoides	squirreltail	Native	Grass	4
Elymus glauca	blue wildrye	Native	Grass	7
Elymus trachycaulus	slender wheatgrass	Native	Grass	4
Elymus lanceolatus	wild-rye	Native	Grass	4
Epilobium brachycarpum	tall annual willowherb	Native	Forb	2
Equisetum hyemale	scouringbrush horsetale	Native	Forb	4
Ericameria nauseosa	rubber rabbitbrush	Native	Shrub	3
Erigeron divergens	spreading fleabane	Native	Forb	4
Erigeron spp.	fleabane	Unknown	Forb	Unknown
Eriogonum spp.	buckwheat	Unknown	Forb	Unknown
Eriogonum umbellatum	sulphur flower	Native	Forb	6
Erodium cicutarium	redstem filaree	Noxious	Forb	0

Scientific Name	Common Name	Status	Type	FQA Value
Fragaria virginiana	wild strawberry	Native	Forb	5
Geranium richardsonii	Richardson geranium	Native	Forb	6
Geum macrophyllum	big leaf avens	Native	Forb	6
Grindelia spp.	gumweed	Native	Forb	Unknown
Helianthus spp.	sunflower	Unknown	Forb	Unknown
Heracleum maximum	cow parsnip	Native	Forb	6
Hesperostipa comata	needle-and-thread grass	Native	Grass	6
Heterotheca villosa	hairy false golden aster	Native	Forb	3
Holodiscus discolor	rock spirea	Native	Shrub	8
Ipomopsis aggregata	scarlet gilia	Native	Forb	5
Iris pseudacorus	yellow flag iris	Noxious	Forb	0
Iris missouriensis	wild iris	Native	Forb	4
Juniperus communis	common juniper	Native	Tree	6
Juniperus monosperma	One-seed juniper	Native	Tree	6
Juniperus scopulorum	Rocky Mountain juniper	Native	Tree	5
Koeleria machanthra	prairie junegrass	Native	Grass	6
Ligusticum porteri	Poter's licorice-root	Native	Forb	7
Linaria vulgaris	yellow toadflax	Noxious	Forb	0
Linum lewissi	prairie flax	Native	Forb	4
Linum spp.	flax	Unknown	Forb	Unknown
Lonicera involucrata	twinberry honeysuckle	Native	Shrub	7
Lupinus spp.	lupine	Native	Forb	Unknown
Machaeranthera coloradoensis	Colorado tansyaster	Native	Forb	6
Mahonia repens	creeping barberry	Native	Forb	5
Maianthemum stellatum	starry false lily of the valley	Native	Forb	7
Medicago lupulina	black medic	Non-native	Forb	0
Medicago sativa	yellow flower alfalfa	Non-native	Forb	0
Melilotus albus	white sweet clover	Non-native	Forb	0
Melilotus officianale	yellow sweet clover	Non-native	Forb	0
Mertensia ciliata	chiming bells	Native	Forb	7
Mimulus spp.	monkey flower	Native	Forb	Unknown
Nassella veridula	green needlegrass	Native	Grass	4
Ocopordum acanthium	scotch thistle	Noxious	Forb	0
Oenothera latifolia	mountain evening primrose	Native	Forb	5
Opuntia fragilis	brittle prickly pear	Native	Cactus	3

Scientific Name	Common Name	Status	Type	FQA Value
Oxytropis lambertii	purple locoweed	Native	Forb	5
Packera spp.	groundsel	Native	Forb	Unknown
Pedicularis spp.	Louseworts	Other	Forb	8
Penstemon barbatus	scarlet penstemon	Native	Forb	6
Penstemon mensarum	Grand Mesa penstemon	Native	Forb	5
Penstemon spp.	beardtongue	Native	Forb	Unknown
Phleum pretense	timothy grass	Non-native	Grass	0
Phlox spp.	phlox	Unknown	Forb	Unknown
Picea englemannii	Engelmann spruce	Native	Tree	5
Picea pungens	Colorado spruce	Native	Tree	6
Pinus edulis	Two-needle pine	Native	Tree	6
Pinus ponderosa	Ponderosa pine	Native	Tree	5
Piptatherum micranthum	little ricegrass	Native	Grass	7
Plantago lanceolata	narrowleaf plantain	Non-native	Forb	0
Poa bulposa	bulbous bluegrass	Noxious	Grass	0
Poa compressa	Canada bluegrass	Non-native	Grass	0
Poa fendleriana	muttongrass	Native	Grass	7
Poa pratensis	Kentucky bluegrass	Other	Grass	0
Populus angustifolia	narrowleaf cottonwood	Native	Tree	5
Populus tremuloides	aspen	Native	Tree	5
Potentilla arguta	tall cinquefoil	Native	Shrub	7
Potentilla pensylvanica	Pennsylvania cinquefoil	Native	Forb	6
Potentilla spp.	cinquefoil	Unknown	Forb	Unknown
Prunus virginiana	chokecherry	Native	Shrub	4
Pseudoroegneria spicata	bluebunch wheatgrass	Native	Grass	7
Pseudotsuga menziesii	Douglas fir	Native	Tree	5
Pteridium aquilinum	bracken fern	Native	Forb	5
Purshia tridentata	antelope bitterbrush	Native	Shrub	6
Pyrola asarifolia	liverleaf wintergreen	Native	Forb	8
Quercus gambelii	Gambel oak	Native	Shrub	5
Ribes spp.	gooseberry	Native	Shrub	Unknown
Rosa woodsii	Woods rose	Native	Shrub	5
Rubus idaeus	American red raspberry	Native	Shrub	5
Rubus parviflorus	thimbleberry	Native	Shrub	7
Rumex accetacella	common sheep sorrel	Native	Shrub	0

Scientific Name	Common Name	Status	Type	FQA Value
Salix exigua	narrowleaf willow	Native	Shrub	3
Saxifraga spp.	saxifrage	Native	Forb	Unknown
Schedonorus arundinaceus	tall fescue	Non-native	Grass	0
Senecio spp.	ragwort	Unknown	Forb	Unknown
Senecio triangularis	arrowleaf ragwort	Native	Forb	7
Silene cserii	Balkan catchfly	Non-native	Forb	0
Sisyrinchium montanum	strict blue-eyed grass	Native	Grass	6
Solidago spp.	goldenrod	Unknown	Forb	Unknown
Sphaeralcea cocinia	scarlet globemallow	Native	Forb	4
Sporobolus cryptandrus	sand dropseed	Native	Grass	2
Symphoricarpos rotundifolius	mountain snowberry	Native	Shrub	5
Taraxacum officianale	dandelion	Other	Forb	0
Tetradymia canescens	spineless horsbrush	Native	Forb	6
Thalactrum fendleri	Fendler's meadow-rue	Native	Shrub	6
Tragopogon dubius	yellow salsify	Non-native	Forb	0
Trifolium pratense	red clover	Non-native	Forb	0
Trifolium repens	white Dutch clover	Non-native	Forb	0
Vaccinium myrtillus	mountain blueberry	Native	Shrub	6
Verascum thapsus	common mullein	Noxious	Forb	0
Vicia americana	American vetch	Native	Forb	5
Wyenthia amplexicaulis	mule's ears	Native	Forb	3

Appendix B: ESA-Listed and USFS Region 2 Sensitive Plant Species with Potential to Occur

Species	Status	Habitat Description
Ferns and Allies		
Triangle globe moonwort *Botrychium ascendens*	Sensitive Presence: Possible Habitat: Yes	Triangle globe moonwort is known to occur in the WRNF, within short and tall riparian willow communities with significant moss, gravel, and cobble ground cover on volcanic or granitic alluvium at 8,000 to 10,900 feet in elevation (Beatty et al. 2003) or previously disturbed sites. Suitable habitat may occur in the southern area of the corridor up to McClure Pass.
Angiosperms – Monocots		
Lesser yellow lady's slipper *Cypripedium parviflorum*	Sensitive Presence: Possible Habitat: Yes	This species grows in a variety of habitats from shady, damp forest understory of mixed deciduous and coniferous forests to open meadows and along streams in acidic soils. In Colorado, this species has been reported between 5,800 and 12,600 feet in elevation (Mergen 2006). Suitable habitat may occur in the corridor.
Giant helleborine *Epipactis gigantea*	Sensitive Presence: Possible Habitat: Yes	Giant helleborine grows from southern British Columbia to northern Mexico and eastward in the U.S. to South Dakota and Texas. Throughout its wide range, it occurs infrequently but can be locally abundant. This species must have a permanent and constant source of water at the roots. In Colorado, this species occupies seeps, streambanks, and hanging gardens between 4,800 and 6,500 feet in elevation (Rocchio et al. 2006). Although there are no known occurrences of this species in the WRNF, habitat is present and occurrences are possible.
Slender cottongrass *Eriophorum gracile*	Sensitive Presence: Possible Habitat: Yes	Slender cottongrass is known to occur in the mountainous areas of Colorado and Wyoming and the Sandhills region of north-central Nebraska and southern South Dakota. It inhabits fens and subalpine wet meadows with saturated soils. Elevations of occurrences range from 7,000 to 11,140 feet in Colorado. It is not known to occur in Pitkin County (Decker et al. 2006). No fens are located within or near the corridor, but suitable habitat within wet meadows may be present at Filoha Meadow (although elevation may limit habitat).
Ute ladies'-tresses orchid *Spiranthes diluvialis*	Threatened Presence: Known Habitat: Yes	Ute ladies'-tresses orchid is a perennial herb that occurs at elevations below 6,500 feet in moist to wet alluvial meadows, floodplains of perennial streams, and around springs and lakes (USFWS 1995). A population is known at Filoha Meadows, and it may be present elsewhere where habitat is present.
Angiosperms – Dicots		
Park milkvetch *Astragalus leptaleus*	Sensitive Presence: Possible Habitat: Possible	Park milkvetch is known from western Montana to east-central Idaho and south to the Rocky Mountains in Colorado. This species occurs in sedge-grass meadows, swale, and hummocks; at the edges of meandering mountain brooks; and among streamside willows at elevations between 6,600 and 9,500 feet. This species is known in Summit County but not known in Pitkin County (NatureServe 2016). The corridor occurs within the elevation range of this species, and suitable habitat could be present.

