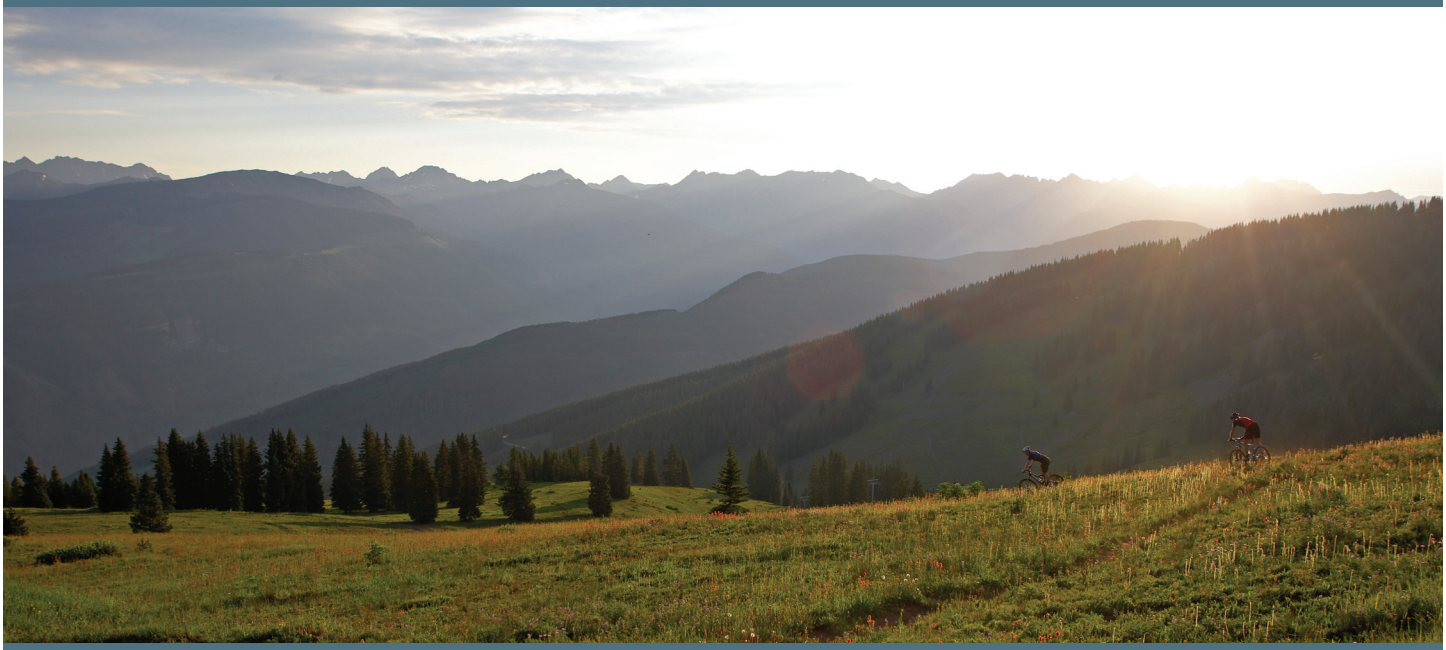
VAIL MOUNTAIN RECREATION ENHANCEMENTS PROJECT DRAFT ENVIRONMENTAL IMPACT STATEMENT



MARCH 2014

USDA Forest Service
White River National Forest
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ABSTRACT

DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE VAIL MOUNTAIN RECREATION ENHANCEMENTS PROJECT

WHITE RIVER NATIONAL FOREST
EAGLE COUNTY, COLORADO

MARCH 2014

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Abstract: This Draft Environmental Impact Statement (DEIS) has been prepared to analyze and disclose the estimated environmental effects of implementation of the Vail Mountain Recreation Enhancements Project. Vail Ski Area is located on the White River National Forest in Eagle County, Colorado and operates in accordance with the terms and conditions of a Special Use Permit, which is administered by the United States Department of Agriculture Forest Service (Forest Service). The Proposed Action includes the following elements: Educational and Interpretive Programs; two zip line canopy tours; two mountain coasters; expanded hiking and mountain biking trails across Vail Ski Area; Riparian Experience; Aerial Adventure Course; modified horse trail in Game Creek Bowl; Wildwood observation deck; wedding venue at The 10th.

Components of the Proposed Action are detailed in Chapter 2, Section B (Alternative 2 – Proposed Action).

This Draft EIS discusses the purpose and need for the Proposed Action; alternatives to the Proposed Action; potential direct, indirect, and cumulative impacts of implementing each alternative; and management requirements. Three alternatives are analyzed in detail in the Draft EIS: Alternative 1 – No Action, Alternative 2 – Proposed Action, and Alternative 3.

Comments on this Draft EIS will be accepted for 45 days from publication of the Notice of Availability (NOA) in the Federal Register. The NOA provides the sole means of calculating the close of the Draft EIS comment period.

Important Notice: Only those who submit timely and specific written comments will have eligibility to file an objection under 36 CFR §218.8. For objection eligibility, each individual or representative from each entity submitting timely and specific written comments must either sign the comment or verify identity upon request. Individuals and organizations wishing to be eligible to object must meet the information requirements in 36 CFR §218.25(a)(3). Comments received, including the names and addresses of those who comment, will become part of the public record for this project and will be subject to review pursuant to the Freedom of Information Act.

Executive Summary

EXECUTIVE SUMMARY

The proposed improvements analyzed in this document constitute a federal action, which has the potential to affect the quality of the human environment on public lands administered by the United States Department of Agriculture Forest Service (Forest Service). Therefore, these projects must be analyzed pursuant to the National Environmental Policy Act of 1969 (NEPA). Under NEPA, Federal Agencies must carefully consider environmental concerns in their decision making processes and provide relevant information to the public for review and comment.

The Forest Service has prepared this Draft Environmental Impact Statement (DEIS) in compliance with NEPA and other relevant federal and state laws and regulations. This DEIS contains analyses consistent with NEPA, Council on Environmental Quality (CEQ) regulations, and Forest Service policy. It discloses potential direct, indirect, and cumulative environmental effects on the human and biological environment anticipated to result with implementation of the Proposed Action or an additional Action Alternative. Additionally, it is intended to ensure that planning considers the environmental and social values of the Project Area and that potential resource conflicts are minimized or avoided.

A. SUMMARY OF THE PURPOSE AND NEED FOR THE PROPOSED ACTION

Public interest in summer outdoor recreation has expanded and evolved throughout recent years, including recreational use of the National Forests. The Forest Service believes that ski areas are well-positioned to introduce user groups that might not otherwise visit National Forests (e.g., urban-based population segments, including youth) to outdoor recreation. When it comes to outdoor recreation, these visitors can be broadly placed into two categories: those who are likely to engage in self-directed recreational activities on NFS lands, and those who seek organized or developed activities in more managed settings (i.e., activities supervised by a permittee or guide). The rise in the popularity of developed activities in more managed settings stems, in part, from (1) the difficulty some families have in finding activities they can participate in together, or (2) barriers (the need for specialized knowledge, equipment, skills or familiarity with the forest environment) that can be associated with many self-directed activities such as mountain biking, kayaking, and rock climbing.

The purpose of this proposal at Vail Ski Area is to engage a larger segment of summer visitors seeking more managed recreation opportunities by providing:

- Adventure or thrill-based experiences that require little specialized knowledge, skills, equipment or familiarity with the mountain environment;
- Activity-based interaction with a forested, mountain environment in a controlled setting, offering an opportunity for users to interact with and learn about nature;

- Human-powered, active recreational experiences that cater to all ability levels; and
- Interpretive programs that offer an educational experience for users seeking to learn more about the environment.

There is a need for summer recreational and learning opportunities at Vail Ski Area that include passive, active and interactive forms of recreation to provide for this comprehensive range of user experiences. Additionally, there is a need for the improved utilization of and access to existing infrastructure such as chairlifts and restaurants.

B. SUMMARY OF THE ALTERNATIVES ANALYZED IN THE DEIS

In addition to the No Action Alternative (analyzed in this document as Alternative 1), two action alternatives are analyzed. Refer to Chapter 2 for a full description of alternatives and Chapter 6 for alternative figures.

ALTERNATIVE 1 – NO ACTION

By definition, the No Action Alternative represents a continuation of existing management practices without changes, additions, or upgrades to existing conditions.

ALTERNATIVE 2 – PROPOSED ACTION

The projects proposed analyzed in this DEIS are designed to respond to the identified Purpose and Need for Action. The proposed projects are confined within Vail Ski Area's Special Use Permit (SUP) boundary (with the exception of some proposed project elements that extend onto adjacent, private lands [refer to Figure 2]), and are located primarily within developed portions of the front side of Vail Mountain.

The Proposed Action includes the following elements, each of which is further defined in Chapter 2. All proposed activities are depicted in Figure 2.

Educational and Interpretive Programs

- An interpretive program would be embedded throughout the range of existing and proposed year-round activities.

Zip Line Canopy Tours

- Two zip line canopy tours:
    - The Game Creek Canopy Tour would consist of seven interconnected zip lines transporting riders around Game Creek Bowl. Riders would descend from Eagle's Nest to the Game Creek Express, ride Game Creek Express to Wildwood, and descend back to Eagle's Nest.

- The Front Side Canopy Tour would consist of ten interconnected zip lines transporting riders down the front side of Vail Mountain. Riders would descend from Mid-Vail to the base of Gondola One.

Mountain Coasters

- Two mountain coasters:
  - Adventure Ridge Mountain Coaster would be located near Adventure Ridge, west of the top terminal of Pride Express. The track would be approximately 3,700 feet in length and would descend approximately 300 vertical feet.
  - Pride Express Mountain Coaster would begin near the top of the proposed Adventure Ridge Mountain Coaster, west of the Pride Express, and would extend to the bottom of the Pride Express. The track would be approximately 12,000 feet in length and would descend approximately 1,200 vertical feet.

Expanded Hiking and Mountain Biking Trails

- Between 45 to 55 miles of hiking and mountain biking trails would be constructed across the front side of Vail Mountain. Approximately 20 percent of new trails would be designated for hiking, approximately 45 percent for cross-country mountain biking, and approximately 35 percent for downhill mountain biking.

Riparian Experience

- The Riparian Experience would be located at Adventure Ridge, just east of Eagle's Nest. This manufactured water feature would be interactive, and designed to allow children to observe, investigate and deepen their understanding of basic hydrologic processes.

Aerial Adventure Course

- The Aerial Adventure Course would be located to the north and west of Eagle's Nest Facility, below the top of Pride Express in a forested area. This aerial ropes and zip line course would contain a variety of features suitable for children, such as small towers, bridges and slides.

Modified Horse Trail in Game Creek Bowl

- The new single track horse trail would roughly parallel the existing roads utilized in current guided horseback tours at Adventure Ridge. The new trail would be approximately 1 mile in length. Additionally, the horse corral would be relocated slightly further west.

Wildwood Observation Deck

- An observation deck at Wildwood would provide views of Vail Ski Area's Back Bowls, Blue Sky Basin, the Gore Range, and the Eagles Nest Wilderness. The ground level deck would be approximately 1,000 square feet.

Wedding Venue at The 10th

- An outdoor wedding venue, designed as a low platform, would be located just north of The 10th restaurant at Mid-Vail. The venue would accommodate groups of up to 100 people.

ALTERNATIVE 3

Alternative 3 includes all projects in Alternative 2, except the following three components:

- Mountain Coasters
- Riparian Experience
- Wedding venue at The 10th

C. PUBLIC INVOLVEMENT

On November 19, 2012, a scoping notice was mailed to approximately 53 community residents, interested individuals, public agencies, and other organizations. The scoping package provided a brief description of the Proposed Action, the purpose of and need for action, preliminary issues raised, and an illustrative map. This notice was specifically designed to elicit comments, concerns, and issues pertaining to the Proposed Action. A Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) was published in the Federal Register on November 26, 2012. A public open house was held on December 5, 2012, at the Avon Public Library in Avon. Following media coverage of the proposal, other individuals obtained copies of the scoping package at the open house or sent requests to the Eagle/Holy Cross District Ranger for information. In addition, the scoping package was posted online, on both the WRNF and project websites. An e-mail address was provided for submitting electronic comments.

Twenty-six letters were received, and the Forest Service Interdisciplinary Team categorized each substantive comment in a comment disposition. The issues are addressed in Chapter 3 – Affected Environment and Environmental Consequences.

D. SUMMARY OF RESOURCE ISSUES ADDRESSED

Based on the results of public scoping, the Forest Service identified specific areas of public concern. Each of the following issue statements includes a list of indicators (see Chapter 1) which were identified as a means of measuring or quantifying the anticipated level of impact on a particular resource.

Recreation

- The Proposed Action would impact recreational opportunities within the Vail Ski Area SUP and the Eagle Valley.

Visuals

- Proposed structures, facilities and features would incrementally add to the developed nature of the Vail Ski Area SUP area and could cause negative scenery impacts. In particular, proposed infrastructure and activities at Adventure Ridge would increase development density and could detract from existing scenic values and important scenic viewsheds.

Traffic, Parking and Ski Area Access

- The Proposed Action may contribute to demand for additional parking within the Town of Vail and additional traffic on I-70 throughout the year.

Social and Economic Resources

- Through construction and operation of proposed non-skiing recreational activities within Vail Ski Area's SUP area, the local economy would be affected.

Cultural Resources

- Proposed projects and associated ground disturbing activities have potential to affect known or unidentified cultural resources in the Analysis Area.

Wildlife and Aquatic Resources

- Implementation of proposed projects (including construction and operation) could affect Proposed, Threatened, and Endangered (TEP), Forest Service Region 2 (R2) Sensitive and Management Indicator (MIS) wildlife, migratory birds and aquatic species in the Analysis Area.

Soils

- Ground disturbance associated with construction and operation of proposed projects has potential to increase erosion/soil compaction and lead to a loss of organic material in the Analysis Area.

Watershed and Wetlands

- Ground disturbance and overstory vegetation removal associated with construction and operation of proposed projects has potential to affect water yield and produce sediment and reduce stream bank stability in the Analysis Area.

- Ground disturbance and proposed overstory vegetation removal associated with construction and operation of proposed projects has potential to affect wetlands and wetland function and values within the Analysis Area.

Vegetation and Botany

- Ground disturbance associated with construction and operation of proposed projects could affect plant communities throughout the Analysis Area, including Threatened, Endangered, and Sensitive (TES) species, WRNF Species of Local Concern (SOLC), and invasive plant species.

E. SUMMARY COMPARISON OF DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Table 2-3 found in Chapter 2 includes a summary comparison of environmental consequences, by resource, for alternatives 1, 2 and 3. Detailed information on affected environment and environmental consequences for each resource considered in this analysis can be found in Chapter 3.