Species	Status	Habitat Description
Hall's fescue (plains rough fescue) *Festuca hallii*	N/A, Rare Presence: Not suspected Habitat: Possible	Known only from five occurrences in Colorado within Park, Larimer, Huerfano, and Custer Counties, Hall's fescue is extremely rare. Seventeen occurrences have been documented in Region 2 (10 of which are on the Shoshone NF in northwestern Wyoming) (Anderson 2006). Habitat requirements are poorly known but include alpine tundra, subalpine grasslands, meadows, grassy slopes, and woodland margins (NatureServe 2017). Historic accounts suggest that it occurs at elevations between 6,800 and 11,500 feet. It is not known if it still occurs in Colorado, and it has not been documented in the WRNF (Anderson 2006).
Colorado tansyaster *Machaeranthera coloradoensis*	Sensitive Presence: Possible Habitat: Yes	This species occurs in small populations in Colorado and Wyoming, in subalpine and alpine environments in meadows, openings, gravelly places, or rock outcrops (often on sandstone or limestone), and tundra at elevations above 8,500 feet (NatureServe 2016). Habitat for this species may occur at and near McClure Pass.
Kotzebue's grass of Parnassus *Parnassia kotzebuei*	Sensitive Presence: Not suspected Habitat: Possible	This obligate wetland species grows in mesic to wet, arctic, and alpine habitats and is found in scattered locations at high elevations in Washington, Nevada, Idaho, Wyoming, and Colorado. This species can occur in tundra and moist to wet rocky places, in moss mats, and along streams, lakeshores, ponds, seeps, and creeks. It is found primarily above tree line but also in subalpine forest openings, on rocky coniferous slopes, and in deep spruce forests. Elevation ranges are between 9,400 and 12,280 feet. Occurrences are usually in remote, infrequently visited areas, and none are known in Pitkin County (Panjabi and Anderson 2007). Habitat for this species may be present, but is not likely, in the corridor at and near McClure Pass.
Harrington's penstemon *Penstemon harringtonii*	Sensitive Presence: Possible Habitat: Yes	This is a Colorado endemic species known from Grand, Eagle**,** Routt, Garfield, Pitkin, and Summit Counties. This species occurs in sagebrush flats with some scattered pinyon-juniper in rocky loam and alluvially derived soils, at elevations between 6,400 and 9,400 feet (NatureServe 2016). Habitat for this species may be present in sagebrush flats with scattered pinyon-juniper at Placita, Janeway, and other scattered locations.
Dwarf raspberry *Rubus arcticus* ssp. *acaulis*	Sensitive Presence: Possible Habitat: Yes	Dwarf raspberry is known from mountainous areas in Colorado and Wyoming. In USFS Region 2, this species grows in montane and subalpine environments at elevations between 7,000 and 9,720 feet. It grows in the upper montane willow zone and has been reported to grow in boggy woods, marshes, mountain meadows, and alpine tundra. In Colorado, it is only reported in Grand, Jackson, and Park Counties (Ladyman 2006). Although habitat may be present in the corridor, this species has not been documented in the WRNF.
American cranberry bush *Viburnum opulus* var. *americanum*	Sensitive Presence: Not suspected Habitat: Yes	American cranberry bush is classified as a wetland plant. In Colorado, this species is typically not listed as part of the flora and is not known to occur in the state, although it is possible that it does occur, and unconfirmed occurrences have been noted (NatureServe 2016), some of which are in the Roaring Fork watershed. It has been observed at elevations between 4,200 and 5,000 feet in Wyoming. The corridor may have suitable habitat for this species in wetland areas below 5,000 feet.

Appendix C: ESA-Listed and USFS Region 2 Sensitive Species with Potential to Occur

Species	Status	Habitat Description	Field Review Approach
Canada lynx *Lynx canadensis*	Threatened with Final Critical Habitat Presence: Known Habitat: Yes	In the southern Rocky Mountains, Canada lynx occur within subalpine and upper montane forest zones, usually above 8,000 feet in elevation. Lynx use riparian areas during the fall. Known lynx populations are located in the potential action area, and the McClure Pass area is a lynx linkage area. Because the McClure Pass area is a lynx linkage area, additional coordination and possible consultation with the USFWS may be required, under the 2014 Lynx Conservation Plan update.	Consider year-round conditions, including winter, and potential impact, both of proposed project and cumulative, in analysis
North American wolverine *Gulo gulo luscus*	Proposed Threatened Presence: Not Suspected Habitat: Yes	North American wolverines use arctic, subarctic, and alpine habitats receiving ample snow that persists into the spring. Habitat for the wolverine is located within the action area, yet none are currently known to occur in Colorado.	Not likely an issue
Fringed myotis *Myotis thysanodes*	Sensitive Presence: Possible Habitat: Yes	Fringed myotis occur primarily at middle elevations in desert, riparian, grassland, and woodland habitats, but have been known to occur at elevations up to 8,200 feet. They roost in caves, mines, cliff faces, rock crevices, old buildings, bridges, snags, and other sheltered sites. In Colorado, most maternity roosts have been observed in crevices of rock faces, sometimes in abandoned mines or abandoned cabins. In spring and summer, males roost separately and are rarely found in nursery colonies. Winter habits are poorly known; hibernacula include caves, mines, and buildings (NatureServe 2016).	Document potential habitat and conduct nighttime acoustic surveys within habitat
Hoary bat *Lasiurus cinereus*	Sensitive Presence: Likely Habitat: Yes	Hoary bat habitat primarily consists of deciduous and coniferous forests and woodlands, including areas altered by humans. Foraging habitat includes various open areas, including spaces over water and along riparian corridors. Individuals may forage around lights in nonurban situations. Roost sites are usually in foliage of large deciduous or coniferous trees, near the end of branches 3–19 meters above ground, with dense foliage above and open flying room below, often at the edge of a clearing and commonly in hedgerow trees. Sometimes these bats roost in rock crevices or other sites, rarely in caves. Individuals have a low level of roost fidelity. Hibernating individuals have been found in various situations, such as on tree trunks, in a tree cavity, in a squirrel's nest, and in a clump of Spanish moss (NatureServe 2017).	Document potential habitat and conduct nighttime acoustic surveys within habitat
Spotted bat *Euderma maculatum*	Sensitive Presence: Possible Habitat: Yes	This solitary rapid-flying bat occurs in various habitats from desert to montane coniferous stands, including open ponderosa pine, pinyon-juniper woodland, canyon bottoms, riparian and river corridors, meadows, open pasture, and hayfields. Active foraging may be mostly in open terrain, including forest clearings, meadows, and open wetlands, sometimes in open areas near buildings (NatureServe 2016).	Document potential habitat and conduct nighttime acoustic surveys within habitat

Species	Status	Habitat Description	Field Review Approach
Townsend's big-eared bat *Corynorhinus townsendii townsendii*	Sensitive Presence: Possible Habitat: Yes	This species prefers relatively cold places for hibernation, often near entrances of structures and caves and in well-ventilated areas. It uses caves, buildings, and tree cavities for night roosts. Throughout much of its known range, this bat commonly occurs in mesic habitats characterized by coniferous and deciduous forests (NatureServe 2016).	Document potential habitat and conduct nighttime acoustic surveys within habitat
American marten *Martes americana*	Sensitive Presence: Possible Habitat: Yes	American martens occur in dense deciduous, mixed, or coniferous upland and lowland forest. When inactive, martens occupy holes in dead or live trees or stumps, abandoned squirrel nests, conifer crowns, rock piles, burrows, and snow cavities. In winter, they use mainly subnivean sites, often associated with coarse woody debris. Young are born in a den, usually in a hollow tree but sometimes in rock. The adult diet consists mainly of small mammals, birds, insects, and carrion. Berries and other vegetable matter are eaten in season. Foraging occurs in trees and on the ground. Martens track prey, ambush, rob nests, excavate burrows, and use hunting perches. They also exploit subnivean prey (e.g., voles and squirrels) (NatureServe 2016).	Document habitat and any incidental observation of sign or presence
Pygmy shrew *Microsorex hoyi*	Sensitive Presence: Possible Habitat: Possible	Pygmy shrew habitat includes moist coniferous forest, late-seral stands, and mosaics of wet and dry forest types. Plant species in pygmy shrew habitat generally include Engelmann spruce, subalpine fir, aspen, riparian willows, sphagnum, or sedges. An abundance of coarse woody debris on the ground likely enhances the habitat for pygmy shrews (NatureServe 2016). The species appears to be limited to specific high-quality bogs, wetlands, and wet meadows in subalpine spruce-fir forests of Colorado. Populations are small, isolated, and vulnerable to injurious habitat modification.	Document any incidental observation of sign or presence and habitat; not likely to occur due to elevation
River otter *Lontra canadensis*	Sensitive Presence: Not suspected Habitat: Yes	This species is found in streams, lakes, ponds, swamps, marshes, estuaries (in some areas), and beaver flowages. When inactive, otters occupy hollow logs; space under roots, logs, or overhangs; abandoned beaver lodges; dense thickets near water; or burrows of other animals. Such sites also are used for rearing young. River otters may travel long distances overland, particularly in snow (NatureServe 2016).	Document any incidental observation of sign or presence and habitat; known in the Crystal River at the confluence with the Roaring Fork, but not in the Crystal River Valley
Rocky Mountain bighorn sheep *Ovis canadensis canadensis*	Sensitive, MIS Presence: Not suspected Habitat: No	Bighorn sheep occur in mesic to xeric, alpine to desert grasslands or shrub-steppe in mountains, foothills, or river canyons. Many of these grasslands are fire-maintained. Suitable escape terrain (e.g., cliffs and talus slopes) is an important feature of sheep habitat (NatureServe 2016). Sheep use primarily alpine tundra and associated rocky cliff areas during summer. In winter, they use lower-elevation open, grassy benches and southerly slopes, with some herds wintering on windswept ridges at high elevations.	Engage with best available science, recent studies, and historic and recent accounts for analysis. Record incidental observations

Species	Status	Habitat Description	Field Review Approach
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	Threatened Presence: Possible Habitat: Unknown	The western yellow-billed cuckoo nests almost exclusively in multistoried dense vegetation riparian woodlands composed of cottonwood, willow, and occasionally tamarisk or other riparian woodland species that is 12 acres (5 ha) or greater in extent (USFWS 2013). Elevation range is generally below 6,000 feet (1,830 meters) within arid to semiarid landscapes, although it may occur at elevations up to 8,500 feet (2,590 meters). Habitat patches as small as 1.2 acres (0.5 hectares) can support one or two breeding pairs. Nests are typically placed in trees where the plant growth is most dense, where trees and shrubs have vegetation near ground level, and where there is a low-density canopy (USFWS 2013). Migrants may stopover in small riparian patches that would be unsuitable for breeding (NatureServe 2017).	Document any potential habitat in the corridor for analysis or further review or dismissal
American bittern *Botaurus lentiginosus*	Sensitive Presence: Not suspected Habitat: Yes	This species uses primarily large freshwater marshes, including lake and pond edges where cattails, sedges, or bulrushes are plentiful and marshes where there are patches of open water and aquatic-bed vegetation. It also occurs in other areas with dense herbaceous cover, such as shrubby marshes, bogs, wet meadows, and less commonly in hayfields. American bitterns nest primarily in inland freshwater wetlands, sparsely vegetated wetlands, or dry grassy uplands. Breeding occurs primarily in wetlands with tall emergent vegetation (NatureServe 2016; Cornell Lab of Ornithology 2016).	Document any incidental observation of sign or presence and habitat
Northern harrier *Circus cyaneus*	Sensitive Presence: Not Suspected Habitat: Yes	This species breeds in marshes, meadows, grasslands, and cultivated fields. It nests on the ground, commonly near low shrubs, in tall weeds or reeds, in bogs, on higher shrubby ground near water, or on dry marsh vegetation. Northern harriers use agricultural fields and wetlands as hunting and nonbreeding territory (NatureServe 2016). Breeding habitat is located within the WRNF, and parts of the action area overlap wetlands and open fields around waterbodies that would provide habitat for northern harriers.	Document any observations; conduct general raptor surveys in habitat
American peregrine falcon *Falco peregrinus anatum*	Sensitive, MIS Presence: Possible Habitat: Yes	This species is found across a wide variety of open habitats including tundra, moorlands, steppe, and seacoasts (especially where there are suitable nesting cliffs) to mountains, open forested regions, and human population centers. The falcon nests on cliff ledges and rocky crags. When not breeding, this species occurs in areas where prey concentrate, including farmlands, marshes, lakeshores, river mouths, tidal flats, dunes and beaches, broad river valleys, cities, and airports (NatureServe 2016). Peregrine nest sites and foraging habitat are located within the Crystal River Valley, and historic presence is documented.	Survey known nest sites; document any observations; conduct general raptor surveys in habitat

Species	Status	Habitat Description	Field Review Approach
Bald eagle *Haliaeetus leucocephalus*	Sensitive, MIS Presence: Possible Habitat: Yes	This species' breeding habitat most commonly includes areas within 2.5 miles of waterbodies that reflect the general availability of primary food sources including fish, waterfowl, and carrion. Bald eagles usually nest in tall trees or on pinnacles or cliffs near water. Tree species used for nesting vary regionally and may include pine, spruce, fir, cottonwood, poplar, willow, sycamore, oak, beech, and others (NatureServe 2016). Bald eagles occur on the WRNF and are known to nest at sites immediately adjacent to large streams or rivers and some large lakes. Bald eagle nesting and foraging habitat are located within the Crystal River Valley, and historic presence is documented.	Document any observations; conduct raptor surveys in habitat
Boreal owl *Aegolius funereus*	Sensitive Presence: Possible Habitat: Yes	This species inhabits dense coniferous forest, mixed forest, and thickets of alder, aspen, or stunted spruce, most commonly in proximity to open grassy areas and muskeg bogs. In the Rockies, it occurs generally in mature multilayered spruce-fir forest. Boreal owls roost in dense cover by day and in cool microsites in summer, and frequently change roosting sites. They nest between April and June (NatureServe 2016).	Document potential habitat and conduct nighttime acoustic surveys within habitat
Black swift *Cypseloides niger*	Sensitive Presence: Not suspected Habitat: No	This species forages over forests and in open areas and nests in dark inaccessible sites with unobstructed flight paths, such as nests behind or next to waterfalls and wet cliffs, and occasionally in limestone caves (NatureServe 2016). Black swifts are known to occur in the WRNF, and the Crystal Valley may provide suitable waterfall or wet cliff habitat.	Document incidental observations and presence of habitat; consider in analysis
Brewer's sparrow *Spizella breweri*	Sensitive Presence: Possible Habitat: Not likely	This species is a sagebrush obligate and prefers extensive open sagebrush (*Artemisia* spp.) habitats. It is tied to sagebrush for food, nesting, and roosting (Cornell Lab of Ornithology 2016). Its breeding season begins in May and continues through June (NatureServe 2016). The corridor has patches of sagebrush at Janeway, Placita, and elsewhere, but it may not be adequate in size to sustain populations.	Document sagebrush habitat if present, and any incidental observations
Columbian sharp-tailed grouse *Tympanuchus phasianellus columbianus*	Sensitive Presence: Not likely Habitat: Not likely	This species nests and breeds in native bunchgrass and shrub-steppe communities. Deciduous shrubs are critical for winter food and escape cover, and bunchgrasses and perennial forbs are important components of nesting and brood-rearing habitat (Hoffman and Thomas 2007). The proposed action is outside of the current range of the species (USFS 2008b).	Document suitable habitat and incidental observations

Species	Status	Habitat Description	Field Review Approach
Ferruginous hawk *Buteo regalis*	Sensitive Presence: Not suspected Habitat: No	This species occupies open country including prairies, plains, and badlands; and sagebrush, saltbush-greasewood shrubland on the periphery of pinyon-juniper and other woodlands, and deserts. It nests in tall trees or willows along streams or on steep slopes, in junipers, on cliff ledges, on river-cut banks, on hillsides, on power line towers, and sometimes on sloped ground on the plains or on mounds in open desert. It generally avoids areas of intensive agriculture or human activity (NatureServe 2016). This species occurs incidentally during migration in the WRNF (USFS 2008b).	Consider impacts for species during winter
Flammulated owl *Otus flammeolus*	Sensitive Presence: Possible Habitat: Yes	This species' habitat includes open montane conifer forests containing mature ponderosa and Jeffery pine with some brush or saplings, in cooler semiarid climate, with a high abundance of nocturnal arthropod prey and some dense foliage for roosting. It nests in abandoned tree cavities in large-diameter pine, Douglas-fir, or aspen trees. They nest between April and June (NatureServe 2016). Forest types preferred by owls occur within the project area, and potential nesting territories for flammulated owls could overlap the action area.	Document potential habitat and conduct nighttime acoustic surveys within habitat
Lewis's woodpecker *Melanerpes lewis*	Sensitive Presence: Possible Habitat: Yes	This species occupies open forest and woodland, often logged or burned, including oak, coniferous forest, primarily ponderosa pine, riparian woodland and orchards, and less commonly in pinyon-juniper. Its distribution is closely associated with open ponderosa pine forest in western North America and is strongly associated with fire-maintained old-growth ponderosa pine. Important habitat features include an open tree canopy, a brushy understory with ground cover, dead trees for nest cavities and dead or downed woody debris, perch sites, and abundant insects (NatureServe 2016).	This species is very likely to occur; document habitat and conduct a thorough evaluation of habitat for presence
Northern goshawk *Accipiter gentilis*	Sensitive Presence: Possible Habitat: Not likely	In the western U.S., this species characteristically nests in coniferous forests including those dominated by ponderosa or lodgepole pine, or in mixed forests dominated by various coniferous species including fir, Douglas-fir, cedar, hemlock, spruce, and larch. Goshawks also nest in deciduous forests dominated by aspen, paper birch, or willow. Nesting occurs between late April and August (NatureServe 2016). Goshawks have been documented throughout the WRNF in suitable habitat.	Document suitable habitat and incidental observations
Olive-sided flycatcher *Contopus cooperi*	Sensitive Presence: Possible Habitat: Yes	Olive-sided flycatchers breed in various forest and woodland habitats, subalpine coniferous forest, mixed coniferous-deciduous forest, burned-over forest, spruce bogs and other forested wetlands, and along the forested edges of lakes, ponds, and streams. Most nesting sites contain dead standing trees, which are used as singing and feeding perches. Nests are placed most often in conifers, on horizontal limbs 2 to 15 meters from the ground (NatureServe 2016). The proposed activity locations may have habitat for this species.	Document suitable habitat and incidental observations

Species	Status	Habitat Description	Field Review Approach
Purple martin *Progne subis*	Sensitive Presence: Possible Habitat: Yes	This species occupies a wide variety of open and partly open habitats, frequently near water in mature aspen stands. Birds nest in abandoned woodpecker holes in trees. In Colorado, purple martins are semicolonial, with multiple pairs of martins nesting in the same tree stand. They feed in open areas, especially near water (NatureServe 2016). The Crystal River Valley may have suitable habitat.	Document suitable habitat and incidental observations
Sage sparrow *Amphispiza bellii*	Sensitive Presence: Possible Habitat: Yes	A sagebrush obligate, this species is closely tied to sagebrush shrub-steppe and may occupy pinyon-juniper woodlands. It generally prefers a relatively high percentage of shrub cover, a high percentage of bare ground, and horizontal patchiness in the shrub community. It prefers as nest sites taller shrubs with larger canopies. Sage sparrows prefer large patches of sagebrush (CPW 2005). While there are patches of sagebrush in the Crystal River Valley, notably at Placita, they are not likely adequate to support sage sparrow breeding or foraging.	Document suitable habitat and incidental observations
Monarch butterfly *Danaus plexippus*	Sensitive Presence: Possible Habitat: Yes	This species breeds in areas that contain milkweed patches (*Asclepia* spp.) in North America and some other regions. The critical conservation feature for North American populations is the overwintering habitats in certain high-altitude Mexican conifer forests or coastal California conifer or eucalyptus groves as identified in literature (NatureServe 2017).	Document and map any observation of milkweed within the corridor, and any incidental observations
Western bumblebee *Bombus occidentalis*	Sensitive Presence: Possible Habitat: Yes	This species was widespread and common throughout the western United States and western Canada before 1998, when it experienced a population crash. Viable populations are still present in Colorado. Bumblebees are generalists that adapt to local climate conditions, will visit a range of different plant species, and are important generalist pollinators of a wide variety of flowering plants and crops (USFS 2012).	Plant community structure and diversity will inform the analysis of potential habitat
Boreal toad *Bufo boreas*	Sensitive, MIS Presence: Possible Habitat: Yes	Boreal toads occur in mountain wetlands. Their range includes various upland habitats around ponds, lakes, reservoirs, and slow-moving rivers and streams. Breeding boreal toads are known to occur in the WRNF (USFS 2008b), and several project activities occur near waterbodies with potential habitat (e.g., Roaring Fork River, Hunter Creek, and Lost Man Reservoir).	Document suitable habitat and incidental observations
Northern leopard frog *Lithobates pipiens*	Sensitive Presence: Possible Habitat: Yes	Northern leopard frogs live near springs, slow streams, marshes, bogs, ponds, canals, floodplains, reservoirs, and lakes; usually they are in or near permanent water with rooted aquatic vegetation. In summer, they commonly inhabit wet meadows and fields. Two populations are known in the WRNF (USFS 2002b).	Document suitable habitat and incidental observations

ERO

Consultants in Natural Resources and the Environment

Carbondale to Crested Butte Trail Study – Crystal River Section

Addendum to Environmental Review: Socioeconomic Analysis

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Cover Photo: Existing Crystal River Trail north of Carbondale

Introduction

This addendum is meant to accompany and supplement the Carbondale to Crested Butte Crystal River Trail Segment Environmental Review, prepared for Pitkin County Open Space and Trails (OST). This report summarizes relevant socioeconomic conditions and potential changes that may result from the proposed Crystal River section of the Carbondale to Crested Butte trail. Topics covered include:

- An overview of recreation trends, a general description of the proposed project, and potential costs.
- A baseline description of the demographic, social, economic, and land use patterns of the communities where the trail would be built and where the most likely trail users reside.
- An overview of preferences and concerns voiced by the public during the trail planning process, through survey results, public comments, and public meetings conducted by OST and Pitkin County.
- A review of relevant literature on multiuse trails projects, with case studies that relate to the issues identified by the community during the planning process.
- An analysis of potential socioeconomic benefits and impacts from the proposed trail project.