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LIST OF ACRONYMS

AADT	Average Annual Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ACCT	Association of Challenge Course Technology
ADT	Average Daily Traffic
AF	Acre feet
AMI	Area Median Income
AMSL	Above Mean Sea Level
APE	Area of Potential Effect
BA	Biological Assessment
BCR	Bird Conservation Region
BE	Biological Evaluation
BEIG	Built Environment Image Guide
BLM	Bureau of Land Management
BMP	Best Management Practice
CAA	Clean Air Act
CCC	Comfortable Carrying Capacity
CDA	Connected Disturbed Area
CDPHE	Colorado Department of Public Health and Environment
CDOT	Colorado Department of Transportation
CE	Categorical Exclusion
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
CNHP	Colorado National Heritage Program
CPTSB	Colorado Passenger Tramway Safety Board
CPW	Colorado Parks and Wildlife
CRCT	Colorado River Cutthroat Trout
CSC	Colorado Ski Country
CWA	Clean Water Act
DAU	Colorado Parks and Wildlife Data Analysis Unit
dbh	Diameter at Breast Height
DEIS	Draft Environmental Impact Statement
DIA	Denver International Airport
DSH	Diurnal Security Habitat
EA	Environmental Assessment
ECO	Eagle County
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EO	Executive Order

ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
FHA	Federal Highway Administration
FPCA	Forest Plan Consistency Analysis
FSH	Forest Service Handbook
FSM	Forest Service Manual
FTE	Full-time-equivalent
GAOT	Guests At One Time
GIS	Geographic Information System
GRP	Gross Regional Product
HCRD	Holy Cross Ranger District
HUC	Hydrologic Unit Code
I-70	Interstate 70
ID Team	Interdisciplinary Team
LAA	Likely to Adversely Affect
LAU	Lynx Analysis Unit
LCAS	Lynx Conservation and Assessment Strategy
LOS	Level of Service
LRMP	Land and Resource Management Plan
LWD	Large Woody Debris
M&E	Management and Evaluation
MA	Management Areas
MAII	May Adversely Impact Individuals
MBTA	Migratory Bird Treaty Act
mg/l	Milligrams per liter
µg	Micrograms
MIS	Management Indicator Species
MM	Management Measures
MOU	Memorandum of Understanding
MPB	Mountain Pine Beetle
NAAQS	National Ambient Air Quality Standards
NDIS	Natural Diversity Information
NE	No Effect
NEPA	National Environmental Policy Act
NFS	National Forest System
NHPA	National Historic Preservation Act
NI	No Impact
NOI	Notice of Intent
NRHP	National Register of Historic Places
OAHP	Office of Archeology and Historic Preservation
PDF	Project Design Feature

PEIS	Programmatic Environmental Impact Statement
PEM	Palustrine Emergent
PPH	People Per Hour
PSS	Palustrine Shrub/Scrub
R2	Region 2
ROD	Record of Decision
SAROEA	Ski Area Recreational Opportunity Enhancement Act
SFE	Single Family Equivalent
SHPO	State Historic Preservation Officer
SIVC	Species with an Identified Viability Concern
SIO	Scenic Integrity Objective
SMS	Scenery Management System
SOLC	Species of Local Concern
SRLMD	Southern Rockies Lynx Management Direction
SUP	Special Use Permit
SWMP	Stormwater Management Plan
TEP	Proposed, Threatened, and Endangered species
TES	Threatened, Endangered, and Sensitive species
TMDL	Total Maximum Daily Load
TOC	Threshold of Concern
USACE	US Army Corps of Engineers
USC	United States Code
USCA	United States Code Annotated
USDA	United States Department of Agriculture
USFS	US Forest Service
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
VPD	Vehicles Per Day
WCPH	Watershed Conservation Practices Handbook
WIZ	Water Influence Zone
WOUS	Waters of the United States
WRNF	White River National Forest

Chapter 1
Purpose and Need

1. PURPOSE AND NEED

A. INTRODUCTION

The proposed projects at Vail Ski Area analyzed in this document constitute a federal action, which has the potential to affect the quality of the human environment on public lands administered by the United States Department of Agriculture Forest Service (Forest Service). Therefore, these projects must be analyzed pursuant to the National Environmental Policy Act of 1969 (NEPA). Under NEPA, federal agencies must carefully consider environmental effects in their decision making processes and provide relevant information to the public for review and comment.

The Forest Service has prepared this Draft Environmental Impact Statement (DEIS) in compliance with NEPA and other relevant federal and state laws and regulations. This DEIS contains analyses consistent with NEPA, Council on Environmental Quality (CEQ) regulations, and Forest Service policy. It discloses anticipated direct, indirect, and cumulative effects on the human and biological environment anticipated to result from implementation of the Proposed Action or an additional Action Alternative.

Additional documentation, including technical documents that provide analyses of Project Area resources, may be found in the project administrative record located at the Eagle/Holy Cross Ranger District office of the White River National Forest (WRNF).

B. BACKGROUND

Vail Ski Area is located on the Eagle/Holy Cross Ranger District of the WRNF and is accessed by Interstate 70 (I-70), which passes through the Town of Vail. The Town of Vail is located approximately 100 miles west of Denver (the largest metropolitan area in Colorado) and is approximately 30 miles east of the Eagle County Airport (refer to the Vicinity Map). Developed skiing at Vail Ski Area began in 1962, with average annual visitation exceeding 1.5 million skiers since 1997.[1]

Vail Ski Area is owned by Vail Associates, Inc. and is operated under a Special Use Permit (SUP) from the Forest Service. The SUP covers 12,590 acres of National Forest System (NFS) lands on the WRNF. Lift-served skiing is supported by operational infrastructure, as well as guest and food service outlets throughout the SUP area.

In concert with growing market demand and the increasing expectations of the skiing public, Vail Ski Area has evolved over the decades since its inception by adding new chairlifts, new and improved ski terrain, additional parking, and day use facilities. While the ski area has traditionally focused on winter

[1] At ski areas, one may see people using Alpine, snowboard, telemark, cross-country, and other specialized ski equipment, such as that used by disabled or other skiers. Accordingly, the terms “ski, skier, and skiing” in this document encompass all lift-served sliding sports typically associated with a winter sports resort.

recreation, increasing attention has been directed in recent years towards summer and multi-season activities to accommodate demand for year-round recreation in the Eagle Valley.

Adventure Ridge, which opened in 1996, has become the focal point for summer and multi-season activities within Vail Ski Area's SUP area. Adventure Ridge is located at the top of the Eagle Bahn Gondola and provides visitors with an opportunity to explore NFS lands with Vail Ski Area's SUP in the summer. Adventure Ridge currently includes numerous activities that are designed to engage the ski area's guests throughout the year, including:

- Sightseeing
- Zip Line
- Challenge Courses
- Mountain Biking
- Hiking
- On-Mountain Dining
- Rebound Trampoline
- Pony Rides
- Horse Tours
- Jeep Tours
- Nature Center
- Disc Golf
- Eagle's Nest Wedding Deck

In November 2011, the Ski Area Recreational Opportunity Enhancement Act (SAROEA) was signed into law. The SAROEA provides authority for the Forest Service to approve facilities and activities within ski area special use permit boundaries to support summer and year-round natural resource-based recreation, in addition to snow sports which were authorized by previous laws. Furthermore, existing infrastructure (e.g., parking, roads, chairlifts and guest service facilities) at ski areas can serve as a foundation for new and expanded summer recreational activities. SAROEA is discussed in greater detail in Section I – Consistency with Policy of this chapter.

C. PURPOSE AND NEED FOR ACTION

Over the years, the ways people engage in recreation during the summer months has evolved to include a new variety of activities and user experiences. Likewise, recreational use in the National Forests has evolved beyond activities traditionally associated with these lands such as hunting, fishing, camping or hiking. Ski areas serve as portals to National Forests and public lands for millions of people every year and provide important opportunities for the public to explore the outdoors and engage in active recreation. Increased summer use at ski areas in recent years has been driven by new technologies and the growing number of people seeking outdoor recreational activities in more managed settings. At Vail Ski Area, summer use increased 100 percent between 2008 and 2013, averaging 103,600 visitors (measured by the number of lift tickets sold for the Eagle Bahn Gondola and Gondola One).

The Forest Service wants to engage the next generation of National Forest users, and believes that ski areas are well-positioned to introduce user groups that might not otherwise visit National Forests (e.g.,

urban-based population segments, including youth) to outdoor recreation. This exposure can build a deeper appreciation for the outdoors and the value of natural resources, leading to a more environmentally aware population.

Having a primarily tourism-based economy, the Eagle Valley both relies on, and attracts, large numbers of visitors throughout the year—most of whom recreate on public lands. The Town of Vail averages approximately 1.1 million summer visitors each year, with an additional 800,000 summer visitors coming to Eagle County for a countywide summer visitation total of 1.9 million people.[2] When it comes to outdoor recreation, these visitors can be broadly placed into two categories: those who are likely to engage in self-directed recreational activities on NFS lands, and those who seek organized or developed activities in more managed settings (i.e., activities supervised by a permittee or guide). The rise in the popularity of developed activities in more managed settings stems, in part, from (1) the difficulty some families have in finding activities they can participate in together, or (2) barriers (the need for specialized knowledge, equipment, skills or familiarity with the forest environment) that can be associated with many self-directed activities such as mountain biking, kayaking, and rock climbing.

The purpose of this proposal at Vail Ski Area is to engage a larger segment of summer visitors seeking more managed recreation opportunities by providing:

- Adventure or thrill-based experiences that require little specialized knowledge, skills, equipment or familiarity with the mountain environment;
- Activity-based interaction with a forested, mountain environment in a controlled setting, offering an opportunity for users to interact with and learn about nature;
- Human-powered, active recreational experiences that cater to all ability levels; and
- Interpretive programs that offer an educational experience for users seeking to learn more about the environment.

There is a need for summer recreational and learning opportunities at Vail Ski Area that include passive, active and interactive forms of recreation to provide for this comprehensive range of user experiences. Additionally, there is a need for the improved utilization of and access to existing infrastructure such as chairlifts and restaurants.

D. SUMMARY OF THE PROPOSED ACTION

Vail Ski Area has proposed a package of projects and activities within its SUP that are designed to enhance the summer and multi-season user experience. The projects proposed and analyzed in this DEIS are designed to respond to the identified Purpose and Need for Action. The proposed projects are confined within Vail Ski Area's SUP boundary (with the exception of some proposed project elements

[2] Romer, 2013

that extend onto adjacent, private lands [refer to Figure 2]), and located primarily within developed portions of the front side of Vail Ski Area.

The Proposed Action includes the following elements, each of which is further defined in Chapter 2. All proposed activities are depicted in Figure 2.

- Educational and Interpretive Programs
- Zip Line Canopy Tours:
  - Game Creek Canopy Tour
  - Front Side Canopy Tour
- Mountain Coasters:
  - Adventure Ridge Coaster
  - Pride Express Mountain Coaster
- Expanded Hiking and Mountain Biking Trails
- Riparian Experience
- Aerial Adventure Course
- Modified horse trail in Game Creek Bowl
- Wildwood observation deck
- Wedding venue at The 10th

Chapter 2 includes a discussion of an additional alternative (Alternative 3) to the Proposed Action.

E. INTERAGENCY COORDINATION

In accordance with regulatory direction, and in furtherance of cooperative management among federal agencies charged with oversight of environmental and natural resources, federal, state, local, and tribal entities with a likely interest and/or jurisdiction in the Proposed Action were sent scoping notices and/or consulted prior to, and throughout, the NEPA process.

F. PUBLIC INVOLVEMENT

On November 19, 2012, a scoping notice was mailed to approximately 53 community residents, interested individuals, public agencies, and other organizations. The scoping package provided a brief description of the Proposed Action, the purpose of and need for action, preliminary issues raised, and an illustrative map. This notice was specifically designed to elicit comments, concerns, and issues pertaining to the Proposed Action. A Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) was published in the Federal Register on November 26, 2012. A public open house was held on December 5,

2012, at the Avon Public Library in Avon. Following media coverage of the proposal, other individuals obtained copies of the scoping package at the open house or sent requests to the Eagle/Holy Cross District Ranger for information. In addition, the scoping package was posted online, on both the WRNF and project websites. An e-mail address was provided for submitting electronic comments.

G. ISSUES AND INDICATORS

Based on the results of public and internal scoping, the Forest Service identified specific resources that require in-depth analysis in Chapter 3 of this EIS. The following issues are statements of cause and effect, linking environmental effects to actions.[3] Each of the following issue statements includes a list of analytical indicators which were identified as a means of measuring or quantifying the anticipated level of impact.[4] While some indicators are necessarily qualitative in nature, every effort was made to utilize indicators that are quantifiable, measurable and predictable.

ISSUES ANALYZED IN DETAIL

Recreation

***Issue*: The Proposed Action would impact recreational opportunities within the Vail Ski Area SUP and the Eagle Valley.**

Analysis Area: Vail Ski Area SUP area and the Eagle Valley

Analytical Indicators:

- Application of a "Guests At One Time" (GAOT) model to estimate how guests disperse across the SUP area at any point in time under alternatives 1, 2 and 3
- Annual summer visitation projections to Vail Ski Area under alternatives 1, 2 and 3

Visuals

***Issue*: Proposed structures, facilities and features would incrementally add to the developed nature of the Vail Ski Area SUP area and could cause negative scenery impacts. In particular, proposed infrastructure and activities at Adventure Ridge would increase development density and could detract from existing scenic values and important scenic viewsheds.**

Analysis Area: The Vail Ski Area SUP area, as viewed from within the ski area, as well as externally from the I-70 corridor and higher elevations of the Eagles Nest and Holy Cross wilderness areas.

Analytical Indicators:

- Discussion of the existing scenic integrity of the Vail Ski Area SUP area and potential changes to this condition

[3] USDA Forest Service, 2012b Section 12.41
[4] Ibid. Section 12.5

- Discussion of the Scenic Integrity Objectives (SIO) for the Vail Ski Area SUP area, as defined by the 2002 Forest Plan
- Completion of a viewshed analysis including identification of viewpoints where proposed projects would be most visible, including at night
- Discussion of Distance Zones (Foreground, Middleground, Background) and how visible proposed projects would be from each viewpoint/distance zone
- Discussion of the Forest Service's Built Environment Image Guide (BEIG), as applicable to existing and proposed guest service and recreational facilities

Traffic, Parking and Ski Area Access

***Issue*: The Proposed Action may contribute to demand for additional parking within the Town of Vail and additional traffic on I-70 throughout the year.**

Analysis Area: The I-70 corridor between the Front Range and Town of Vail

Analytical Indicators:

- Available parking spaces throughout the Town of Vail
- Parking demand (spaces) related to Vail Ski Area's summer operations under all alternatives
- Existing and projected daily vehicles on I-70 specifically related to Vail Ski Area's summer operations under all alternatives

Social and Economic Resources

***Issue*: Through construction and operation of proposed non-skiing recreational activities within Vail Ski Area's SUP area, the local economy would be affected.**

Analysis Area: Eagle County

Analytical Indicators (as per IMPLAN3 economic modeling):

- Population
- Employment (both inside the resort and outside of the resort, including a discussion of part-time/seasonal employment vs. full-time equivalents)
- Personal income (i.e., wages)
- On- and off-site visitor spending
- Town/county tax revenue (total state/local and federal)
- Environmental Justice

Cultural Resources

***Issue*: Proposed projects and associated ground disturbing activities have potential to affect known or unidentified cultural resources in the Analysis Area.**

Analysis Area: The Vail Ski Area SUP area

Analytical Indicators:

- Identification of known cultural resources in the Area of Potential Effects (APE) as based on previously-conducted surveys
- Discussion of the potential for proposed projects to impact known cultural resources in the APE

Wildlife and Aquatic Resources

***Issue*: Implementation of proposed projects (including construction and operation) could affect Proposed, Threatened, and Endangered (TEP), Forest Service Region 2 (R2) Sensitive and Management Indicator (MIS) wildlife, migratory birds and aquatic species in the Analysis Area.**

Analysis Areas: *Wildlife* – The Vail Ski Area SUP area, Eagle Valley and Camp Hale Lynx Analysis Units, and Dowd Junction and Vail Pass Lynx Linkage Areas.
Aquatics – Mill, Two Elk, and Game Creek watersheds, as well as the segment of Gore Creek below the confluence with Mill Creek.

Analytical Indicators:

- Identification, quantification and analysis of TEP, R2 sensitive and MIS (including migratory birds) animal habitat in the Analysis Area
- Identification, quantification and analysis of TEP, R2 sensitive and MIS aquatic (fish, amphibians, and macroinvertebrates) habitat in the Analysis Area; this includes an analysis of physical stream health in regards to aquatic habitat
- Identification of effects within Lynx Analysis Unit (LAU) boundaries and Lynx Linkage Areas in relation to the Vail Ski Area SUP area
- Description of effects to lynx from potential increased traffic
- Determination of stream health within the Analysis Area

Soils

***Issue*: Ground disturbance associated with construction and operation of proposed projects has potential to increase erosion/soil compaction and lead to a loss of organic material in the Analysis Area.**

Analysis Area: Areas proposed for ground disturbance throughout the Vail Ski Area SUP area.

Analytical Indicators:

- Identification and estimated quantification (acres) of temporary and permanent ground disturbance according to high/moderate/low erodibility soils classes
- Analysis of area (acres) of increased erosion hazard due to temporary and permanent ground disturbance

Watershed and Wetlands

***Issue*: Ground disturbance and overstory vegetation removal associated with construction and operation of proposed projects has potential to affect water yield and produce sediment and reduce stream bank stability in the Analysis Area.**

***Issue*: Ground disturbance and proposed overstory vegetation removal associated with construction and operation of proposed projects has potential to affect wetlands and wetland function and values within the Analysis Area.**

Analysis Area: Areas proposed for ground/vegetation disturbance within the Project Area and Gore Creek below the confluence with Mill Creek.

Analytical Indicators:

- Identification of perennial and intermittent stream channels across the Analysis Area in relation to proposed projects
- A thorough characterization of existing hydrologic function and stream health conditions in the watersheds within the Analysis Area
- Identification and discussion of existing problem areas and sensitive areas within the Analysis Area in relation to the proposed projects
- Identification of waters of the U.S., including wetlands, across the Analysis Area in relation to proposed projects
- Identification of any Clean Water Act (CWA) impaired or threatened waterbody segments in the Analysis Area
- Quantification of connected disturbed areas (CDA) in the Analysis Area
- Identification of proposed overstory vegetation removal and grading in the Water Influence Zone (WIZ)
- Quantification of changes in water yield or discharge to receiving streams related to proposed ground disturbance and overstory vegetation removal

Vegetation and Botany

***Issue*: Ground disturbance associated with construction and operation of proposed projects could affect plant communities throughout the Analysis Area, including Threatened, Endangered, and Sensitive (TES) species, WRNF Species of Local Concern (SOLC), and invasive plant species.**

Analysis Area: Areas proposed for ground disturbance throughout the Vail Ski Area SUP area.

Analytical Indicators:

- Identification of TES plant habitat/individuals in the Analysis Area
- Identification of WRNF SOLC habitat/individuals in the Analysis Area
- Estimation (acreage) of proposed ground disturbance and overstory vegetation removal in relation to site-specific and conceptual project locations
- Identification of invasive species in the Analysis Area
- Discussion of forest health within the Analysis Area in relation to the mountain pine beetle epidemic
- Identification of invasive species in the vicinity of the Project Area and use of Best Management Practices (BMPs) to limit their spread

SUBSTANTIVE ISSUES THAT DROVE THE DEVELOPMENT OF AN ALTERNATIVE TO THE PROPOSED ACTION

No physical or biological resource issues were identified that warranted consideration of alternatives to the Proposed Action. However, one policy issue did drive the development of an additional alternative.

As discussed in Section I – Consistency with Policy of this chapter, in November 2011, Congress enacted the SAROEA which clarifies the authority of the Secretary of Agriculture regarding additional recreational uses of NFS land subject to ski area permits. The SAROEA provides authority for the Forest Service to approve facilities to support natural resource-based recreation summer and four-season use, in addition to facilities for snow sports. However, final policy that identifies which specific activities are allowable/precluded on NFS lands is forthcoming. Until this final policy is released, some components of the Proposed Action may not be authorized. Chapter 2 includes information on alternatives to the Proposed Action.

H. SCOPE OF THE ANALYSIS

Based on preliminary internal Forest Service and external public scoping, and evaluation of the context and intensity factors contained in 36 CFR 1508.27, the Forest Service has determined that an EIS is necessary to review, analyze, and document the potential impacts to the human and biological environment anticipated to result from the implementation of the proposed projects. This DEIS is a disclosure rather than a decision document and its purpose is to provide sufficient environmental analysis

to support a Record of Decision (ROD), which will be released in conjunction with a Final Environmental Impact Statement (FEIS).

Scope consists of the range of actions, alternatives, and impacts to be considered within this DEIS. (Section G identifies the resources that are analyzed in detail in Chapter 3 of this DEIS, and the substantive issues that drove the development of alternatives to the Proposed Action.) Furthermore, it includes the spatial and temporal boundaries associated with the actions, alternatives, and impacts as the scope of the analysis relates to the Purpose and Need. Individual project elements are discussed in detail in Chapter 2 and illustrated in the alternative maps. A scope of analysis is presented at the beginning of each resource section in Chapter 3. The Analysis Area is determined by individual resource analyses presented in Chapter 3 (e.g., the Watershed and Aquatic Resources Analysis Area is spatially different from the Wildlife Analysis Area). It is important to note that implementation of the projects could occur jointly, individually, and/or at different points in time.

As based on direction provided by the Council on Environmental Quality (CEQ) the analysis provided in this DEIS considers the following types of actions, alternatives, and impacts.[5]

ACTIONS

1. Connected Actions: actions that are dependent on each other for their utility.
2. Cumulative Actions: actions which, when viewed with other proposed actions, have cumulatively significant impacts and should therefore be discussed in the same impact statement.

ALTERNATIVES

1. No Action.
2. The Proposed Action.
3. Other reasonable courses of action identified in response to substantive issues.

IMPACTS

1. Direct impacts are caused by the action and occur at the same time and place.
2. Indirect impacts are later in time or farther removed in distance but are still reasonably foreseeable (i.e., likely to occur within the life of the project).
3. Cumulative impacts are the result of the incremental effects of any action when added to other past, present, and reasonably foreseeable future actions and can result from individually minor, but collectively significant actions taking place over an extended period of time.

[5] 40 CFR 1508.25

I. CONSISTENCY WITH POLICY

WHITE RIVER NATIONAL FOREST LAND AND RESOURCE MANAGEMENT PLAN

Vail Ski Area's operations carried out on NFS lands must comply with management direction provided in the 2002 Revised White River National Forest Land and Resource Management Plan (2002 Forest Plan). The 2002 Forest Plan includes 33 separate Management Areas for different portions of the forest based on ecological conditions, historic development, and anticipated future conditions. All components of Alternative 2 – Proposed Action and Alternative 3 fall within the 8.25 Management Area – Ski Areas (Existing and Potential), which directs:

> *"Facilities may be intensively used throughout the year to satisfy a variety of seasonal recreational demands…Protection of scenic values is emphasized through application of basic landscape aesthetics and design principles, integrated with forest management and development objectives…Transportation systems provide convenient access to National Forest System lands in key portal locations with adequate public parking, base facilities, and community infrastructure. Base areas that serve as entrance portals are designed as gateways to public lands. They are architecturally designed to blend with the forest setting and contain convenient facilities and services that provide for the needs of forest visitors."*[6]

As part of this analysis, the alternatives and Purpose and Need were reviewed to determine consistency with the Forest-wide Goals and Objectives as well as the specific Standards and Guidelines for Management Area 8.25. The Proposed Action was compared against pertinent Forest-wide and Management Area standards and guidelines; no inconsistencies between the proposal and pertinent standards and guidelines were identified.

The theme of Management Area 8.25 is discussed in the 2002 Forest Plan and states:

> *"Ski areas are developed and operated by the private sector to provide opportunities for intensively managed outdoor recreation activities during all seasons of the year. This management area also includes areas with potential for future development."*[7]

2011 SKI AREA RECREATIONAL OPPORTUNITY ENHANCEMENT ACT

Most of the 122 ski areas operating on NFS lands in the United States are authorized under special use permits per the National Forest Ski Area Permit Act of 1986 (the 1986 Act).[8] As originally enacted, the 1986 Act authorized Nordic and Alpine skiing at ski areas on NFS lands. In November 2011, Congress enacted the SAROEA, which amended the 1986 Act to clarify the authority of the Secretary of

[6] USDA Forest Service, 2002 p 3-80
[7] Ibid.
[8] 16 USC 497b

Agriculture regarding additional recreational uses of NFS land subject to ski area permits, and for other purposes.

The purpose of SAROEA was to amend the 1986 Act in two ways:

(1) to enable snow-sports (other than nordic and alpine skiing) to be permitted on National Forest System land subject to ski area permits issued by the Secretary of Agriculture under section 3 of the National Forest Ski Area Permit Act of 1986; and

(2) to clarify the authority of the Secretary of Agriculture to permit appropriate additional seasonal or year-round recreational activities and facilities on National Forest System land subject to ski area permits issued by the Secretary of Agriculture under section 3 of the National Forest Ski Area Permit Act of 1986.

SAROEA amended the 1986 Act by *striking* specific references to ''nordic and alpine" ski areas, facilities, operations and purposes and *inserting* more general language regarding 'ski areas and associated facilities'' and ''skiing and other snow sports and recreational uses authorized by this Act.'' However, for the purposes of this analysis, the most important amendment to the 1986 Act is an insertion to section 3 regarding "Other Recreational Uses."

Per SAROEA, subject to the terms of a ski area permit, the Secretary may authorize a ski area permittee to provide such other seasonal or year-round natural resource-based recreational activities and associated facilities (in addition to skiing and other snow-sports) on National Forest System land subject to a ski area permit as the Secretary determines to be appropriate.

Importantly, each activity and facility authorized by the Secretary shall:

(A) encourage outdoor recreation and enjoyment of nature;

(B) to the extent practicable:

  (i) harmonize with the natural environment of the National Forest System land on which the activity or facility is located; and

  (ii) be located within the developed portions of the ski area;

(C) be subject to such terms and conditions as the Secretary determines to be appropriate; and

(D) be authorized in accordance with:

  (i) the applicable land and resource management plan; and

  (ii) applicable laws (including regulations).

Inclusions identified in SAROEA

Activities and facilities that may, in appropriate circumstances, be authorized include:

(A) zip lines;

(B) mountain bike terrain parks and trails;

(C) frisbee golf courses; and

(D) ropes courses.

Exclusions identified in SAROEA

Activities and facilities that are prohibited include:

(A) tennis courts;

(B) water slides and water parks;

(C) swimming pools;

(D) golf courses; and

(E) amusement parks.

The Secretary may not authorize any activity or facility if the Secretary determines that the authorization would result in the primary recreational purpose of the ski area permit to be a purpose other than skiing and other snowsports.

PROPOSED DIRECTIVE FOR ADDITIONAL SEASONAL OR YEAR-ROUND RECREATIONAL ACTIVITIES AT SKI AREAS

On October 2, 2013, the Forest Service proposed changes to Forest Service Manual direction to provide authorized officers guidance in the implementation of SAROEA. Until such direction is finalized, only those activities expressly identified in SAROEA may be implemented.

J. DECISION TO BE MADE

Based on the analysis documented within this DEIS, the Responsible Official, the Forest Supervisor for the WRNF, will decide whether to select Alternative 1 – No Action, Alternative 2 – Proposed Action, or Alternative 3. The Forest Supervisor is not required to choose either an action alternative or the No Action Alternative described herein, but may select components of an action alternative or develop an entirely new alternative created from components of each. In addition to determining which alternative to select, the Forest Supervisor will also identify which Management Requirements (including Project Design Features [PDF], mitigation measures, and Best Management Practices [BMPs]) are necessary, as based on the information provided in the EIS.

In compliance with Forest Service Handbook 1909.15 chapter 18, the Forest Service will continually review the relevancy of the analysis and subsequent decision for new and changed conditions as any approved projects are advanced for implementation.

K. OTHER NECESSARY PERMITS, LICENSES, ENTITLEMENTS AND/OR CONSULTATION[9]

The Forest Service decision would apply only to NFS lands analyzed within this DEIS. However, other federal, state, and local entities may also have jurisdiction. Decisions by jurisdictions to issue or not issue approvals related to this proposal may be aided by the analyses presented in this DEIS. While the Forest Service assumes no responsibility for enforcing laws, regulations, or policies under the jurisdiction of other governmental agencies, Forest Service regulations require permittees to abide by applicable laws and conditions imposed by other jurisdictions. In addition to requisite Forest Service approvals, consultation with the following entities, or permits, may be required to implement any approved projects:

- U.S. Fish and Wildlife Service (USFWS), Endangered Species Act (ESA) Section 7 Consultation
- Eagle County General Construction Permit
- Colorado Department of Public Health and Environment (CDPHE), Construction Stormwater Discharge Permit. Colorado stormwater regulations s (5CCR 1002-61) require a permit for construction activity that disturbs 1 acre or more during the life of the project.

[9] Per 40 CFR 1502.25(b)

Chapter 2
Description of Alternatives

2. DESCRIPTION OF ALTERNATIVES

A. INTRODUCTION

Chapter 2 describes the alternatives considered within this environmental analysis and briefly summarizes the environmental consequences anticipated to result with the implementation of each. As required by the Council on Environmental Quality (CEQ), the alternatives considered are presented in comparative form.[9] Project Design Features (PDF) and Best Management Practices (BMPs), designed to lessen or avoid impacts anticipated to occur as a result of implementation of any of the action alternatives, are also detailed.

NEPA requires that an environmental analysis examine a range of alternatives, which are reasonably related to the purpose of the project.[10] Both CEQ Regulations and Forest Service Handbook direction emphasize that alternatives must meet the "reasonableness" criteria in order to warrant detailed analysis. Alternatives that were considered within the analysis process, but were determined not reasonable, were eliminated from detailed study with a brief discussion of the rationale for their elimination.[11]

The issues raised during the scoping process (detailed in Chapter 1) were utilized as the basis for determining the need for alternatives to the Proposed Action.

B. ALTERNATIVES CONSIDERED IN DETAIL

In addition to the Proposed Action, a second action alternative (Alternative 3) and the required No Action Alternative are analyzed in detail within this DEIS.

ALTERNATIVE 1 – NO ACTION

As required by NEPA, a No Action Alternative has been included in this analysis for review alongside the action alternatives.[12] By definition, the No Action Alternative represents a continuation of existing management practices without changes, additions, or upgrades to existing conditions. Brief descriptions of existing on-mountain facilities and services are provided below. The No Action Alternative is depicted in Figure 1.

The No Action Alternative provides a baseline for comparing the effects of the action alternatives. The No Action Alternative essentially reflects a continuation of existing management practices without changes, additions, or upgrades. No new facilities or recreational activities are included in the No Action Alternative.

[9] 40 CFR 1502
[10] USDA Forest Service, 2012b Section 12.33
[11] 40 CFR 1502.14(a)
[12] 40 CFR 1502.14(d)

ALTERNATIVE 2 – PROPOSED ACTION

The Proposed Action includes the following elements, each of which is defined in the subsequent text:[13]

- Educational and Interpretive Programs
- Zip Line Canopy Tours:
  - Game Creek Canopy Tour
  - Front Side Canopy Tour
- Mountain Coasters:
  - Adventure Ridge Mountain Coaster
  - Pride Express Mountain Coaster
- Expanded Hiking and Mountain Biking Trails
- Riparian Experience
- Aerial Adventure Course
- Modified horse trail in Game Creek Bowl
- Wildwood observation deck
- Wedding venue at The 10th

Proposed projects have been designed to harmonize with, and benefit from, the natural setting within Vail Ski Area's existing Forest Service-administered SUP area. They are designed to both complement and improve the existing non-skiing recreational opportunities that are currently offered on NFS lands at Vail Ski Area. All of the proposed projects rely on the mountain forest setting, either because of the natural surroundings (such as the forest canopy and views) or because of the natural conditions (such as topography and vertical relief).

While some of the proposed projects (e.g., coasters and canopy tours) could be used year-round, the overall package of projects is primarily designed to benefit the summer user at Vail Ski Area. As a whole, the existing and proposed activities at Adventure Ridge and throughout the SUP area are designed to offer guests multiple days' of entertainment throughout the summer, and would likely drive increased utilization of the ski area at that time. However, the coasters and canopy tours would be amenities to the skiing experience during the winter, and would not—by themselves—drive any additional winter visitation to the ski area.