Methods

Study Area

The study area includes Pitkin County and Garfield County and the communities located within the Crystal Valley (Figure 1). A general overview of these two counties provides context for understanding the more localized social and economic patterns within the Crystal Valley's communities. When appropriate, Colorado is included to provide a comparison to statewide trends. Descriptions of the communities where effects from the trail may be more noticeable follow the county baseline descriptions.

The Crystal Valley within Garfield County includes the town of Carbondale and the rural areas between Carbondale and the Pitkin County line. The Crystal Valley in Pitkin County includes residential developments, homes, and the community of Redstone located between the county line and McClure Pass. Carbondale is the most densely populated area in the Crystal Valley.

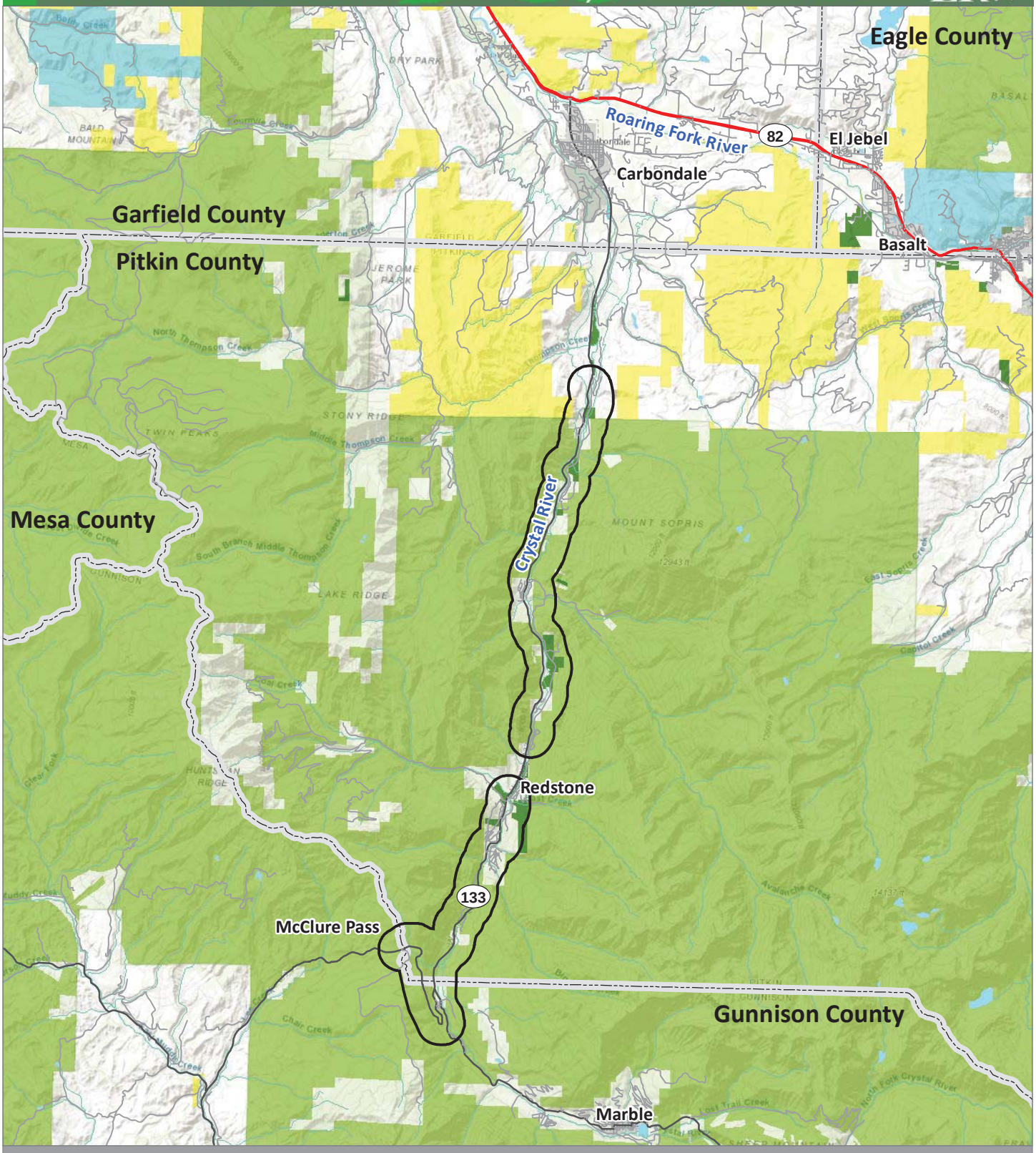
Data

Data for the baseline descriptions of counties were collected from the U.S. Census Bureau's (USCB) American Community Survey (ACS) 5-year estimates for 2012 to 2016, and are referenced as USCB 2016. Historic demographic and economic data were collected from the USCB's decennial census counts and are referenced as USCB 1990, 2000, and 2010. Community-level data for the Crystal Valley communities are from ACS census block groups and places from the same period. Other data sources include the Colorado Department of Local Affairs (DOLA 2010), Colorado Department of Transportation (CDOT 2018), and Headwaters Economics Economic Profile System (EPS 2016a and 2016b).

The overview of public preferences and concerns was informed by public comment and survey data and summaries that were collected and prepared by OST during the trail planning process. Other sources that informed the analysis include publicly available documents from Pitkin County, the Crystal Caucus, and the Town of Carbondale; journalism articles; and other publications relevant to the study area.

Carbondale to Crested Butte Trail Study

ERO



Socioeconomics

- Trail Study Area
- River/Stream
- Pitkin County Open Space
- USFS
- BLM
- State of Colorado

0 1.5 3 Miles

February 28, 2018

Background research, literature, and relevant case studies were accessed from various sources, including Headwaters Economics, academic peer-reviewed journals, the U.S. Forest Service, and public sources. Trail usage data were obtained from Pitkin County's DataNet site, which compiles usage data for the county's trails (DataNet 2018). Trail usage economic multipliers were estimated based on a review of research and the *Economic and Health Benefits of Bicycling and Walking* report that was completed for the Colorado Office of Economic Development and International Trade, Colorado Department of Public Health and the Environment, CDOT, and the Colorado Pedals Project (BBC 2016).

Summary of Findings

- Population, residential development, and highway traffic in the study area will likely increase.
- Recreation and tourism will continue to be an important part of the local economy and culture.
- Population growth and development in the Crystal Valley will increase pressure on wildlife habitat and ecological resources; trail development is not likely to have an isolated impact on those resources.
- Trail *construction* would result in temporary employment and economic activity but would not result in long-term economic growth.
- Trail *implementation and use* would likely attract additional out-of-region tourism, with anticipated expenditures of about $94.00 per day (number of tourist visits is unknown at this time).
- Economic benefits from local users (residential, commuters, recreationists) are assumed to be up to $21.00 per day, resulting in up to about $157,000 per year.
- Trail development may attract new residents to the Crystal Valley who value expanded connectivity and recreation activities.
- Trail development would open up recreation opportunities to more diverse user groups including minority and low-income communities and those with less access to recreation opportunities.
- Trail development would likely result in more non-motorized visitors, including residents from nearby communities and out-of-region/out-of-state tourists.
- Trail construction could raise privacy concerns among adjacent landowners.
- Construction of a trail that is off Highway 133 would result in increased pedestrian and recreationist safety.

Project Context and Background

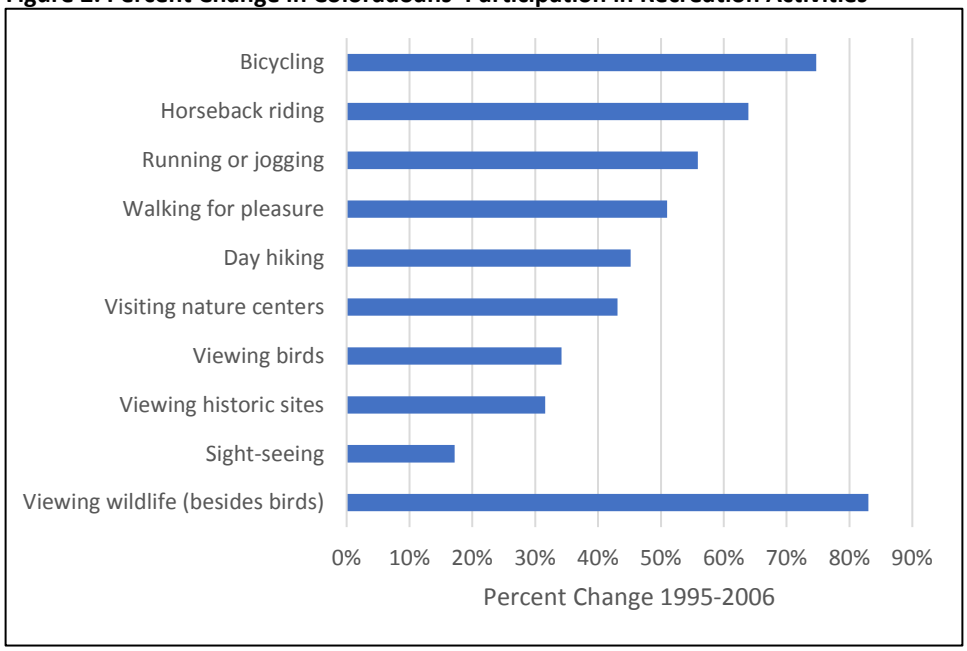
The proposed trail segment through the Crystal Valley to Redstone would be a multiuse trail that would accommodate bikers, walkers, equestrians, joggers, and other non-motorized recreationists. Pitkin County OST manages approximately 80 miles of multiuse trail, including the Lower Crystal River Trail. OST also manages several open space parcels within the Crystal Valley, including Red Wind Point, Crystal River Parcel, and Filoha Meadows. OST has management plans in place for Red Wind Point and Filoha Meadows that stipulate types of usage and seasonal closures for sensitive wildlife habitat.

State Recreation Trends

Based on a 2013 survey of Colorado residents, participation in land-based recreation activities has increased by 53 percent since 1995. Participation in activities that would be appropriate for a multiuse trail such as the proposed trail segment has increased (Figure 2). The growth in recreation participation has outpaced overall population growth in the state (Colorado Statewide Comprehensive Recreation Plan 2014). In 2006, an estimated 90 percent of Colorado residents participated in trail, street, or road recreation activities, and 96 percent participated in land resource-based activities (Colorado Parks and Wildlife [CPW] 2014).

Hiking, walking, and picnicking are the three most popular outdoor recreation activities across the state. As information about recreation activities becomes more widely available and population increases, recreation participation by state residents is likely to increase.

Figure 2. Percent Change in Coloradoans' Participation in Recreation Activities



Source: CPW 2014

Coloradoans' participation in recreation tends to increase with income and education and decrease with age (CPW 2014). White non-Hispanic or Latino and Native American Coloradoans have the highest visitation rates to wilderness or primitive areas, while white non-Hispanic or Latino and Hispanic or Latino residents have the highest participation rates in hiking. All demographic groups have high participation rates in walking for pleasure, while about a third of all groups participate in mountain biking.

Economic Impacts of Recreation

Recreation is an important part of Colorado's economy and contemporary culture. Based on USCB estimates, 11 percent of the employment in the state is derived from recreation, arts, and the tourism industry (USCB 2016). Recreation and tourism account for almost a third of the direct employment in Pitkin County (USCB 2016), and many more jobs are indirectly related to the industry. The *Economic and Health Benefits of Bicycling and Walking* report estimated that 2.2 million out-of-state bicycle tourists visit Colorado annually, each spending an estimated $93.92 per day in the state's communities. The total value of expenditures by out-of-state tourists who participated in bicycling in Colorado in 2016 was $317 million (BBC 2016).

Regional Recreation Trends

Northwest Colorado, where Pitkin County is located, is characterized by having an abundance of outdoor recreation opportunities. Residents of the region tend to stay close to home, while the state's broader population tends to recreate in other parts of the state (CPW 2014). Walking, hiking, mountain biking, road biking, jogging, and wildlife viewing account for the most popular activities in the region (CPW 2014).

Pitkin County Trails Use and Trends

The proposed trail segment would be a continuation of the Lower Crystal River Trail, which begins at the Rio Grande Trail in Carbondale and ends at the BRB KOA campground in Pitkin County. Use of the Crystal Trail has exceeded 10,000 individuals every year since 2010, with approximately 11,000 visits in 2017. The Rio Grande Trail, which runs through the Roaring Fork Valley between Aspen and Glenwood Springs, generally has between 25,000 and 100,000 visits per year.

Based on increases in use of the Crystal Valley Trail over time, and anticipated population growth in Carbondale and the Crystal Valley, trail use is likely to increase in the future. Other trails managed by OST have between 5,000 and 125,000 visits per year (DataNet 2018). The trails with a high number of users are located within the Roaring Fork Valley near Aspen, where population density is greater than in the Crystal Valley.

Proposed Trail Description

Much of the proposed Carbondale to Crested Butte trail would be constructed on U.S. Forest Service land in Gunnison County. The approximately 21-mile segment in the Crystal Valley between the terminus of the Lower Crystal River Trail and McClure Pass is an important missing link crossing U.S. Forest Service and Pitkin County land (Figure 1).

Trail Planning Process

In 2017, Pitkin County OST initiated the current phase of planning for the trail segment in this study area. (Several previous studies, dating back to the 1990s, had envisioned this trail.) Planning efforts in 2017 included the development of multiple alignment alternatives, an engineering study outlining the feasibility and cost of various alternatives, and an environmental review of the preliminary alternatives. Based on this process, two proposed alternatives for the trail are currently being considered by Pitkin County (Figure 1):

- Alternative A – Follows the west side of the Crystal River along the Colorado State Highway 133 (Highway 133) right-of-way (ROW).
- Alternative B – Follows a historic railroad grade and wagon roads along the east side of the Crystal River.
- Bridges – Up to 13 bridge locations to cross between Alternative A and B segments.

The northern segment between the BRB KOA campground and Redstone would likely include a combination of both highway ROW (Alternative A) and off-highway alignments (Alternative B). The trail through this segment would be a wider, surfaced pathway (asphalt or crusher fines) that is typical of regional trails. OST and Pitkin County are evaluating the preferred alternative based on topography, environmental values, community preferences, engineering and construction costs, and land ownership and availability.

South of Redstone to McClure Pass, the proposed trail would either follow a historic wagon road (Alternative B) or continue along the shoulder of Highway 133 (Alternative A). The trail though this section would be natural-surface single-track. Trail construction costs would depend on the final alignment and could range from $18.7 million (Alternative B) to $100 million (Alternative A) (Loris and Associates 2017). The ultimate trail alignment could be a combination of segments from both alternatives.

County and Community Baseline

Baseline descriptions of the counties and the communities provide an understanding of how a proposed project may impact the economies, social patterns, and ways of life.

County Baseline Social and Economic Descriptions

Residents and communities in Pitkin and Garfield are most likely to be affected by trail implementation, while residents and communities in Gunnison County may also be impacted by the larger Carbondale to Crested Butte trail project. Residents of these three counties, as well as Eagle, Delta, and Mesa Counties, participated in the public comment opportunity during trail planning. The demographics in Pitkin and Garfield Counties are discussed in greater depth below.

County Demographics

Population and Age

Garfield County has over three times the population and the land area of Pitkin County, and the median age in Pitkin County is substantially older than in Garfield County (Table 1). Population densities are comparable. Figure 3 shows the percentage of total population by age group for Garfield County and Pitkin County. A larger proportion of Pitkin County's population is above 45 years of age, while a larger proportion of Garfield County's population is under 19 years of age.

Table 1. Population and age characteristics of Pitkin and Garfield Counties

Demographic Indicator	Colorado	Pitkin County	Garfield County
Population (2016)	5,359,295	17,543	57,495
Population change 2000–2016	26%	18%	31%
Land area	104,185 mile^2	973 mile^2	3,260 mile^2
Population density	0.19 people/mile^2	0.055 people/mile^2	0.057 people/mile^2
Hispanic and Latino	21.1%	9.8%	27.9%
Non-white, non-Hispanic	31.1%	31.2%	13.9%
No high school degree	9.0%	4.6%	13.1%
Bachelor's degree or higher	38.7%	60.4%	29.1%
Median age	36.4	43.2	36.1
Population 18 and under	17%	18%	28%
Population 65 and over	13%	16%	11%

Source: USCB 2016; EPS 2016a, 2016b

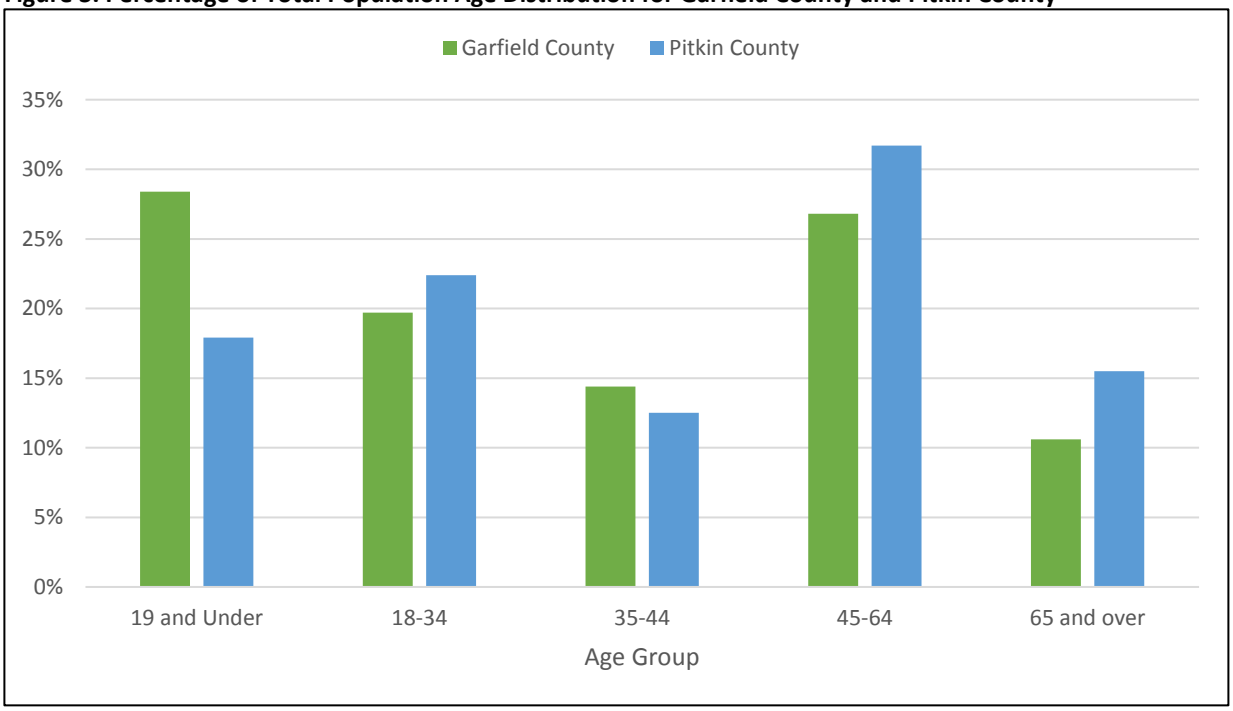
Population Trends and Projections

Garfield County has experienced rapid growth since 1990, outpacing Pitkin County's growth by more than double its percentage (160 percent compared to 32 percent). More recently, population growth has slowed in both counties. Between 2010 and 2016, the population growth in the two counties was comparable (Table 1).