[13] Note: the proposed canopy tours and adventure park have been planned by Bonsai Design, a firm with over 20 years of experience in designing and building aerial adventure systems. Bonsai Design is a member of the Association of Challenge Course Technology (ACCT) and has developed stringent internal design standards, as well.

To facilitate the use and enjoyment of these proposed projects, an existing on-mountain food service venue is proposed for summer use at Wildwood restaurant. This existing facility is presently only used during the winter, but under Alternative 2 its operation would extend throughout the summer. Other existing infrastructure—namely chairlifts—are proposed for summer operation. As discussed below, Avanti Express, Wildwood Express, Mountaintop Express, Game Creek Express, and Pride Express would operate in the summer to provide access to activities and hiking and biking trails.

All proposed activities and operations are depicted in Figure 2.

Educational and Interpretive Programs

The WRNF and Vail Ski Area recognize that there are ample opportunities available to educate guests about the outdoors and public lands. A key component of the Proposed Action is an interpretive program that is embedded throughout the range of existing and proposed year-round activities at Vail Ski Area. The interpretive program revolves around the concept of learning through play. Environmental education and interpretive elements (signs and displays) would be integrated within each activity, at the staging areas, along the trails and walkways, and within buildings. The evolving interpretive program would be defined through coordination with partner environmental organizations. Participatory programs would also be developed focusing on skills and knowledge that would help people further explore the outdoors on their own.

Zip Line Canopy Tours

Two proposed canopy tours would be composed of multiple, elevated, interconnected zip lines that would allow riders to traverse through, or above, the forest canopy. The canopy tours can be operated year-round. Because individual trees in the lodgepole pine, spruce and aspen forest throughout the Project Area are not large enough to serve as anchors for the canopy tours, cables would be connected to specialized towers that are fitted with elevated platforms (refer to Photo 2-1). This would enable riders outfitted with climbing harnesses to descend by gravity from the top to the bottom of the inclined cable. Reverse grades on the cables at the landing zones would decelerate descending riders. Groups of riders would be escorted along the entire canopy tour by trained guides. The elevation of each individual zip line would be determined by features such as topography, vegetation, activity overlap and infrastructure location. Each tower would consist of a wooden platform supported by two wooden or dark galvanized steel poles and guy wires and would typically be between 20 to 35 feet tall (refer to Appendix B for a typical tower design).

Construction of the towers would require clearing vegetation within an approximate 50-foot radius of the towers, as well as the construction/access routes that are necessary to build and maintain the towers. Most zip line segments would require corridors of vegetation removal through the forest canopy to ensure the safety of riders. Construction/access routes would typically coincide with the clearance zone along the canopy tour route.

Photo 2-1:
Zip Line Canopy Tour

Riders would traverse over tree tops within tens of feet; however, a "Safe Clearance Zone" would be cleared of vegetation. The Safe Clearance Zone would be cleared a minimum of 6 feet horizontally from the centerline of each zip line (i.e., 12 feet total for the corridor) with larger clearance zones to account for wind gusts as users get farther away from the towers. The vertical clearance would be at least 15 feet below the un-weighted line, with additional consideration given to large trees within felling distance of the line. Low-lying vegetation in the corridors would remain.

Finally, standalone shelters (approximately 150 square feet in size) would be constructed in conjunction with each canopy tour (for a total of two structures) for use during inclement weather. These simple structures would be constructed with three sides (open on the fourth side) with sloped roofs and wooden floors to provide protection from the elements.

In total, both zip line canopy tours would total approximately 5.3 miles of interconnected zip lines. Construction of both zip line canopy tours would result in approximately 9 acres of disturbance (including grading and/or vegetation removal) for the implementation of towers, base stations, weather structures and cable pathways.

Game Creek Canopy Tour

The proposed Game Creek Canopy Tour would allow riders to descend to the base of Game Creek Bowl from Eagle's Nest, then utilize the Game Creek Express to access the Wildwood restaurant, and finally descend back to Eagle's Nest. The Game Creek Canopy Tour would be composed of seven interconnected zip lines. The first tower would serve as a launch and landing location for the canopy tour. From the start/finish tower, riders would descend three zip lines into Game Creek Bowl. After descending to ground level from the third tower, the Game Creek Express would transport riders to Wildwood. From there, canopy tour riders would take four more zip lines back to the start/finish tower at Eagle's Nest to complete their tour. A stand-alone shelter would be constructed along the Game Creek Canopy Tour at the tower near the base of the Game Creek Express for use during inclement weather.

The Game Creek Canopy Tour would total approximately 2.1 miles of interconnected zip lines. This project would involve the construction of eight towers. The two lowest towers in Game Creek Bowl are located on private land. Construction of the Game Creek Canopy Tour would result in approximately 3 acres of disturbance (including grading and/or vegetation removal).

Front Side Canopy Tour

The Front Side Canopy Tour is proposed on the front side of Vail Mountain—beginning at Mid-Vail and ending near the base of Gondola One, a short walk from Vail Village. A total of ten interconnected zip lines are included in the design. The longest segment (between towers 5 and 6) would be approximately 3,300 feet long, carrying riders over 500 feet above the ground.

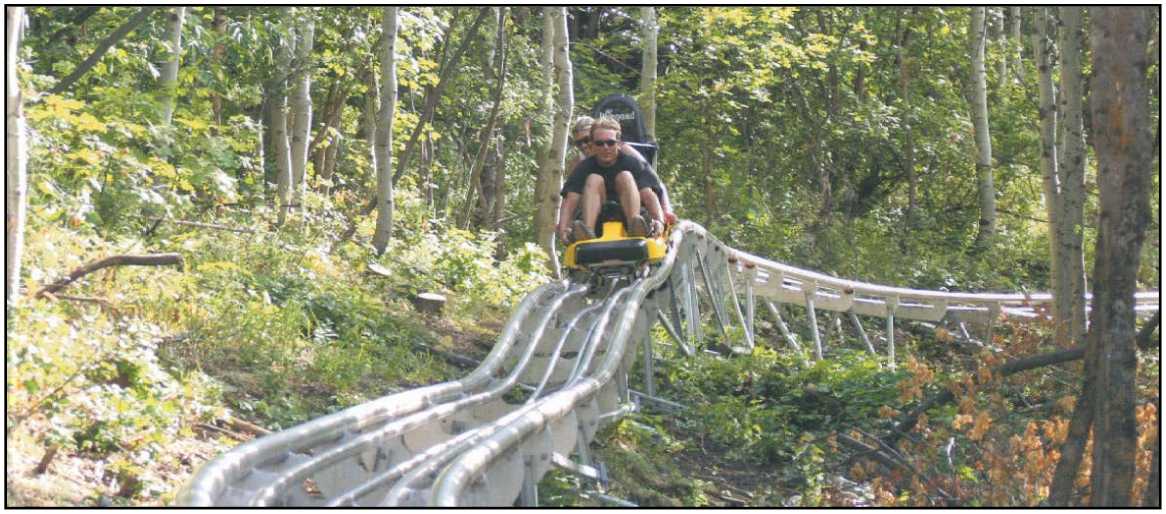
In total, the Front Side Canopy Tour would total approximately 3.2 miles. This project would involve the construction of eleven towers and a Safe Clearance Zone. As with the Game Creek Canopy Tour, a shelter would be constructed halfway along the route for use during inclement weather. Construction of the Front Side Canopy Tour would result in approximately 6 acres of disturbance (including grading and/or vegetation removal).

Mountain Coasters

Mountain coasters are elevated, self-contained, fixed-rail rides that allow users on individual carts to descend on tracks through the forest in a participant-controlled manner. Speed is controlled by the rider through a manual braking system. Depending on the design, either an integrated motorized conveyance, or an existing chairlift, can be used to transport riders and carts back to the top. Mountain coasters can be operated year-round.

Mountain coasters are designed specifically based on the slope, contours and topography of an area, and a forested setting with proper grades is integral to the overall experience. The natural topography in the vicinity of Adventure Ridge, combined with existing guest service infrastructure, creates a logical location for the mountain coasters placement. In addition, the Adventure Ridge area already receives substantial use in the day and evening. Both coasters would tie into the existing power system at the Eagle’s Nest Facility.

Photo 2-2:
Mountain Coaster



Two mountain coasters are included in the Proposed Action. In total, both coasters would total approximately 3.3 miles of rail line. Approximately 2.3 acres of ground disturbance would be required for start and finish locations. Minimal ground disturbance would be required for footings and anchors along the track, and a 14-foot wide corridor would be cleared of vegetation. Storage and operating shelters for the Adventure Ridge Mountain Coaster are described below.

Adventure Ridge Mountain Coaster

The proposed Adventure Ridge Mountain Coaster would be located just west of Pride Express. As proposed, the track would be approximately 3,700 feet in length, with numerous turns and twists as it descends roughly 300 vertical feet through the forest from start to finish. A return track of approximately 1,700 feet in length would return the carts to the starting area.

The elevated track assembly (up to 15 feet above the ground, and 20 feet high at road crossings) would be composed of parallel tubular rails. The elevation of the track would be dictated by features such as topography, vegetation, anticipated snow depth, track geometry and the need to cross access roads or trails. A wide track offers stability throughout the descent, and derailment is not a concern as carts are securely fastened to the outer track. Carts can accommodate up to two riders.

Riders control their velocity for the entire descent by releasing pressure on a brake handle through straights and curves in the track (if the brake handle is released entirely, the cart will stop). The top speed of each cart can be set with centrifugal brakes (up to approximately 25 mph). Each cart is equipped with safety belts, brake levers and energy absorbent front and rear bumpers.

Because snow and rain do not affect their operation and safety, they can be operated throughout the year, and at night. Low-wattage headlights can be fitted to each cart, and low-level lighting on elevated posts is

proposed at both the start and finish areas. Low-level lights are also proposed at turns along the track so riders can be aware of upcoming turns. However; there would be no net increase in lighting at Adventure Ridge as existing lights are proposed to be relocated or removed from the Chair15 area to the top and bottom locations of the mountain coasters. An approximate 400-square foot (roughly 15 feet x 25 feet) storage building is proposed at the top, with a small operator shelter at the bottom.

The design and construction of the Adventure Ridge Mountain Coaster would incorporate low-impact design techniques and require an approximately 14-foot wide corridor of vegetation removal. Foundations for start and finish areas would require approximately 0.3 acre of ground disturbance. Likewise, the elevated track between the start and finish area would be supported by a combination of concrete footings (approximately 4 square feet each) and anchors spaced as necessary along the track. Where loops are incorporated into the track design, a larger concrete foundation (approximate 25 square feet) would be necessary. No new access routes would be necessary for installation and operation of the Adventure Ridge Mountain Coaster.

Pride Express Mountain Coaster

The Pride Express Mountain Coaster is proposed to provide a longer and more adventurous experience compared to the proposed Adventure Ridge Mountain Coaster.

The proposed Pride Express Mountain Coaster would begin near the top of the proposed Adventure Ridge Mountain Coaster, west of the Pride Express, and would extend to the bottom of the Pride Express. This would involve roughly 12,000 feet of track descending approximately 1,200 vertical feet. After descending, riders would use the Pride Express to return to Eagle's Nest.[14] The Pride Express Mountain Coaster could accommodate one or two riders per cart.

Like the Adventure Ridge Mountain Coaster, this project would require an approximately 14-foot wide corridor of vegetation removal and minimal ground disturbance. Start and finish areas would be approximately 0.3 acre and track footings would resemble those described above under the Adventure Ridge Mountain Coaster.

Expanded Hiking and Mountain Biking Trails

There are currently approximately 59 miles of hiking, mountain biking (cross-country and downhill) and multi-use trails across Vail Mountain. This trail network is proposed to be supplemented with additional hiking and biking trails that would traverse the front side of Vail Mountain. These trails would use the Avanti Express, Wildwood Express, Mountaintop Express, Game Creek Express, Gondola One, Eagle Bahn Gondola and Pride Express for access.

[14] Individual chairs on the Pride Express would be retrofitted with hangers designed to transport carts.

Between 45 and 55 miles of hiking and biking trails are proposed in the areas identified on Figure 2. The average width of new hiking and biking trails would range from 3 to 8 feet, depending on cross slope. An approximate breakdown of these trails, by type, includes:

- 20 percent: Hiking
- 45 percent: Cross-Country Mountain Biking
- 35 percent: Downhill Mountain Biking

Conceptual areas have been identified for proposed hiking and biking trails across the front side of Vail Mountain (refer to Figure 2). Pending approval, trails would be "field-fit" within areas that have been identified and analyzed in the EIS. All trails would be subject to project design features, best management practices and management requirements in order to lessen or avoid resource impacts. Proposed hiking and biking trails would be constructed using a combination of hand tools and specialized machinery, and could require some grading and minor tree removal for the length of the trails. Through planning and incorporating sustainable trail design, direct fall line descents would be avoided and modern erosion control measures would be incorporated; any wetlands within the vicinity of the trails would be avoided or bridged.

Riparian Experience

The proposed Riparian Experience is intended to be a "hands-on," interactive, interpretive and educational experience for children. This would be similar to a residential water feature (refer to Photo 2-3), but would be designed to allow children to observe, investigate and deepen their understanding of the basic hydrologic processes in a natural-looking setting. The Riparian Experience would be located on the east side of Eagle's Nest, just west of the top of Chair 15, and would be constructed of a mix of materials including stone, metal and wood. This manufactured water feature would include check dams and water wheels in braided, in-ground streams approximately 18 inches wide and 4 inches deep. Children would be able to interact with the water features (building dams, rerouting water, etc.), while simultaneously learning about hydrologic processes. A self-contained water recirculating system that ties into the existing system at Eagle's Nest would minimize water usage.

This project would be incorporated in an area of approximately 2,250 square feet. This area has been disturbed in the past and does not contain any overstory vegetation.

Photo 2-3:
Riparian Experience

Image sources: opalcreek.org and www.botanicgardens.org

Aerial Adventure Course

An aerial ropes and zip line course is proposed to the north and west of Eagle's Nest Facility, in a forested area below and west of the top of Pride Express. This would be an aerial trekking park with a variety of features suitable for children, such as small towers, bridges, slides and zip lines. The features would represent a variety of difficulty levels. Primarily natural materials and colors would be used. After being outfitted with equipment and an orientation session, children would be able to act independently to overcome obstacles in a natural environment.

Photo 2-4:
Aerial Challenge Course

This project would be dispersed across an area of approximately 0.5 acre. Ground disturbance and vegetation clearing for the construction of pathways and features would be limited.

Modified Horse Trail in Game Creek Bowl

Guided horseback tours that occur entirely on mountain roads are currently provided at Adventure Ridge. These tours take guests from Adventure Ridge through the Game Creek Bowl and back. In order to provide a more natural and engaging experience, a single track trail is proposed in a roughly parallel alignment to the existing roads utilized in current tours. The alignment would allow the horseback tours to avoid pedestrian traffic in the center of Adventure Ridge. The modified equestrian trail would be approximately 4 feet wide and would require approximately 1 mile of new trail construction, creating approximately 0.5 acre of ground disturbance. Additionally, the corral would be relocated to a location slightly further west. Construction of the new corral would result in approximately 0.5 acre of ground disturbance.

Wildwood Observation Deck

A deck is proposed at Wildwood (at the edge of Sundown Bowl) to provide views of Vail Ski Area's Back Bowls, Blue Sky Basin, the Gore Range, and the Eagles Nest Wilderness. The footprint of the Wildwood observation deck would be approximately 1,000 square feet and would be designed to incorporate the requirements of the BEIG, as appropriate.

Wedding Venue at The 10th

An outdoor wedding venue is proposed to be designed as a low platform and located just north of The 10th restaurant at Mid-Vail. It would be constructed from natural materials and would accommodate groups of up to 100 people; the participants and officiant would be on a raised surface, while spectators would be gathered/seated on grass surrounding it. The location of the wedding venue would capitalize on existing infrastructure and food service, as well as Gondola One.