Garfield County's population is anticipated to reach over 100,000 people by 2050, while Pitkin County's population is expected to reach just over 23,000 by 2050 (Figure 4). Pitkin County is expected to grow by 0.6 to 0.8 percent each year through 2050, while Garfield County is expected to grow by 1.4 to 2.1 percent each year. Between 2010 and 2016, population growth was mostly attributed to an increase is residents over 65 years of age in both counties. Pitkin County experienced substantial increases in the

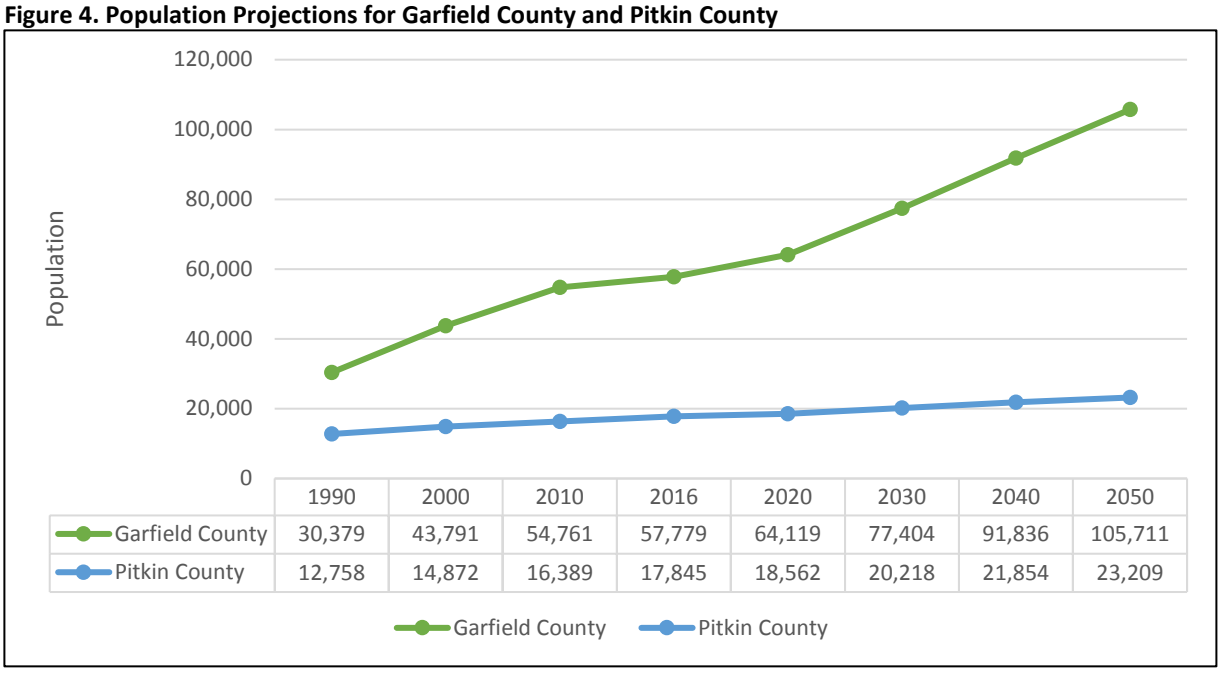
number of residents age 20 to 34 years. Both counties saw decreases in the proportion of younger residents overall.

Figure 3. Percentage of Total Population Age Distribution for Garfield County and Pitkin County



Source: EPS 2016a

Figure 4. Population Projections for Garfield County and Pitkin County



	1990	2000	2010	2016	2020	2030	2040	2050
Garfield County	30,379	43,791	54,761	57,779	64,119	77,404	91,836	105,711
Pitkin County	12,758	14,872	16,389	17,845	18,562	20,218	21,854	23,209

Source: USCB 1990, 2000, 2010, 2016; DOLA 2010

Education

Pitkin County has a high percentage of residents with a bachelor's degree or higher, and a low percentage of people with no high school degree, compared to Colorado and Garfield County (Table 1). Garfield County has a higher percentage of people with no high school degree than the state, and a lower percentage of people with a bachelor's degree or higher.

Race and Ethnicity

A large majority of Garfield and Pitkin Counties' populations describe their race as white and their ethnicity as non-Hispanic or Latino (Table 1). The largest minority group in all three areas self-identifies as Hispanic or Latino. Garfield County has a greater proportion of Hispanic and Latino residents compared to Colorado. Pitkin County has a greater proportion of non-minority race and ethnicity populations compared to Colorado.

County Economic Conditions

Individual and household incomes in Pitkin County are higher than in Garfield County and in Colorado (Table 2). Pitkin County's family poverty rate is almost half that of Garfield County and Colorado. Unemployment rates in the counties are comparable to each other and to Colorado (Table 2). Between 2010 and 2016, Pitkin County's unemployment rate more than doubled (from 1.8 to 4.2 percent), while its number of jobs grew at nearly half the rate of the state. During the same period, Garfield County's number of jobs decreased slightly and remained below the state average, while its unemployment rate increased and was slightly higher than the state average.

Table 2. Economic characteristics of Colorado, Garfield County, and Pitkin County

Economic Indicator	Colorado	Garfield County	Pitkin County
Per Capita Income (2016 dollars)	$33,230	$29,179	$59,229
Median Household Income (2016 dollars)	$62,520	$61,300	$69,789
Family Poverty Rate	8.1%	7.8%	4.1%
Unemployment Rate	4.0%	4.5%	4.2%

Source: EPS 2016a, 2016b

Pitkin County's largest single employment sector is arts, entertainment, and recreation services, while Garfield County and Colorado's largest sector is education services, health care, and social assistance (Table 3). Construction is a major employment sector in Garfield County, while finance, insurance, and real estate are important sectors in Pitkin County.

Table 3. Major employment sectors by industry group

Major Employment Sector Industry	Colorado	Garfield County	Pitkin County
Educational services, and health care and social assistance	21%	18%	15%
Professional, scientific, and management, and administrative and waste management services	14%	11%	12%
Retail trade	11%	11%	8%
Arts, entertainment, and recreation, and accommodation and food services	11%	11%	29%
Construction	8%	17%	6%
Finance and insurance, and real estate and rental and leasing	7%	6%	11%
Other sectors including manufacturing, wholesale trade, transportation, utilities, information, agriculture, mining, and natural resources	29%	27%	19%

Source: USCB 2016

Crystal Valley Community Characteristics

The following discussion describes the unique character of the area, as well as the attitudes and preferences of its residents about trail development and usage. Information for this discussion comes from demographic and land use information; public reports from Pitkin County, the Crystal Caucus, and other sources; and public survey data and comments during the trail planning process.

Crystal Valley in Garfield County – Carbondale

The northern extent of the valley includes Carbondale and the confluence of the Crystal Valley with the Roaring Fork River Valley, in Garfield County. The proposed trail would extend the existing Lower Crystal River Trail, which terminates south of the Garfield County line, at the BRB KOA campground in Pitkin County (Figure 1). Based on census block data, Carbondale's demographic and economic characteristics vary from the rural residential area south of town (USCB 2016).

Demographic Character

The Crystal Valley in Garfield County is more densely populated than the Crystal Valley in Pitkin County, with approximately 6,600 residents living within Carbondale's town limits. Carbondale's population has grown substantially since 2000 and is expected to continue to grow. Carbondale's population includes a high proportion of Hispanic or Latino residents. The rural areas south of town (closer to the proposed trail) are characterized by an older population that is less ethnically and racially diverse, and has fewer households with children and more households with older members than the population in the northern area of the town (USCB 2016) (Table 4).

Table 4. Carbondale demographics

Demographic Indicator	Carbondale
Total population	6,600
Population change 2000–2016	26%
Hispanic or Latino	44%
Non-white, non-Hispanic or Latino	3%
Median age	33.4
No high school degree	21.6%
Bachelor's degree or higher	43.9%
Households with children under 18	30%
Households with person over 60	27%

Source: USCB 2016

Economic Character

The rural areas south of Carbondale have a higher median household income and median property value than the town (Table 5). The proportion of households that receive social security income, which includes federal retirement benefits as well as supplemental income assistance, is higher south of town, while the poverty rate for families is higher in Carbondale. One reason for the high proportion of households receiving social security income in the rural areas south of Carbondale may be the substantial proportion of households with one or more members at or approaching retirement age (Table 4).

Table 5. Carbondale economic characteristics

Economic Indicator	Carbondale
Median household income (2016 dollars)	$64,250
Family poverty rate	8%
Median home value (2016 dollars)	$448,000
Households with social security income	18%
Unemployment rate	3.4%

Source: USCB 2016

Carbondale has seen a 1.4 percent decline in the total employment, and a decline in unemployment from 5.7 percent in 2010 to 3.4 percent in 2016. Unemployment is higher for residents living in Carbondale than for those living south of town.

Social Character

Through the public comments received from Garfield County, residents voiced strong preferences for expanded recreation opportunities and the importance of connecting the valley's communities. The Crystal Valley within Garfield County is a mix of rural and suburban development. While Carbondale and its surroundings have a rural and small-town character, it is also a bedroom community for the town of Aspen and other parts of Pitkin County with higher costs of living. Over 60 percent of Carbondale's employed residents work outside of Carbondale, and almost half commute over 30 minutes one-way to work. The high cost of living in the Roaring Fork Valley combined with a housing shortage has resulted in the area being one of the most unaffordable places to live in Colorado, with high levels of in- and out-migration and a somewhat unstable workforce dynamic that depends on low-wage service labor, much of which is immigrant labor (Gardner-Smith 2011).

Recreation Access

The location of Carbondale allows residents to access trails and amenities in Garfield, Eagle, and Pitkin Counties. Trails and open space near Carbondale include the Rio Grande Trail, a multiuse paved path that connects the communities along the Roaring Fork River from Aspen to Glenwood Springs. The multiuse paved Lower Crystal River Trail intersects with the Rio Grande Trail, follows the Crystal River through Carbondale, and terminates in Pitkin County at the BRB KOA campground. Other trails near Carbondale include the Red Hill trails area north of town, with about 15 miles of single-track trail; and Prince Creek trails west of town, with about 18 miles of single-track trail.

Land Use and Community Change

The majority of the land in the Crystal Valley in Garfield County is privately owned. The area south of Carbondale, outside of the town boundary, is primarily privately owned agricultural land, while land use within the town is residential, commercial, and light industrial. Several conservation easements have been designated around Carbondale.