ALTERNATIVE 3

No resource issues were raised during public or internal scoping that drove the consideration of an alternative to the Proposed Action. However, an alternative to the Proposed Action was created in response to passage of SAROEA. While the 2011 Act specifically identifies zip lines, mountain biking trails, frisbee golf courses, and ropes courses as activities and facilities that can be authorized on NFS lands, some activities are specifically prohibited, and others are not addressed at all. Therefore, until final Forest Service policy is released that clarifies the types of activities that can be authorized on NFS lands, it is unknown whether some components of the Proposed Action are consistent with the 2011 Act.

In order to provide assurance that one of the action alternatives is consistent with SAROEA, Alternative 3 includes all projects in the Proposed Action, except the following three components:

- Mountain Coasters
- Riparian Experience
- Wedding venue at The 10th

C. MODIFICATIONS MADE TO THE PROPOSED ACTION

Since the Proposed Action was scoped in November 2012, the following project components have been removed from the analysis or modified.

- Rappel Activity at Adventure Ridge: removed from Proposed Action
- Reconfigured Talon's Deck and Barbeque Area at Eagle's Nest: removed from Proposed Action
- Observation Tower at Adventure Ridge: removed from Proposed Action
- Observation Tower at Wildwood: Clarified that this is proposed as a deck extending from Wildwood overlooking Sun Down Bowl

D. MANAGEMENT REQUIREMENTS

The following Management Requirements (including Project Design Features [PDF] and Mitigation Measures) have been incorporated into alternatives 2 and 3 (refer to Table 2-1).

PDF are designed into the Proposed Action and alternatives to avoid or minimize impacts, and include BMPs, Forest Plan Standards and Guidelines (S&Gs) and Standard Operating Procedures. PDF come from federal, state, and local laws, regulations and policies; forest plans, Interdisciplinary Team (ID Team) recommendations, and/or scientific research and from experience in designing similar projects. As opposed to PDF, which are embedded in the proposed activities, Mitigation Measures are actions that have been added after initial environmental analysis if environmental impacts are shown to be unacceptable.

Responsibility for ensuring that the following Management Requirements (listed in Table 2-1) are implemented rests with Vail Ski Area and the Forest Service. In all cases, the ultimate enforcement mechanism for implementation of the specified PDF would be the Record of Decision for the FEIS, and would extend to the Forest Service Special Use Permit Administrator, the District Ranger and the Forest Supervisor.

Table 2-1:
Management Requirements

RECREATION
Where appropriate, fencing, flagging, signage and other safety mechanisms would be used to alert skiers to the location of zip line canopy tour towers, guy wires, mountain coaster tracks, and other infrastructure.
VISUALS
All proposed structures, features, and facilities will adhere to the WRNF's Building Design Review, and will be consistency with the Vail Mountain Design Guidelines, which were developed in cooperation with the WRNF.
Comply with the Forest Service's Built Environment Image Guide (BEIG) when constructing approved facilities.
Plan, design and locate vegetation manipulation on a scale that retains the color and texture of the landscape character, borrowing directional emphasis of form and line from natural features. (Forest Plan Guideline)
Facilities, structures and towers with exteriors consisting of galvanized metal or other reflective surfaces will be treated or painted dark non-reflective colors that blend with the forest background to meet an average neutral value of 4.5 or less as measured on the Munsell neutral scale. (Forest Plan Guideline)
All structures, facilities, and features will meet color guidelines. Bright colors are inappropriate for the forest setting. The colors will be muted, subdued colors that will blend well with the natural forested environment. (Page 37 of Forest Service Handbook No. 617)
All structures, facilities, and features will meet reflectivity guidelines. This includes any reflective surfaces (metal, glass, plastics, or other materials with smooth surfaces), that do not blend with the natural environment. Reflective surfaces will be covered, painted, stained, chemically treated, etched, sandblasted, corrugated, or otherwise treated to meet the solar reflectivity guidelines. (Refer to WRNF Forest Plan, Scenery Management Guidelines.)
When removing vegetation for any proposed structure, the shape of new openings in the forest canopy should appear natural and blend into the surrounding vegetated mosaic. Edges of new openings should be non-linear, and changes in tree heights along edges will be gradual rather than abrupt, where possible. Soften hard edges by selective removal of trees of different ages and heights to produce irregular corridor edges where possible.
When removing trees or other vegetation, stumps will be cut as low as possible to the ground to lessen scenery impact and avoid safety hazard.
Any site grading will blend disturbance into the existing topography to achieve a natural appearance. Minimize cut and fill at the transition of proposed grading and existing terrain.
Aside from horse, mountain biking and hiking trails, all disturbed areas will be re-vegetated. Re-vegetation will include planting native trees and shrubs and seeding with native grasses and forbs. Reseed with a native seed mixture recommended by the Forest Botanist. Seeding and planting will be repeated until satisfactory re-vegetation is accomplished.
When planting trees, do not plant in straight lines. For newly planted trees, the goal is to avoid appearance of tree farm regular spacing when planting. When planting, attempt to emulate the shape of openings and patterns in the surrounding landscape where possible. The edges of the stands will be varied and random to blend with the native vegetative mosaic. Plant clumps of trees in random patterns.
All facilities including trails and signs must meet Forest Service accessibility guidelines.
CULTURAL RESOURCES
If proposed hiking and biking trails are approved within the unsurveyed northwest area of the SUP boundary, an inventory for cultural resources shall be conducted prior to project implementation.

Table 2-1:
Management Requirements

If undocumented historic and/or prehistoric properties are located during ground disturbing activities or planning activities associated with approved construction activities, all construction in the immediate vicinity would cease and they would be treated as specified in 36 CFR 800.11 concerning Properties Discovered During Implementation of an Undertaking.
VEGETATION AND BOTANY
Before implementing any approved project activities not included in the 2013 botanical survey area, the specific project areas will be surveyed using established protocol. Surveys would be conducted for Threatened, Endangered, Proposed and Candidate Species, Sensitive Species, and Species of Local Concern (SOLC). More specifically, site-specific surveys will be conducted along all approved mountain biking and hiking trails and in any other areas where changes to the disturbance footprint have been made since the 2013 botanical survey. Such areas potentially include, but are not limited to, the proposed horse corral, the upper portion of the Pride Express Mountain Coaster, and construction access routes to Game Creek Canopy Tour towers.
If any previously unknown occurrences of R2 Sensitive or SOLC plants are encountered within the project footprint prior to or during project implementation, a Forest Service Botany Representative will be notified to derive suitable mitigation measures to avoid or minimize impacts as appropriate.
Minimize and avoid impacts to habitat occupied by relatively common *Botrychium* spp. (SOLC), and that provides habitat for R2 Sensitive moonworts.
Use construction fencing or other barriers to delineate occupied moonwort habitat and direct construction personnel to avoid parking or storing materials in these areas.
Implement Forest Service approved revegetation guidelines to all disturbed sites.
Implement noxious weed control throughout the Analysis Area including: • All mulch, hay, and straw used shall be certified weed-free. • Equipment coming from off-forest would be inspected and cleaned as necessary to ensure it is “weed-free” prior to moving into the Analysis Area. • Treat existing weed infestations within and adjacent to travel routes and project activity prior to implementation. • Monitor project activity areas and treat new infestations promptly.
WILDLIFE
This wildlife impact assessment, considering alternatives 2 and 3, was based on sampling and wildlife use documented from an extensive wildlife database for Vail Ski Area. Adequately prior to the implementation of any project component, potential impact areas should be identified, adequately evaluated (surveyed) for species that may be seasonally present, and potential negative effects minimized to the extent that resulting impacts do not exceed levels considered in this wildlife impact assessment. Species-specific surveys should consider those species addressed below in this table.
Final layout of conceptually approved mountain biking and hiking trails will be done in coordination with Forest Service biologists. All efforts will be made to avoid or minimize impacts to isolated (from existing summer activities) and/or large (e.g., ~30 to 50 acres) inter-trail tree islands, particularly those supporting mature, closed canopy spruce fir habitats exhibiting high quality lynx winter foraging habitat. Examples of such islands include, but are not limited to, the four large islands on the east side of Northeast Bowl (i.e., those on opposite sides of the Highline chairlift and those on opposite sides below the base of the Sourdough chairlift), the large habitat block to the east (i.e., mostly outside the SUP area boundary), and the spruce-fir island at the top of Sundown Bowl.
Unauthorized hiking and biking trails developed by third parties shall be promptly deconstructed and reclaimed the season that they are discovered.
During construction, contractors should provide an on-site bear proof container for all edible and food related trash in order to minimize conflicts with black bears. No food products or food containers should be thrown in the larger roll-off type dumpsters.

Table 2-1:
Management Requirements

All construction activities should be confined to daylight hours, excluding emergencies.
Construction workers are prohibited from bringing dogs to the construction site.
All vehicle windows should be kept closed and doors locked on all vehicles to prevent bear entry.
To reduce the risk for human/wildlife conflicts in areas where food or trash could be present, all trash containers should be bear proof and any locations that have food products stored outside of a building should have bear proof food containers.
Survey for raptor nests in areas proposed for tree removal prior to tree cutting each year. Active nests (i.e., those containing birds or eggs, Williams 2003) are protected under the Migratory Bird Treaty Act (MBTA). A no-disturbance buffer around active nest sites would be required from nest-site selection to fledging (generally March through July). Removal of inactive raptor nests should be consistent with Williams (2003) and be conducted only after authorization from the HCRD following a nest inspection by a qualified biologist.
Regarding trees with nest cavities, prior to tree removal, educate surveyors (marking trees for cutting) and sawyers regarding the identification and value of trees with nest cavities and the need to avoid cutting those trees. When glading, avoid cutting any tree containing a nest cavity by cutting other adjacent trees to provide the required clearing.
If flammulated owl nests are detected within mature, closed canopy aspen impact areas, direct mortality of eggs and/or nestlings could be avoided by conducting tree removal in potential nesting habitat outside of the June 1 to July 31 nesting (with eggs/young) period.
If boreal owl nests are detected within impact areas, direct mortality of eggs and/or nestlings could be avoided by conducting tree removal in potential nesting habitat outside of the May 21 to July 15 nesting (with eggs/young) period.
If olive-sided flycatcher nests are detected within impact areas, direct mortality of eggs and/or nestlings could be avoided by conducting tree removal in potential nesting habitat outside of the June 1 and July 15 nesting (with eggs/young) period.
Egg and altricial young mortality could be avoided for all migratory birds by conducting forest clearing outside of the broader May 21 to July 31 nesting period, dates inclusive.
Vertical, open-topped pipes, tubes, and other such structures can be lethal to migratory birds and other wildlife. To minimize bird and other animal mortality caused by such structures on public lands, appropriately cap any existing and proposed uncapped vent pipes including restrooms, stove pipes, sign posts, gate posts, tubes protecting plants, and fence posts to prevent animal access, while maintaining their intended use and function (Weldon 2012). This includes any temporarily open hollow vertical pipes, such as snowmaking bases without guns.
If American marten dens are detected within impact areas, direct mortality of current year recruitment could be avoided by conducting tree removal in potential denning habitat outside of the March 1 to June 15 period.
Re: elk, under Alternative 2, the Adventure Ridge Mountain Coaster would have a return chairlift closely associated with the mountain coaster's track. Elevated sections of Mountain Coaster's track and the return chairlift (where they cross roads) would line up with each other facilitating big game passage. To avoid big game from getting caught between the two track sections, the openings between the FF and return chairlift may need to be fenced. Any fencing required should be designed and installed to prevent the entanglement of wildlife.
Vail Ski Area has a mandatory closure (beginning just south of the mountain road following the crest of the mountain) of the back bowls (this does not include Game Creek Bowl) from May 6 through July 1, dates inclusive, to protect elk calving values. In the event that a hiking/biking trail, is proposed within that closure area, there shoulkd be no activity (construction or recreation) along that trail for the duration of the annual closure period.

Table 2-1:
Management Requirements

There are two mule deer staging areas (i.e., where deer congregate prior to being "pushed" to downvalley winter ranges by accumulating snowfall) overlapping the Project Area, on Golden Peak (Thompson 1993, 1998) and west of the Lionshead Gondola. The latter area is of adequate importance (i.e., to avoid disrupting deer that will have to migrate through the Mud Springs underpass east of Dowds Junction) that CPW has maintained a hunting closure in the area west of the Eagle Bahn Gondola, north of the crest of Vail Mountain, south of I-70, and east of Highway 24, for many years. This annual hunting closure begins with archery season that usually starts in late August. It would be in the best interest of mule deer if additional biking trails were not developed in these two areas. In the event that biking trails are developed on Golden Peak, it would be best for deer if the trails did not approach or extend over the crest of the ridge such that no trails are located on the north-facing slope above I-70. I the event that trails are created in these two areas, construction, maintenance, and biker activity should end before September 15. In addition, CPW (2012) suggested an activity closure from May 6 to June 15 (dates inclusive) to protect spring mule deer migration in the area west of the Lionshead Gondola. Although fall deer and elk across the ski area is also considered to be a critical period, it coincides with accumulating snow conditions that occur after summer and before the ski area opens around Thanksgiving (Thompson 1986a,b). Because ski area activity during this period is generally compatible with fall migration, there has been no activity closure to facilitate these movements and no additional mitigation is warranted for the Proposed Action, other that that recommended above for elk.
AQUATICS
Reduce sediment sources (connected disturbed areas [CDA]) on existing and proposed trails and stream crossings.
Design new trails to minimize sediment input into streams at crossing points; use bridges where necessary.
Design bridges/culverts to withstand high flow and runoff events. Bridge structures must be constructed above bank full stage.
SOILS
Prior to construction, soil surveys will be completed within the disturbance area to ensure no net loss of soil organic matter.
Prior to construction, a detailed site erosion control plan will be prepared. This plan shall include the following components: • Silt fences, straw bales, straw wattles, and other standard erosion control BMPs shall be employed to contain sediment onsite. • Jute-netting or appropriate erosion-control matting on steep fill slopes (i.e., land with a slope angle of 35% or greater) will be utilized to protect soils and enhance conditions for vegetation re-establishment. • Promptly revegetate disturbed areas. Seed mixtures and mulches will be free of noxious weeds. To prevent soil erosion, non-persistent, non-native perennials or sterile perennials may be used while native perennials become established. The Forest Service must approve the seed mixtures prior to implementation, unless previously approved seed mixes are employed.
Existing roads will be used for construction and routine maintenance of the proposed project components where possible.
Vegetative buffers will be maintained adjacent to intermittent or perennial drainages and wetlands, to the extent possible. Where avoidance of the vegetative buffer is not possible, disturbance will be minimized.
In all areas where grading or soil disturbance will occur, a reassessment of the quantity (depths) of soil A and/or organic ground cover would be made to ensure no net loss of this material.
Soil-disturbing activities will be avoided during periods of heavy rain or excessively wet soils.
Areas determined to have been compacted by construction activities may require mechanical subsoiling or scarification to the compacted depth to reduce bulk density and restore porosity.
Ground cover, as a combination of revegetation, organic amendments and mulch applications, will restore depths of soil A and/or organic ground cover.

Table 2-1:
Management Requirements

WATERSHED AND WETLANDS
In order to ensure that stream health in the Analysis Area is maintained or improved with implementation of proposed activities, a follow-up assessment would be required once site-specific locations of activities, particularly trails, are known. The follow-up assessment would include a site-specific delineation of the effective WIZ and other identified Sensitive Areas, as well as quantification of connected disturbed areas and water influence zone (WIZ) disturbance, including proposals for mitigation and treatment of such. This assessment would be updated on a project-by-project basis and would require collaboration between the Forest hydrologist, consulting hydrologists, and Vail Ski Area.
Vail Ski Area is required to have a Stormwater Management Plan (SWMP) to operate under a State approved Permit for Stormwater Discharges Associated with Construction Activity (CDPS Permit No. COR-030541). The SWMP describes practices (BMPs) to be used to reduce the pollutants in stormwater discharges associated with construction activities and is updated annually to incorporate appropriate BMPs for specific projects.
In the water influence zone next to perennial and intermittent streams, lakes and wetlands, allow only those land treatments that maintain or improve long-term stream health and riparian ecosystem condition.
Keep heavy equipment out of streams, swales, and lakes, except to cross at designated points, build crossings, or do restoration work, or if protected by at least 1 foot of packed snow or 2 inches of frozen soil. Keep heavy equipment out of streams during fish spawning, incubation and emergence periods.
Locate new concentrated-use sites outside of the WIZ if feasible and outside riparian areas and wetlands always. Harden or reclaim existing sites in the WIZ to prevent detrimental soil and bank erosion. (WIZ boundaries adjacent to project areas should be clearly demarcated on the ground to prevent infringement during construction and operation.)
Do not excavate earth material from, or store excavated earth material in, any stream, swale, lake, wetland, or WIZ. (WIZ boundaries adjacent to project areas should be clearly demarcated on the ground to prevent infringement during construction and operation.)
Do not excavate earth material from, or store excavated earth material in, any stream, swale, lake, wetland, or WIZ.
Keep ground vehicles out of wetlands unless protected by at least 1 foot of packed snow or 2 inches of frozen soil. Do not disrupt water supply or drainage patterns into wetlands.
If trails must enter wetlands, use bridges or raised prisms with diffuse drainage to sustain flow patterns. Set crossing bottoms at natural levels of channel beds and wet meadow surfaces. Avoid actions that may dewater or reduce water budgets in wetlands.
Final locations of any approved mountain biking and hiking trails will avoid all wetlands (including through the use of bridges and/or other structures). If any wetland impacts are determined to be absolutely necessary, additional NEPA analysis and U.S. Army Corp of Engineers (USACE) permitting will be required prior to construction.
Avoid long-term reduction in organic ground cover and organic soil layers in any wetland (including peat in fens).
Limit disturbed sites to the minimum feasible number, width, and total length consistent with the purpose of specific operations, local topography, and climate. (No new roads are proposed, but temporary construction access routes are required for installation and maintenance of canopy tour towers and coasters.)
Stabilize soils onsite. Endhaul soil if full-bench construction is used. Avoid slopes steeper than 70%.
Avoid soil-disturbing actions during periods of heavy rain or wet soils. Apply travel restrictions to protect soil and water.
Install cross drains to disperse runoff into filter strips and minimize connected disturbed areas. Make cuts, fills, and road surfaces strongly resistant to erosion between each stream crossing and at least the nearest cross drain. Revegetate using certified local native plants as feasible; avoid persistent or invasive exotic plants.

Table 2-1:
Management Requirements

Retain stabilizing vegetation on unstable soils. Avoid new roads or heavy equipment use on unstable or highly-erodible soils.
Use existing roads unless other options will produce less long-term sediment. Reconstruct for long-term soil and drainage stability.
Avoid ground skidding with blades lowered or on highly erodible slopes steeper than 40%. Conduct logging to disperse runoff as feasible.
Designate, construct, and maintain recreational travelways for proper drainage and harden their stream crossings as needed to control sediment. (Applies primarily to biking, hiking, and horse trails.)
Any construction-related disturbance will minimize sediment discharge into streams, lakes and wetlands.
Design trails and other soil disturbing activities to the minimum standard for their use and to "roll" with the terrain as feasible.
Use filter strips, and sediment traps if needed, to keep all sand sized sediment on the land and disconnect disturbed soil from streams, lakes and wetlands. Disperse runoff into filter strips.
Key sediment traps into the ground. Clean them out when 80% full. Remove sediment to a stable gentle upland site and revegetate.
Stabilize disturbed sites during and after construction to control erosion.
Do not encroach fills or introduce soil into streams, swales, lakes, or wetlands.
Properly compact fills and keep woody debris out of them. Revegetate cuts and fills upon final shaping to restore ground cover, using certified local native plants as feasible; avoid persistent or invasive exotic plants. Provide sediment control until erosion control is permanent.
Do not disturb ditches during maintenance unless needed to restore drainage capacity or repair damage. Do not undercut the cut slope.
PLANNING CONSIDERATION BMPS (CDPHE, WQCC, REGULATION 82)
CDPHE, Construction Stormwater Discharge Permit – Colorado stormwater regulations s (5CCR 1002-61) require a permit for construction activity that disturbs 1 acre or more during the life of the project. Prior to commencement of construction, a stormwater management plan (SWMP) with appropriate erosion and sediment control BMPs must be developed and implemented. A comprehensive list of potentially appropriate BMPs is included in the CDPHE 401Certification Regulation (5 CCR 1002-82).
An erosion and sediment control plan should be developed and is comprised of three major elements. The erosion control measures that will be used to limit erosion of soil from disturbed areas at a construction site; the sediment control measures that will be used to limit transport of sediment to off-site properties and downstream receiving waters; and the drainageway protection and runoff management measures that will be used to protect streams and other drainageways located on the construction site from erosion and sediment damages.
Some of the site constraints that should be considered planning/designing/locating approved projects and activities include slope stability, drainage aspect and constructability, along with the general stream hydrology, stream morphology, water quality and aquatic ecology. (Site constraints, such as avoidance of wetlands, are address above under the USFS Design Standards.)
Seasonality should be considered, particularly when construction must take place within streams and other waterways. (For example, construction during periods of high stream should be avoided.)
Surface roughening provides temporary stabilization of disturbed areas from wind and water erosion; surface roughening should be performed after final grading to create depressions 2 to 4 inches deep and 4 to 6 inches apart. It is particularly useful where temporary revegetation cannot be immediately established due to seasonal planting limitations. Surface roughening only provides temporary protection and must be used in combination with other BMPs, such as mulching and temporary cover.
Mulching of all disturbed areas should occur within 14 days after final is reached on all portions of site not permanently stabilized.

Table 2-1:
Management Requirements

A viable vegetative cover should be established within one year on all disturbed areas and soil stockpiles not otherwise permanently stabilized. Vegetation is not considered established until a ground cover is achieved, which is sufficiently mature to control soil erosion and can survive severe weather conditions.
The seed mix for erosion control and stabilization during construction should be compatible with the final seeding needs and will be approved by the WRNF.
As a minimum, topsoil preservation and reuse involves the removal, stockpiling, and re-spreading of the surface 6 to 8 inches of natural soil.
Erosion control blankets are used in place of mulch on areas of high velocity runoff and/or steep grade, to aid in controlling erosion on critical areas by protected young vegetation.
To provide vegetative cover on disturbed areas not paved or built upon for a period of two years or longer, or for an indeterminate length of time, a perennial grass should be planted.
Cut-and-fill slopes must be designed and constructed to minimize erosion. This requires consideration of the length and steepness of the slope, the soil type, up-slope drainage area, groundwater conditions and other applicable factors. Slopes that are found to be eroding excessively will require additional slope stabilization until the problem is corrected.
Sediment entrapment facilities include terracing, slope drains, straw bale barriers, silt fences, filter strips, sediment traps and sediment basins; at least one entrapment facility should capture runoff leaving a disturbed area.
A silt fence is made of a woven synthetic material and acts to filter runoff. Silt fence can be placed as a temporary barrier at the base of a disturbed area but is not recommended for use in a channel or swale.
A sediment trap is a temporary structure that is designed to fill with sediment. A sediment trap can be constructed by either excavating below grade or building an embankment across a swale. Excavated traps are less prone to failure than embankments. No pipe is used at the outlet, as in a sediment basin, and an open-channel spillway must be included in the design. A minimum of 900 cubic feet of storage volume must be provided for each tributary acre.
All BMPs shall be maintained and repaired as needed to assure continued performance. Straw bale barriers or silt fences may require periodic replacement and all sediment accumulated behind them must be removed and disposed of properly. Sediment traps and basins will require periodic sediment removal when the design storage level is one-half full. All facilities must be inspected following each heavy precipitation or snowmelt event that results in runoff.
All temporary erosion and sediment control measures must be removed within 30 days after final stabilization.
Good housekeeping requires keeping potential areas where pollutants and pollution exist clean and orderly. Use of common sense to improve and maintain basic housekeeping methods: accidental spill response, well-maintained machinery and processes, improved operations, material storage practices, material inventory controls, routine or regular clean-up schedules, well organized work areas, educational programs and method to prevent mixing of runoff into environment from stormwater runoff. Preventative maintenance involves regular inspection and testing of equipment and operational systems to prevent break downs and failures that cause potential runoff contamination.
AIR QUALITY
Site improvements will be installed promptly in order to reduce the potential for dust emissions.
The area disturbed by clearing, earth moving, or excavation activities will be kept to a minimum at all times, allowing improvements to be implemented in sections.

E. COMPARISON OF ALTERNATIVES

Table 2-2 provides a comparison of project elements associated with each alternative.

Table 2-2:
Alternative Comparison Matrix

	Alternative 1	Alternative 2	Alternative 3
ACTIVITIES			
Adventure Ridge Mountain Coaster	--	X	--
Pride Express Mountain Coaster	--	X	--
Front Side Canopy Tour	--	X	X
Game Creek Canopy Tour	--	X	X
Aerial Adventure Course	--	X	X
Riparian Experience	--	X	--
Wedding venue at The 10th	--	X	--
HIKING AND BIKING TRAILS			
Multi-Use	14 miles	14 miles	14 miles
Hiking	10 miles	21 miles	21 miles
XC Biking	25 miles	50 miles	50 miles
DH Biking	11 miles	30 miles	30 miles
Sub-Total	*59 miles*[a]	*114 miles*[a]	*114 miles*[a]
FOOD SERVICE			
Game Creek Club	X	X	X
Talon's Deck	X	X	X
Bistro 14	X	X	X
The 10th	X	X	X
Sarge's BBQ	X	X	X
Wildwood	--	X	X
CHAIRLIFTS			
Eagle Bahn Gondola	X	X	X
Gondola One	X	X	X
Avanti Express	--	X	X
Wildwood Express	--	X	X
Mountaintop Express	--	X	X

[a] Due to rounding, the sub-total for hiking and biking trails differs from the sum of individual trail types

F. SUMMARY COMPARISON OF DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Per direction provided in 40 CFR 1502.14, Table 2-3 provides a comparison of environmental impacts by alternative. Detailed information on environmental impacts to each resource can be found in Chapter 3.

Table 2-3:
Summary Comparison of Direct and Indirect Environmental Consequences

Alternative 1	Alternative 2	Alternative 3
RECREATION		
Issue: The Proposed Action would impact recreational opportunities within the Vail Ski Area SUP and the Eagle Valley.		
Indicator: Application of a "Guests At One Time" (GAOT) model to estimate how guests would be expected to disperse across the SUP area		

	GAOT	Percent of Total
Activities	488	11.4
Hiking and Biking Trails	1,187	27.6
Food Service	1,402	32.6
Chairlifts	1,224	28.5
Total	*4,301*	*100*

	GAOT	Percent of Total
Activities	1,000	13.0
Hiking and Biking Trails	2,110	27.3
Food Service	2,477	32.1
Chairlifts	2,134	27.6
Total	*7,721*	*100*

	GAOT	Percent of Total
Activities	764	10.2
Hiking and Biking Trails	2,110	28.2
Food Service	2,477	33.1
Chairlifts	2,134	28.5
Total	*7,485*	*100*

Indicator: Annual summer visitation projections to Vail Ski Area under alternatives 1, 2 and 3

Average Annual Growth Rate: 7%	
Year	**Visitation Projection**
2019	201,000
2018	188,000
2017	176,000
2016	165,000
2015	154,000

Average Annual Growth Rate: 11%	
Year	**Visitation Projection**
2019	251,000
2018	226,000
2017	204,000
2016	183,000
2015	165,000

Average Annual Growth Rate: 9%	
Year	**Visitation Projection**
2019	225,000
2018	206,000
2017	190,000
2016	174,000
2015	159,000

VISUALS		
Issue: Proposed structures, facilities, and features would incrementally add to the developed nature of the Vail Ski Area SUP area and could cause negative scenery impacts. In particular, proposed infrastructure and activities at Adventure Ridge would increase development density and could detract from existing scenic values and important scenic viewsheds.		
Indicator: Discussion of the existing scenic integrity of the Vail Ski Area SUP and potential changes to this condition		
Under Alternative 1, the visual characteristics of Vail Ski Area's SUP area would continue to be dominated by chairlifts and developed ski terrain.	The scenic integrity of the Vail Ski Area SUP is not anticipated to change under Alternative 2. Proposed projects would incrementally contribute to the developed character of the Vail Ski Area SUP area.	Same as Alternative 2.

Table 2-3:
Summary Comparison of Direct and Indirect Environmental Consequences

Alternative 1	Alternative 2	Alternative 3
Indicator: Discussion of the Scenic Integrity Objectives (SIO) for the Vail Ski Area SUP, as defined by the 2002 Forest Plan		
Generally speaking, the SUP area would continue to meet, and in some cases exceed, the SIO of Very Low ("appears heavily altered").	With adherence to management requirements (defined in Chapter 3B), none of the proposed projects are expected to increase scenery impacts to the character of the SUP area such that it would not meet the SIO of Very Low.	Under Alternative 3, the SUP area would continue to maintain compliance with the SIO of Very Low.
Indicator: Completion of a viewshed analysis including identification of viewpoints where proposed projects would be most visible (including at night)		
Alternative 1 does not include any new projects.	Projects proposed in Alternative 2 would not be visible from identified critical viewpoints, with the following exceptions: **Mountain Coasters:** Lights from potential nighttime operation of the Adventure Ridge Mountain Coaster could be visible from higher-elevation vantage points across the Eagle Valley. **Zip Line Canopy Tours:** The Front Side Canopy Tour would likely be visible from some points along I-70 and from across the Eagle Valley.	Projects proposed in Alternative 3 would not be visible from identified critical viewpoints, with the following exceptions: **Zip Line Canopy Tours:** The Front Side Canopy Tour would likely be visible from some points along I-70 and from across the Eagle Valley.
Indicator: Discussion of Distance Zones (Foreground, Middleground, Background) and how visible proposed projects would be from each viewpoint/distance zone		
Currently, developed recreation facilities (including trails, chairlifts, etc.) are visible to users within Vail Ski Area's SUP area in the immediate foreground, foreground, and middleground distance zones. Along the I-70 corridor between East and West Vail, the developed lift and trail network is a dominant component of the visual environment in the foreground and middleground distance zones. Backcounty recreationists in the nearby Eagles Nest and Holy Cross Wilderness Areas can also see the Vail Ski Area SUP area in the middleground and background distance zones.	**Mountain Coasters:** The mountain coasters would be visible in the immediate foreground and foreground distance zones when the track is in open areas. With the exception of at night, neither coaster is anticipated to be visible from outside of the Vail Ski Area SUP boundary in the middleground or background distance zones. **Zip Line Canopy Tours:** The Game Creek Canopy Tour would be visible in the foreground and middleground distance zones from Adventure Ridge, as well as from within Game Creek Bowl. The Front Side Canopy Tour would likely be visible in the foreground and middleground distance zones from some points along I-70 and from across the Eagle Valley.	Alternative 3 includes all projects from Alternative 2 with the exception of the mountain coasters, Riparian Experience, and wedding deck. The impacts of all other projects would be the same as under Alternative 2.