Land use the area is expected to change in response to population growth. The cost of housing and a shortage of available housing in the Roaring Fork Valley are likely to shape future land use patterns. There are approximately 2,500 housing units in Carbondale and 670 housing units in the rural area in the Crystal Valley outside the town.

Crystal Valley in Pitkin County

Within the Crystal Valley in Pitkin County, most residents live in subdivisions and within the town of Redstone. Residential subdivisions include 7 Oaks, Crystal River Country Estates, Wild Rose Ranch, Redstone Ranch Acres, Elk Mountain, and Crystal River Park. The Crystal Valley in Pitkin County includes the area that is represented by the Crystal Caucus.[1] Members of the Crystal Caucus include the qualified electors living within the caucus area and non-resident landowners.

Demographic Character

The Crystal Valley in Pitkin County is sparsely populated. Population has grown since 2000 and is expected to keep growing at rates comparable to Pitkin County. Its rural and quiet setting underscores residents' sense of attachment to place. Approximately 950 residents live within the valley and the adjacent hills.

Table 6. Crystal Valley in Pitkin County demographics

Demographic Indicator	Crystal Valley in Pitkin County
Total population	950
Population change 2000–2016	7%
Hispanic and Latino	1%
Non-white, non-Hispanic or Latino	--
Median age	51.3
No high school degree	--
Bachelor's degree or higher	55%
Households with children under 18	23%
Households with person over 60	42%

Source: USCB 2000, 2016

As indicated above, demographic characteristics of the area include an older population with higher income levels and less racial and ethnic diversity than in Carbondale and in the rest of Pitkin County. Median property value also exceeds that of Carbondale. The Crystal Valley in Pitkin County has about the same proportions of households with members at or approaching retirement age and of households with children as the county as a whole. Residents tend to have high levels of education (USCB 2016) (Table 6).

Economic Character

The Crystal Valley in Pitkin County can be characterized as having higher median household income and property values than in Carbondale (Table 7). The proportion of households that receive social security income is greater than in Carbondale,

Table 7. Crystal Valley in Pitkin County economic characteristics

Economic Indicator	Crystal Valley in Pitkin County
Median household income (2016 dollars)	$76,300
Family poverty rate	16%
Median home value*	$616,700
Households with social security income	25%
Unemployment rate	3.7%

Source: USCB 2016

[1] Pitkin County has nine caucuses, which are geographic areas with contiguous social, economic, cultural, and environmental characteristics. Their purpose is to facilitate a representative democratic process by providing county officials with recommendations on policies that will affect county residents (Pitkin County 2018).

which may be in part because of a high proportion of households with older members (Table 6). The family poverty rate is higher than in Carbondale.

Social Character

The Crystal Valley study area is small in population and is otherwise rural and residential. Existing retail businesses are primarily located in Redstone, which supports several shops, restaurants, and lodges. As part of the economic and tourism infrastructure, the study area has about seven hotels or lodges, the largest of which is the iconic Redstone Inn. In addition, up to about 15 private homes or properties are available for short-term vacation rentals (based on recent searches of Airbnb and VRBO).

During public meetings, Crystal Valley residents voiced strong preferences for the rural lifestyle and interface with the natural environment. The Crystal Valley in Pitkin County is an exurban area, with low-density residential developments occurring mostly outside of city and town limits. The area stands in contrast to the denser residential areas, traffic, and commercial development in Carbondale and the Roaring Fork Valley.

Community Values

The Crystal Caucus adopted the Crystal River Valley Land Use Master Plan in 2016. The plan outlines the values and priorities of its members (Pitkin County 2016a). The core values and objectives of the master plan emphasize the quiet rural setting of the area, access to outdoor recreation and public lands, environmental and wildlife protection, and limited residential growth (see inset). The Crystal Valley is becoming attractive to families seeking a mountain lifestyle away from the more populated areas of Pitkin and Garfield Counties. The Crystal Valley in Pitkin County, like Carbondale, is a bedroom community for the larger towns in the area, with almost 60 percent of employed residents commuting more than 30 minutes one-way to work.

The Crystal Valley in Pitkin County residents have been engaged in

Crystal Caucus Core Values

Crystal River Valley Land Use Master Plan (2016)

- Preservation of the natural environment and the protection of our rural character are valued.
- As the rest of the state becomes increasingly urbanized, the Crystal Valley is a place where the rural character should remain substantially unchanged.
- We value the preservation of open space, wildlife habitat, the Highway 133 scenic corridor, and water quality in the Crystal Valley.
- We enjoy the out of doors and believe recreational opportunities should be expanded—including walking, hiking, cross-country skiing, bicycle riding, horseback riding, and whitewater sports.
- The Caucus supports the development of a pedestrian and bicycle path as part of the West Elk Loop path within the existing highway right of way and/or on a separate grade where appropriate. The safety of users and wildlife protection should be paramount in planning such a path.
- We support limiting growth in our valley, consistent with the core values outlined above, and believe that future development should not occur at the expense of endangering wildlife or habitat.
- The County should support small-scale commercial activities and the economic vitality of existing and home-based businesses.
- The Caucus supports a limitation on growth to no more than the historic average; residents wish to ensure that future growth is consistent with the rural character of the valley, reflects the sensitivity to the natural and built environment, and is sustainable with respect to carrying capacity.
- Limit the development of new and the expansion of old lodges, hotels, or motels in the Crystal Valley outside of Redstone.

documenting and understanding the ecology and environmental setting. The Crystal Caucus has conducted or commissioned several environmental studies to document the ecological diversity and to evaluate impacts from proposed trails projects, including the Lower Crystal River Trail and the proposed trail (Crystal Caucus 2007 and 2010). The Crystal Caucus has proposed that a 39-mile stretch of Crystal River be designated as wild and scenic, and has advocated against projects in the valley that would impact environmental quality (Crystal Caucus 2015).

The proposed regional trail through the valley has been controversial. As shown in the Crystal Caucus Master Plan community values above, the Crystal Valley in Pitkin County community supports expanding outdoor recreation access in general, and the proposed trail in particular, but the core values also emphasize wildlife preservation and habitat conservation.

Preferences for a rural setting and lifestyle and the desire to preserve ecological diversity and conserve environmental quality result in sometimes-competing values. While the exurban character of the area offers residents a quieter lifestyle with a greater perceived connection with wildlife and the environment, some ecological studies indicate that exurban development impacts on biodiversity may be significant, both in the immediate vicinity of homes and on nearby public and private lands (Hansen et al. 2005; U.S. Department of Agriculture 2007). An awareness of these potential conflicts is evident in the trail planning process public comments and survey responses, in the Crystal Caucus meeting minutes, and in the opinions and perspectives voiced at public meetings.

Recreation Access

Recreation in the Crystal Valley in Pitkin County includes trails and OST-managed open space areas, U.S. Forest Service land and managed trails, Penny hot springs, several retreat centers and small resorts including the Redstone Inn, and Avalanche Ranch. Filoha Meadows is a popular location for wildlife viewing in the summer months.

Land Use and Community Change

Land ownership in the Crystal Valley in Pitkin County is heavily dominated by public land owned and managed by the U.S. Forest Service. Pitkin County owns several large tracts of land as open space, and the Colorado Department of Transportation owns land along the Highway 133 ROW. Fifteen percent of the Crystal Valley in Pitkin County land is privately owned.

Potential Residential Buildout

In 2014, Pitkin County completed a residential buildout analysis for the Crystal Caucus area, which is a subunit of the county that includes the entirety of the study area (Pitkin County 2014). While some of the private lands with potential buildout are located outside of the study area, most are within the Crystal Valley (Table 8).

Table 8. Crystal Caucus potential residential buildout analysis

Land Use Type	Figure
Total private land	22,173 acres (15%)
Total private parcels	661
Maximum number of dwelling units allowed by zoning and conservation agreements	1,020
Existing dwelling units	435
Maximum remaining buildout potential (dwelling units)	585
Likely remaining buildout potential (dwelling units)	351
Potential population in 2040 (based on historic growth rate)	1,100

Source: Pitkin County 2014

If the likely remaining buildout potential occurs, an additional 351 dwelling units would be built, primarily within the Crystal Valley in Pitkin County. This would result in an 81 percent increase in the number of dwelling units—and presumably population—within the study area.

Traffic

An ongoing trend and a factor in discussions about regional trail development is the increasing traffic volumes along Highway 133 within the Crystal Valley in Pitkin County. Based on data provided by CDOT, traffic along Highway 133 has been rising steadily over time and is expected to continue to grow. Measured and projected data for annual average daily traffic at four locations in the study area is shown in Table 9. Concerns about biker and pedestrian safety along the highway were raised by the public during the trail planning process.

Table 9. Traffic counts along Highway 133

Station ID	Location	1990	2000	2016	2030	2040	Percent Change 1990–2016	Percent Change 2016–2040
104556	Base of McClure Pass	1059	1267	1600	1891	2099	+51%	+31%
104557	Redstone	1801	1839	1900	1953	1991	+55%	+6%
104558	Pitkin Co. Line	2691	2733	2800	2859	2901	+4%	+4%
104559	Prince Creek Road	3553	3648	3800	3933	4028	+7%	+11%

Source: CDOT 2018

Community Perceptions of Trail Development

Within Pitkin County, most residents have a favorable view of trails, paths, and trail development supported by the OST and paid for by tax dollars, including the development of additional trails connecting communities (Pitkin County 2016b). Adjacent communities in Garfield and Eagle Counties also benefit from collaborative efforts to build and maintain a trail system in the Roaring Fork Valley and the region.

OST conducted two open house meetings and an online public comment period during the fall of 2017, after publishing the engineering environmental analysis reports and an online story map describing the trail alternatives in detail. During the public comment period, a joint listening session cornering the trail alignments was hosted by the Pitkin County Board of County Commissioners, the OST board, and the Town of Carbondale Board of Trustees. Public comments during the trail planning process provide a more detailed look at the perceptions and preferences of the Garfield and Pitkin County residents, as well as the perspectives of potential trail users and interested parties outside of the valley, in Pitkin County and in nearby communities.

The following social and economic topics briefly summarize the issues and concerns Pitkin and Garfield County residents perceive as important during the trail planning process:

- The Crystal Valley's environmental quality and impacts on the ecological values that may result from a trail through sensitive areas.
- The unique rural character of the Crystal Valley and impacts on residents' property, privacy, and quality of life that may result from a trail near homes and neighborhoods.
- The opportunity to connect the Crystal Valley's communities by a unique and scenic trail that may result in improved quality of life and recreational opportunities for residents, as well as an opportunity for individuals to connect with nature and the area's unique ecology.
- The economic costs and benefits of building a trail, including the costs of construction and maintenance as well as the potential benefits for the local economy.
- Safety concerns for trail users, area residents, and wildlife.