Table 2-3:
Summary Comparison of Direct and Indirect Environmental Consequences

Alternative 1	Alternative 2	Alternative 3
	Horse Corral and Trail: The proposed trail would be visible in the immediate foreground and foreground distance zones, and the corral would be visible in the foreground. **Riparian Experience:** This project would be visible in the immediate foreground and foreground at Adventure Ridge. **Wildwood observation deck**: This project would only be visible from the immediate foreground and foreground within the Vail Ski Area SUP boundary. **Aerial Adventure Course:** This project would be visible in the foreground distance zone from Adventure Ridge. **Wedding venue at The 10th:** This project would be visible in the foreground distance zone from Mid-Vail. **Mountain Biking and Hiking Trails:** These trails would not be visible beyond the foreground distance zone within Vail Ski Area's SUP area.	
Indicator: Discussion of the Forest Service's Built Environment Image Guide (BEIG) as applicable to existing and proposed guest service and recreational facilities		
The Vail Mountain Design Guidelines were used in the design and construction of existing facilities at Vail Ski Area.	All new facilities would be designed and built to the standards established in the BEIG and Vail Mountain Design Guidelines.	All new facilities would be designed and built to the standards established in the BEIG and Vail Mountain Design Guidelines.
TRAFFIC, PARKING AND SKI AREA ACCESS		
Issue: The Proposed Action may contribute to demand for additional parking within the Town of Vail and additional traffic on I-70 throughout the year.		
Indicator: Quantification of available parking spaces throughout the Town of Vail		
2,500 total spaces are available in the Village and Lionshead parking structures. Additional parking is available on the Frontage Road.	Same as Alternative 1.	Same as Alternative 1.

Table 2-3:
Summary Comparison of Direct and Indirect Environmental Consequences

<table>
<tr><th>Alternative 1</th><th>Alternative 2</th><th>Alternative 3</th></tr>
<tr><td colspan="3">Indicator: Quantification of parking demand (spaces) related to Vail Ski Area’s summer operations under all alternatives</td></tr>
<tr><td>On some weekends and during special events throughout the summer, parking within the Town of Vail would continue to be an issue under Alternative 1. Additional vehicles associated with Vail Ski Area’s summer operations are not anticipated to be a consequential factor in parking.</td><td>The increase in parking needs would largely be met by the Town of Vail’s structures in Main Vail. On weekends and during special events throughout the summer, parking within the Town of Vail would likely continue to be an issue under Alternative 2.</td><td>Same as Alternative 2.</td></tr>
<tr><td colspan="3">Indicator: Quantification of existing and projected daily vehicles on I-70 specifically related to Vail Ski Area’s summer operations</td></tr>
<tr><td><table><tr><th>Year</th><th>Vehicles</th></tr><tr><td>2015</td><td>456</td></tr><tr><td>2016</td><td>489</td></tr><tr><td>2017</td><td>521</td></tr><tr><td>2018</td><td>557</td></tr><tr><td>2019</td><td>596</td></tr></table></td><td><table><tr><th>Year</th><th>Vehicles</th></tr><tr><td>2015</td><td>489</td></tr><tr><td>2016</td><td>542</td></tr><tr><td>2017</td><td>604</td></tr><tr><td>2018</td><td>670</td></tr><tr><td>2019</td><td>744</td></tr></table></td><td><table><tr><th>Year</th><th>Vehicles</th></tr><tr><td>2015</td><td>471</td></tr><tr><td>2016</td><td>516</td></tr><tr><td>2017</td><td>563</td></tr><tr><td>2018</td><td>610</td></tr><tr><td>2019</td><td>667</td></tr></table></td></tr>
<tr><td colspan="3">SOCIAL AND ECONOMIC RESOURCES</td></tr>
<tr><td colspan="3">Issue: Through construction and operation of proposed non-skiing recreational activities within Vail Ski Area’s SUP area, the local economy would be affected.</td></tr>
<tr><td colspan="3">Indicator: Population</td></tr>
<tr><td>Population growth projections expect Eagle County’s baseline resident population to grow to 68,350 year-round residents by 2020. This growth would represent a 31% increase over current population levels.</td><td>Same as Alternative 1. Population growth resulting from any of the alternatives is expected to have a negligible effect on the baseline population trend.</td><td>Same as Alternative 1. Population growth resulting from any of the alternatives is expected to have a negligible effect on the baseline population trend.</td></tr>
<tr><td colspan="3">Indicator: Employment (both inside the resort and outside of the resort, including a discussion of part-time/seasonal employment vs. full-time equivalents)</td></tr>
<tr><td>No changes to employment at Vail Ski Area are expected to occur. The ski area would be expected to continue to employ approximately 2,841 workers (or 1,257 Full-Time Equivalents [FTEs]) in the winter and approximately 550 workers (or 364 FTEs) in the summer. However,</td><td>On-going operation of Adventure Ridge as a result of the Proposed Action would directly create approximately 118 FTEs at Vail Ski Area. Vail Ski Area would add 3 year-round employment positions (2 full-time, 1 part-time), 100 employment positions in the winter (79 full-</td><td>On-going operation of Alternative 3 would directly create approximately 97 FTEs at Vail Ski Area. Vail Ski Area would add 2 year-round employment positions (1 full-time, 1 part-time), 80 employment positions in the winter (63 full-time, 17 part-time—related to operation of</td></tr>
</table>

Table 2-3:
Summary Comparison of Direct and Indirect Environmental Consequences

<table>
<tr><th>Alternative 1</th><th>Alternative 2</th><th>Alternative 3</th></tr>
<tr><td>as summer visitation is expected to increase slightly under the No Action Alternative, direct, indirect and induced employment resulting from the summer spending would be expected to increase. New summer visitation would generate approximately 4.6 FTEs (2.6 direct, 1.1 indirect and 0.9 induced) outside the resort.</td><td>time, 21 part-time—related to operation of canopy tours and coasters) and 158 employment positions in the summer (115 full-time, 43 part-time) upon implementation of the Proposed Action.
As summer visitation is expected to increase under the Proposed Action, direct, indirect and induced employment resulting from the summer spending would also increase. New summer visitation would generate approximately 19.4 FTEs outside the resort (11 direct, 4.2 indirect and 4.2 induced).</td><td>canopy tours) and 138 employment positions in the summer (99 full-time, 39 part-time) upon implementation of Alternative 3.
As summer visitation is expected to increase under Alternative 3, direct, indirect and induced employment resulting from the summer spending would also increase. New summer visitation would generate approximately 14.6 FTEs outside the resort (8.3 direct, 3.1 indirect and 3.2 induced).</td></tr>
<tr><td colspan="3">Indicator: Personal income (i.e., wages)</td></tr>
<tr><td>Approximately $198,000 in total labor income would be generated in conjunction with the 4.6 FTEs discussed above.</td><td>Approximately $5.2 million in total labor income would be generated in conjunction with the 118 Vail Ski Area FTEs discussed above.
Approximately $838,000 in total labor income would be generated in conjunction with the 19.4 FTEs generated outside the resort discussed above.</td><td>Approximately $4.3 million in total labor income would be generated in conjunction with the 97 Vail Ski Area FTEs discussed above.
Approximately $629,000 in total labor income would be generated in conjunction with the 14.6 FTEs generated outside the resort discussed above.</td></tr>
<tr><td colspan="3">Indicator: Visitor spending</td></tr>
<tr><td>Summer Visitation Spending
(in thousands of dollars)
<table>
<tr><th>Impact Type</th><th>In-Resort Summer Spending</th><th>Out of Resort Summer Spending</th><th>Total Summer Spending</th></tr>
<tr><td>Direct Effect</td><td>260</td><td>280</td><td>540</td></tr>
<tr><td>Indirect Effect</td><td>50</td><td>70</td><td>120</td></tr>
<tr><td>Induced Effect</td><td>460</td><td>70</td><td>130</td></tr>
<tr><td>Total Effect</td><td>370</td><td>420</td><td>790</td></tr>
</table></td>
<td>Summer Visitation Spending
(in thousands of dollars)
<table>
<tr><th>Impact Type</th><th>In-Resort Summer Spending</th><th>Out of Resort Summer Spending</th><th>Total Summer Spending</th></tr>
<tr><td>Direct Effect</td><td>1,090</td><td>1,180</td><td>2,270</td></tr>
<tr><td>Indirect Effect</td><td>220</td><td>290</td><td>510</td></tr>
<tr><td>Induced Effect</td><td>270</td><td>280</td><td>550</td></tr>
<tr><td>Total Effect</td><td>1,580</td><td>1,760</td><td>3,340</td></tr>
</table></td>
<td>Summer Visitation Spending
(in thousands of dollars)
<table>
<tr><th>Impact Type</th><th>In-Resort Summer Spending</th><th>Out of Resort Summer Spending</th><th>Total Summer Spending</th></tr>
<tr><td>Direct Effect</td><td>810</td><td>890</td><td>1,700</td></tr>
<tr><td>Indirect Effect</td><td>170</td><td>220</td><td>390</td></tr>
<tr><td>Induced Effect</td><td>210</td><td>210</td><td>420</td></tr>
<tr><td>Total Effect</td><td>1,190</td><td>1,320</td><td>2,510</td></tr>
</table></td></tr>
</table>

Table 2-3:
Summary Comparison of Direct and Indirect Environmental Consequences

Alternative 1	Alternative 2	Alternative 3
Indicator: Town/County tax revenue (total state/local and federal)		
Total economic activity (*direct*, *indirect* and *induced*) associated with new visitation to Eagle County would generate approximately $55,900 in local and state tax revenues and approximately $67,700 in federal tax revenues.	Total economic activity (direct, indirect and induced) associated with new visitation to Eagle County is projected to generate an additional $237,000 in local and state tax revenues and approximately $287,000 in federal tax revenues. Construction of the Proposed Action is projected to generate approximately $598,000 in local and state tax revenues and approximately $1.6 million in federal tax revenues.	Total economic activity (direct, indirect and induced) associated with new visitation to Eagle County would generate approximately $177,800 in local and state tax revenues and approximately $215,200 in federal tax revenues. Construction of the Proposed Action would generate approximately $323,000 in local and state tax revenues and approximately $838,600 in federal tax revenues.
Indicator: Environmental Justice		
No existing minority populations were identified where either: (a) the minority population of the affected area exceeds 50% or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. Likewise, no low-income populations were identified in the affected area.	No changes or modifications would be approved under any Alternative that would directly or indirectly affect minority or low-income populations in Eagle County.	No changes or modifications would be approved under any Alternative that would directly or indirectly affect minority or low-income populations in Eagle County.
CULTURAL RESOURCES		
Issue: Proposed projects and associated ground disturbing activities have potential to affect known or unidentified cultural resources in the Analysis Area.		
Indicator: Identification of known cultural resources in the Area of Potential Effects (APE) as based on previously-conducted surveys		
Six previously recorded cultural resources are known to exist within the APE; all were determined to be **not eligible** for the NRHP.	Same as Alternative 1.	Same as Alternative 1.

Table 2-3:
Summary Comparison of Direct and Indirect Environmental Consequences

Alternative 1	Alternative 2	Alternative 3
Indicator: Discussion of the potential for proposed projects to impact known cultural resources in the APE		
Because no ground disturbance is proposed under the No Action Alternative, there would be no effects to any known/unknown NRHP-eligible or non-eligible resources within the APE.	Alternative 2 would have no effect on any known NRHP-listed or eligible properties in all of the APE except for a small area where downhill mountain biking trails are proposed. Because the northwestern portion of the APE has not yet been inventoried, it is not yet possible to determine impacts. Given the size and location of these un-inventoried parcels, it is unlikely that cultural resources would be found. An inventory for cultural resources shall be conducted prior to implementation of any approved trails.	Same as Alternative 2.
WILDLIFE AND AQUATICS		
Issue: Implementation of proposed projects (including construction and operation) could affect Proposed, Threatened and Endangered (TEP), Forest Service Region 2 (R2) Sensitive and Management Indicator (MIS) wildlife, migratory birds and aquatic species in the Analysis Area.		
Indicator: Identification, quantification and analysis of TEP, R2 sensitive and MIS (including migratory birds) animal habitat in the Analysis Area		
No impacts to TEP, R2, MIS, migratory birds, or aquatic species would occur under Alternative 1.	**Threatened and Endangered Species** <u>Canada lynx:</u> May affect, not likely to adversely affect **Region 2 Sensitive Species** "May adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing" determinations were made for the following R2 sensitive species. • Boreal western toad • Northern goshawk: • American peregrine falcon: • Flammulated owl: • Boreal owl: • Olive-sided flycatcher: • Pygmy shrew:	Same as Alternative 2.

Table 2-3:
Summary Comparison of Direct and Indirect Environmental Consequences

Alternative 1	Alternative 2	Alternative 3
	• Hoary bat: • American marten: **Management Indicator Species** Elk: No measurable effect on habitat effectiveness within the DAU. **Migratory Birds** No bird nests were detected in proposed impact areas during field surveys. PDFs would be implemented to minimize incidental take.	
Indicator: Identification, quantification and analysis of TEP, R2 sensitive and MIS aquatic (fish, amphibians, and macroinvertebrates) habitat in the Analysis Area. This includes an analysis of physical stream health in regards to aquatic habitat		
No impacts would occur under Alternative 1.	**Region 2 Sensitive Species** Colorado River cutthroat trout: May adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing. **Management Indicator Species** Aquatic macroinvertebrates: Aquatic macroinvertebrate habitat would persist in all Project Area streams and would not measurably contribute to any negative trend in the Forest-wide population or habitat trend of aquatic macroinvertebrates that would affect achieving Forest Plan MIS objectives. All trout: Trout habitat would persist in all currently inhabited Project Area streams and would not measurably contribute to any negative trend in the Forest-wide population or habitat trend of all trout that would affect achieving Forest Plan MIS objectives.	Same as Alternative 2.

Table 2-3:
Summary Comparison of Direct and Indirect Environmental Consequences

Alternative 1	Alternative 2	Alternative 3
Indicator: Identification of effects within LAU boundaries and Lynx Linkage Areas in relation to the SUP area		
No effect.	Modifications to lynx habitat types would have barely discernable changes on lynx habitat statistics in the Eagle Valley and Camp Hale LAUs. Modifications to currently unsuitable habitat would remain unchanged at approximately 57% and 56% for the Eagle Valley and Camp Hale LAUs, respectively. This would be consistent with Southern Rockies Lynx Management Direction applicable to ski areas.	Same as Alternative 2.
Indicator: Description of effects to lynx from potential increased traffic		
Baseline increases in traffic volume would marginally increase threats of mortality, habitat fragmentation, and generally impair lynx movement.	Incremental traffic increases on I-70 through the Vail Pass and Dowds Junction lynx linkages would have an insignificant and discountable effect on lynx.	Same as Alternative 2.
Indicator: Determination of stream health within the Analysis Area		
Under the No Action Alternative, hydrologic function and stream health within all sub-basins would remain as surveyed (i.e., stable with no evidence of erosion except for sub-basins MC-1 and GP-3).	Short-term and permanent, localized, ground disturbing activities and increased runoff with potential to increase erosion, sedimentation, and local slope failures that could extend to local creeks and cause changes to the hydrology, aquatic habitat, and all trout communities within Project Area streams.	Same as Alternative 2.
SOILS		
Issue: Ground disturbance associated with construction and operation of proposed projects has potential to increase erosion/soil compaction and lead to a loss of organic material in the Analysis Area.		
Indicator: Identification and estimated quantification (acres) of temporary and permanent ground disturbance according to high/moderate/low erodibility soils classes		
No ground disturbance.	Table 3G-2 identifies disturbance by soil map unit. Approximately 15 acres of ground disturbance would occur in areas with low surface and subsurface soil erodibility potential ($K_w \leq 0.22$).	Approximately 10.2 acres of ground disturbance would occur in areas with low surface and subsurface soil erodibility potential ($K_w \leq 0.22$). Ground disturbance for proposed hiking and biking trails cannot be precisely quantified at this

Table 2-3:
Summary Comparison of Direct and Indirect Environmental Consequences

Alternative 1	Alternative 2	Alternative 3
	Ground disturbance for proposed hiking and biking trails cannot be precisely quantified at this time, but the general areas in which these trails are proposed are mostly mapped as having low surface and subsurface soil erodibility potential ($K_w \leq 0.22$). However, one area proposed for cross-country biking area and one area proposed for downhill biking have moderate surface and subsurface erodibility potential.	time, but the general areas in which these trails are proposed are mostly mapped as having low surface and subsurface soil erodibility potential ($K_w \leq 0.22$). However, one area proposed for cross-country biking area and one area proposed for downhill biking have moderate surface and subsurface erodibility potential.
Indicator: Analysis of area (acres) of increased erosion hazard due to temporary and permanent ground disturbance		
No ground disturbance.	Soils within these Project Areas are mapped as having low surface and subsurface soil erodibility potential ($K_w \leq 0.22$), and with implementation of appropriate features for drainage management, erosion within the Analysis Area could be minimized.	Soils within these project areas are mapped as having low surface and subsurface soil erodibility potential ($K_w \leq 0.22$), and with implementation of appropriate features for drainage management, erosion within the Analysis Area could be minimized.
WATERSHED		
Issue: Ground disturbance and overstory vegetation removal associated with construction and operation of proposed projects has potential to affect water yield and produce sediment and reduce stream bank stability in the Analysis Area.		
Issue: Ground disturbance and proposed overstory vegetation removal associated with construction and operation of proposed projects has potential to affect wetlands and wetland function and values within the Analysis Area.		
Indicator: Identification of perennial and intermittent stream channels across the Analysis Area in relation to proposed projects		
Under the No Action Alternative, the proposed summer recreation facilities would not be developed and there would be no change in the stream channel network.	The proposed summer recreation facilities would not result in any increases in the stream channel network because no roads or drainage extensions are proposed. The proposed hiking and mountain biking trails would be outsloped in accordance with Forest Service design standard so that drainage network extensions would not occur.	Same as Alternative 2.
Indicator: A thorough characterization of existing hydrologic function and stream health conditions in the watersheds within the Analysis Area		
Under the No Action Alternative, hydrologic function and stream health within all sub-basins would remain as surveyed (i.e., stable with no	Additional 51 acres of total disturbed area in association with Alternative 2.	Additional 46.1 acres of total disturbed area in association with Alternative 3.