Background on Socioeconomic Implications of Trails

The following summary of research is intended to generally address the topics and concerns identified, as well as the social character identified in the baseline descriptions of the Crystal Valley communities.

Environmental Values

A key issue in the public comments was the potential impact of a trail on the Crystal Valley's environmental quality. As discussed above, valley residents perceive the connection with their environment and the habitat it provides for wildlife to be very important. A more detailed review of literature on the potential impacts on wildlife can be found in the main body of the environmental report.

Economic Costs and Benefits

Research generally indicates that trails have beneficial economic effects in communities:

- A review of a broad range of studies examining the economic impacts of bicycling concluded that the economic benefits to local communities and businesses that can result from trail development can exceed public investment (Wiegand 2008).
- The new jobs resulting from increased local economic activity resulting from trails may have long-lasting economic benefits to local communities (Meletiou et al. 2005; Schoutens 2006; Wiegand 2008; Steer Davies Gleave 2015).
- Several studies have examined the benefits of recreational bicycling and bicycle tourism with a focus on expenditures directly related to bicycle equipment or to travel expenses such as food and lodging. Each study has found valuable contributions to local economies (Wen and Rissel 2008; Sælensminde 2004; Meletiou et al. 2005; Busbee 2001; Grabow et al. 2010; CRESP 2000).
- In some instances, cyclists will return to an area with high-quality recreation amenities such as trail systems and even consider moving to areas where trail and recreation infrastructure supports a desired quality of life. These in-migrants often have high incomes and contribute to the economic health of the communities in which they live (Meltzer 2014; Resource Dimensions 2014).
- A survey of cyclists found that they are more likely to visit businesses in an area after an off-highway bicycle lane has been built than before (National Institute for Transportation and Communities 2014).
- A study of cyclists and drivers in Portland, Oregon, showed that motorists tend to spend more on average per trip, but cyclists spend more on average overall. While cyclists may spend less money at supermarkets, restaurants, convenience stores, and bars, per visit, they tend to visit these establishments more frequently than drivers (Clifton et al. 2012).

Studies of the economic impacts a trail may give insight into the potential for a trail's contribution to a local or regional economy. Some examples include the following:

- As previously discussed, the Colorado Office of Economic Development and International Trade commissioned a study of bicycling and walking behavior statewide and the economic and health benefits of such activity. Using the estimate of the number of days out-of-state visitors spend bicycling (1.5), the average spending per person per day ($93.92), and the number of out-of-state bicycle visitors (2,256,345), the total expenditures by out-of-state tourists who participate in bicycling per year is $318 million (2016 dollars) (BBC 2016).
- A study in Colorado's Pikes Peak region predicted that residents who bike, either as commuters, for utilitarian purposes, or for recreation, spend between $3 and $4 per day on average in the local community because of bike path use. Non-resident recreational cyclists spend between $110 and $250 per day in the local economy. The overall local economic value of cycling is estimated to be $27.9 million per year (2015 dollars) (Steer Davies Gleave 2015).
- A study of Wisconsin recreationists found that average expenditures among road cyclists (including athletic cyclists and casual riders) amounted to $39.57 per day. Data from surveys of trail users in national forests showed daily expenditures among off-road recreational cyclists averaging $17.99 (Stynes and White 2006).

Social Values

Even when trails do not attract a great deal of outside visitors and tourism, research suggests that non-monetary benefits include increased social connection, connection to the natural environment, access to recreation, and physical fitness opportunities.

- Access to recreation and trails is cited as a reason why residents move to and decide to stay in a location (Meltzer 2014; Resource Dimensions 2014; Whatcom Mountain Bike Coalition 2014; Corning et al. 2012).
- Multiple studies show that residents living near trails often perceive the trail as having a positive impact on their health and quality of life, and use trails near their homes frequently. In some areas with similar demographic and land use patterns as the Crystal Valley, up to 90 percent of residents use trails at least every other day in summer (Kaliszewski 2011; Leisure Vision 2011).
- Low-income and minority populations with easy access to trails are much more likely to use them; often lower rates of trail usage by these groups is not indicative of lack of interest, but rather lack of opportunity (RRC Associates 2016).

Property and Privacy

High-quality and accessible trail infrastructure is often associated with higher property value when a trail is designed to connect residents and communities while maintaining residents' privacy. Research on trails and private property concern indicates the following:

- Those who oppose a trail before its construction generally find the trail and trail users to be less intrusive and often use the trail themselves (Corning et al. 2012; Zarker et al. 1987; Feeney 1997; Lindsey et al. 2004).
- Increases in crime, including trespassing, do not generally occur as a result of a trail close to residential areas (Zarker et al. 1987; Feeney 1997; Lindsey et al. 2004).
- Legal, well-marked access points have been shown to eliminate problems with trail users trespassing on private property (Moore 1992; Tracy and Morris 1998).
- All states have recreation use statutes that protect private land users from risks and liability associated with trails. Under these statutes, landowners are able to specify conditions for use in access easements (Headwaters 2016).
- Risk to property owners is often successfully reduced or eliminated through careful design of trails and access points, clear signage, emergency planning by county and municipalities, and adequate trail maintenance (Headwaters 2016).

Safety

A recent comprehensive study of bicycle path safety was completed by the National Institute for Transportation and Communities (2014). Findings include the following:

- Bicyclists report that they ride their bikes more often in areas where protected and off-highway bike lines are present.
- Women are more likely to increase the frequency that they bike when protected bike lanes and trails are available.

- Safety at intersections and trail access points can be increased by careful design. Traffic signs and signals are effective at reducing car/biker conflict.
- Trails that have greater physical separation from busy roads increase bikers' comfort. Any type of barrier between traffic and a bike lane increases biker ease compared to a striped bike lane.
- Residents that live near off-roadway paths perceive their neighborhoods as safer and are more likely to use the trails.
- Over half of residents near protected bike lanes found that interactions between motorists and cyclists had become more predictable and less dangerous.

Summary of Findings – Socioeconomic Effects of Trail Development

Colorado's demographic and economic character is experiencing change and growth, a substantial part of which is due to the attractiveness of the mountain lifestyle and the amenities its communities offer. The Crystal Valley offers residents and visitors unique opportunities for recreation and connection with nature, as expressed in the survey and public comment response and by the Crystal Caucus's core values. Based on historic trends and projections, the following is likely:

- The population, residential development, and highway traffic in Carbondale and the Crystal Valley in Pitkin County will increase at rates similar to county and state projections.
- Recreation and tourism in the area will continue to be an important part of the economy and culture, as population and tourism increase.
- Visitors to the Crystal Valley will include residents from nearby communities in the Roaring Fork Valley and Colorado's Western Slope, as well as tourists from outside the area and state.

The proposed trail may result in the outcomes described in the following sections.

Environmental Quality

The main body of the environmental review report includes an analysis of the potential environmental impacts from the trail, existing landscape disturbance, background on seasonal trail closures, and a review of literature on impacts from trails and recreation.

- The Crystal Valley's population is growing, and along with growth and land development in rural areas comes increased pressure on wildlife habitat and ecological resources.
- Taken together with existing disturbance from residential development, population growth, and development projections, it is not likely that the trail would have an isolated impact on the environmental quality that the residents of the Crystal Valley enjoy.

Economic Costs and Benefits

As described previously, construction of the proposed Crystal River segment of the Carbondale to Crested Butte trail is expected to cost between about $18 million and $108 million, depending on the final alignment. While construction activities would result in short-term increases in employment and spending within the project area during a two- to four-year construction period, trail construction itself is not anticipated to result in long-term local employment or economic growth. However, the completion of the trail is anticipated to result in long-term economic benefits to local communities and Pitkin County as a result of increased bike-related tourism, and economic benefits from increased local trail use (residents, recreationists, and commuters).

- The economic benefit from potential out-of-region tourism, assuming that the 81-mile trail to Crested Butte would attract overnight cyclists, could be substantial. Pitkin and Gunnison Counties are mountain- and road-biking destinations. Expenditures of $93.92 per day by tourists at local businesses in the Crystal Valley may result in substantial economic benefit. (Available trail use data is not sufficient to project the specific economic value to the local economy that would result from additional tourist visits resulting from the trail.)

- The economic benefits from residential users, including commuters, recreationists, and utilitarian trail users, may also result in substantial impacts on the local economy based on review of literature on the expenditures of trail users in Colorado and communities with similar amenities. If daily expenditures by residential users are $3.50 to $21.00 per day, and assuming that the trail segment sees 30 percent of the users of the Lower Crystal River Trail, local economic impacts may range from $15,700 to $157,000 per year.
- OST would likely hire additional personnel to support the long-term maintenance and safety of the trail.

Demographic and Social

- The trail may contribute to increased population, as some residents may be attracted to the Crystal Valley in part because of access to a trail that provides connection to other communities and easy access to expanded recreation activities. Population and residential development in the valley is likely to increase regardless of the trail segment, and it is not likely that the trail would have a substantial isolated impact on growth.
- The trail segment may open up opportunities for a more diverse trail user group to explore the Crystal Valley and engage with the ecological and historic environment. Carbondale's high proportion of Hispanic and Latino residents, households with children, and households with relatively low incomes would have easier access to expanded recreation opportunities. Increased access may result in beneficial public health and social outcomes for these groups.

Property and Privacy

- A trail segment would likely result in more non-motorized visitors to the Crystal Valley, including residents from nearby communities and out-of-state tourists.
- Trail construction and use could raise concerns about privacy among landowners who are immediately adjacent to the trail alignment.
- Recreation use statutes would protect property owners in the Crystal Valley from risk and liability associated with trail use.
- Crystal Valley property owners with access easements would be able to determine the parameters of use for the easement across their property.
- Trail design and mitigation measures would likely reduce or eliminate concerns about trespassing and disturbances to Crystal Valley property owners and residents.
- Based on studies of impacts on property owners from trails, it is possible that the trail and trail users would be good neighbors.

Safety

- With traffic along Highway 133 projected to increase, a trail that is protected and removed from traffic would result in increased pedestrian and recreationist safety. It is likely that the Crystal Valley's population will increase over time, resulting in more recreationists. The trail would not likely have an isolated substantial effect on either increased traffic or population growth.

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