Table 2-3:
Summary Comparison of Direct and Indirect Environmental Consequences

Alternative 1	Alternative 2	Alternative 3
evidence of erosion except for sub-basins MC-1 and GP-3).	The maximum increase in peak flows would be less than 0.4 cfs, too small to be measurable, and would result in no adverse impact. Several isolated stream reaches were identified that are unstable under existing conditions and disturbance associated with construction activities could further destabilize these stream reaches. Impacts to the five Analysis Area watersheds are summarized: **Cascade Village:** Ground disturbance within the WIZ may not result in adverse impacts to stream health if BMPs are implemented to minimize or prevent increases in CDA. **Mountain Front:** Stream health would be maintained or improved with implementation of Management Requirements. **Mill Creek:** Some crossings of perennial and/or intermittent streams may be unavoidable for trails but hydrologic and water quality impacts could be mitigated with construction and drainage Management Requirements. Stream health would be maintained or improved with implementation of Management Requirements. **Game Creek:** There would be no tree clearing or ground disturbance within the WIZ in the Game Creek watershed and existing stream health conditions would be maintained. **Golden Peak:** Some crossings of perennial and/or intermittent streams may be unavoidable for proposed trails, but hydrologic and water quality impacts could be mitigated with construction and drainage Management Requirements. Implementation of these projects in the Golden Peak Watershed would therefore maintain or improve stream health conditions.	The maximum increase in peak flows would be less than 0.4 cfs, too small to be measurable, and would result in no adverse impact. Several isolated stream reaches were identified that are unstable under existing conditions and disturbance associated with construction activities could further destabilize these stream reaches. Impacts to the five Analysis Area watersheds are summarized: **Cascade Village:** There would be no change in stream health conditions. **Mountain Front:** Stream health would be maintained or improved with implementation of Management Requirements. **Mill Creek:** Stream health would be maintained or improved with implementation of Management Requirements. **Game Creek:** There would be no tree clearing or ground disturbance within the WIZ in the Game Creek watershed and existing stream health conditions would be maintained. **Golden Peak:** Stream health would be maintained or improved with implementation of Management Requirements.

Table 2-3:
Summary Comparison of Direct and Indirect Environmental Consequences

Alternative 1	Alternative 2	Alternative 3
Indicator: Identification and discussion of existing problem areas and sensitive areas within the Analysis Area in relation to the proposed projects		
No new problem and sensitive areas would develop as a result of selection of the No Action Alternative. **Cascade Village:** No sensitive areas identified. **Mountain Front:** 5 bank instabilities, 2 slope failure, 9 erosion areas. **Mill Creek:** 1 moderate bank instability, 1 slope failure, 4 erosion areas. **Game Creek:** No sensitive areas identified. **Golden Peak:** 1 degraded stream, 6 slope failures, 1 erosion areas.	**Cascade Village:** Adventure Ridge Mountain Coaster and Pride Express Mountain Coaster have potential to impact channel conditions due to temporary ground disturbance. No mass wasting or significant erosion. **Mountain Front:** Proposed DH mountain biking trails within the WIZ have potential to impact channel conditions due to temporary ground disturbance. Proposed facilities/projects should avoid areas of the 2 slope failures and several erosion areas. **Mill Creek:** Proposed mountain biking trails have potential to impact channel conditions due to temporary ground disturbance. Slope failure and mass wasting areas adjacent to the West Fork of Mill Creek were identified and should be avoided with minor changes to Front Site Canopy Tour and cross-country biking trails. Several isolated erosion areas were found in the Mill Creek watershed, all of which were associated with roads and recent maintenance activities but no Alternative 2 facilities have conflict with these areas. **Game Creek:** Game Creek Canopy Tour would span Game Creek and the WIZ, but towers would be located well outside of the WIZ and the watershed would not impacted. No mass wasting or significant erosion was identified. **Golden Peak:** Proposed mountain biking trails have potential to impact channel conditions due to temporary ground disturbance. Five slope failures should be avoided by utilizing maintenance road in mountain biking trail design or are not in immediate vicinity slope failures.	**Cascade Village:** No impacts to channel condition, mass wasting or significant erosion areas by Alternative 3 proposed projects. **Mountain Front:** Same as Alternative 2. **Mill Creek:** Same as Alternative 2. **Game Creek:** Same as Alternative 2. **Golden Peak:** Same as Alternative 2.

Table 2-3:
Summary Comparison of Direct and Indirect Environmental Consequences

Alternative 1	Alternative 2	Alternative 3
	One significant erosion area is associated with recent tree clearing but are not effected by Alternative 2.	
Indicator: Identification of waters of the U.S., including wetlands, across the Analysis Area in relation to proposed projects		
Under the No Action Alternative, there would be no impacts to wetlands. The wetlands identified in the Analysis Area occur in narrow bands immediately adjacent to the streams and isolated pockets that are associated with springs and drainage collection areas.	Alternative 2 would not impact any known and previously identified wetlands. Detailed design and layout for implementation of the proposed hiking and biking trails would require surveys to assure the wetlands are avoided and consistent with Section 404 of the Clean Water Act. It is likely some stream crossing would be required. Management Requirements would be implemented to avoid impacts to riparian wetlands. If wetland impacts are determined to be unavoidable, additional NEPA analysis and USACE permitting would be required prior to construction.	Same as Alternative 2.
Indicator: Identification of any Clean Water Act (CWA) impaired or threatened waterbody segments in the Analysis Area		
Under the No Action Alternative, no new impaired or threatened segments identified by the CWA would be impacted. **Gore Creek**: Black Core Creek at confluence with Eagle River (aquatic life) *Impaired* **Eagle River:** Ute Creek (temperature) *Management and Evaluation (M&E)* Rube Creek (temperature) *Impaired* Squaw Creek (aquatic life) *M&E* Squaw Creek (sediment) *Impaired* Berry and Rube Creeks (sediment) *M&E*	Alternative 2 would not impact any known and previously identified wetlands. Detailed design and layout for the proposed hiking and biking trails would require surveys to assure the wetlands are avoided, consistent with Section 404 of the Clean Water Act. It is likely that some stream crossings for mountain biking, horse, and hiking trails would be required, in which case, Management Requirements would be implemented to avoid impacts to wetlands. If any wetland impacts are determined to be unavoidable, additional NEPA analysis and USACE permitting would be required prior to construction.	Same as Alternative 2.

Table 2-3:
Summary Comparison of Direct and Indirect Environmental Consequences

Alternative 1	Alternative 2	Alternative 3
Indicator: Quantification of connected disturbed areas (CDA) in the Analysis Area		
Estimated CDA in the Analysis Area under existing conditions is 45.5 acres. Under the No Action Alternative, the proposed summer recreation facilities would not be developed and there would be no change in CDA.	Construction of the proposed activities and facilities would result in a substantial amount of temporary ground disturbance and potential increases in the amount of CDA throughout the Analysis Area. However, the proposed facilities would be spread over a large area during multiple construction seasons, and projects can be configured/located to minimize the amount of direct drainage connections between disturbed areas and streams by employing appropriate erosion/drainage BMPs and project design features (refer to Table 3H-7), coupled with wide vegetative buffers. Disturbed areas located outside of the WIZ would be effectively disconnected from streams, or existing CDA throughout the watersheds would be disconnected. Total disturbed areas, including WIZ areas, were estimated for each watershed for existing conditions and the action alternatives are shown in Table 3H-9. Connected disturbed areas within the WIZ of each watershed are shown in Table 3H-10 for each alternative. Because the actual locations and layouts of the proposed mountain biking trails and hiking trails are unknown at this time, impacts within the WIZ were estimated	Same as Alternative 2.
Indicator: Identification of proposed overstory vegetation removal and grading in the Water Influence Zone (WIZ)		
Under the No Action Alternative, the proposed summer recreation facilities would not be developed and there would be no change in the overstory vegetation and no grading in the WIZ.	Because site specific trail layouts are not available at this time, impacts within the WIZ were estimated based on the proportion of the total WIZ acres within each watershed. Therefore, the proposed summer recreation projects have potential to remove approximately 49.2 acres of trees for construction of trails and corridors for	Proposed summer recreation projects have potential to remove approximately 48.9 acres of trees for construction of trails and corridors for the proposed canopy tours and coasters. This would result in a 0.59% reduction in tree area in the Analysis Area.

Table 2-3:
Summary Comparison of Direct and Indirect Environmental Consequences

Alternative 1	Alternative 2	Alternative 3
	the proposed canopy tours and coasters. This would result in a 0.64% reduction in tree area in the Analysis Area. Approximately 3.3 acres of grading would occur within the WIZ as a result of the hiking and mountain biking trail project components.	Approximately 3.3 acres of grading would occur within the WIZ as a result of the hiking and mountain biking trail project components.
Indicator: Quantification of changes in water yield or discharge to receiving streams related to proposed ground disturbance and overstory vegetation removal		
Under the No Action Alternative, baseline conditions for assessment of impacts on water yields and peak flows are assumed to be the existing conditions.	The proposed summer recreation facilities would result in removal of approximately 51 acres of vegetation, which would be broadly distributed over the Analysis Area due to the linear configurations of the proposed trails, canopy tours and coasters. This vegetation removal would result in increases to annual runoff in Analysis Area watersheds up to 0.8% and peak flow increases up to 0.9%. These changes would be too small to measure and would not adversely affect stream health.	The proposed summer recreation facilities would result in removal of approximately 46.1 acres of vegetation, which would be broadly distributed over the Analysis Area due to the linear configurations of the proposed trails and canopy tours. This vegetation removal would result in increases to annual runoff in Analysis Area watersheds up to 0.70% and peak flow increases up to 0.76%. These changes would be too small to measure and would not adversely affect stream health.
VEGETATION AND BOTANY		
Issue: Ground disturbance associated with construction and operation of proposed projects could affect plant communities throughout the Analysis Area, including Threatened, Endangered, and Sensitive (TES) species, WRNF Species of Local Concern (SOLC), and invasive plant species.		
Indicator: Identification of TES plant habitat/individuals in the Analysis Area		
There is no habitat for any federally listed threatened or endangered plant species within the Analysis Area. No occupied habitat for any Region 2 Sensitive plants was located; however, potential habitat for *Botrychium ascendens*, *B. lineare*, and *B. paradoxum* is present.	There is no habitat for any federally listed threatened or endangered plant species within the Analysis Area. A MAII determination was made for three R2 sensitive plants: *Botrychium ascendens*, *B. lineare* and. *B. paradoxum*. These moonwort plants were not observed, but are presumed to be present and could be affected by project activities.	Same as Alternative 2.

Table 2-3:
Summary Comparison of Direct and Indirect Environmental Consequences

Alternative 1	Alternative 2	Alternative 3
Indicator: Identification of WRNF SOLC habitat/individuals in the Analysis Area		
Under Alternative 1, no new projects would be implemented, and no impacts to SOLC are expected.	Under Alternative 2, up to 200 square feet of occupied *Botrychium* spp. habitat could be impacted. There is a potential for indirect effects such as increased noxious weed invasion, increased sedimentation or erosion, deceased light from shading caused by the coasters, or altered hydrologic regimes.	Under Alternative 3, impacts to SOLC would be similar as those discussed under Alternative 2. However, potential direct impacts to moonwort habitat would be less than under Alternative 2.
Indicator: Estimation of proposed ground disturbance and overstory vegetation removal in relation to site-specific and conceptual project locations		
Under Alternative 1, no new projects would be implemented, and no new impacts to forest stands are expected.	Under Alternative 2, ~51 acres of disturbance would take place including 15.1 acres of forest overstory removal. The majority of the vegetation impacts are due to disturbed ski-trails and to MBP affected lodgepole pine stands, however, there would also be some impacts to spruce-fir forests, aspen forests, and native meadows.	Under Alternative 3, ~46.2 acres of disturbance would take place including 11.6 acres of forest overstory removal. The majority of the vegetation impacts are due to disturbed ski-trails and to MBP affected lodgepole pine stands; however, there would also be some impacts to spruce-fir forests, aspen forests, and native meadows.
Indicator: Identification of invasive species in the Analysis Area		
Six species of invasive Colorado Noxious Weeds were observed within the Analysis Area, including one List A species and five List B species. The invasive plants are most common on the disturbed ski trail habitats on the front side of Vail Ski Area.	Identical to Alternative 1	Same as Alternative 1
Indicator: Discussion of forest health within the Analysis Area in relation to the mountain pine beetle epidemic		
The MPB epidemic is currently declining within the Analysis Area (see Chapter 3, Section I).	Alternative 2 would not measurably affect MPB activity within the Analysis Area.	Same as Alternative 2.
Indicator: Identification of invasive species in the vicinity of the Project Area and use of BMPs to limit their spread		
Currently, Vail Ski Area does not have an integrated weed management plan. Rather, invasive weeds are controlled on a case-by-case basis per direction of the Forest Service. Invasive weed control activities, per direction of the Forest Service, would continue under Alternative 1.	Management Requirements have been identified to control invasive weed species. Refer to Table 2-1.	Same as Alternative 2.

Chapter 3

Affected Environment and Environmental Consequences

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

Council of Environmental Quality (CEQ) regulations direct agencies to succinctly describe the environment that may be affected by the alternatives under consideration.[15] As such, Chapter 3 describes the existing physical, biological, social, and economic components of the project area which have potential to be affected by implementing any of the alternatives (i.e., the Affected Environment). Each Affected Environment description is followed by an Environmental Consequences discussion that provides an analysis of the potential effects of implementation of each of the alternatives.

Chapter 3 is organized by resource area, and follows the organization of issues and resources requiring further analysis (and indicators) as presented in Chapter 1. Each resource section in Chapter 3 is organized in the following order:

SCOPE OF THE ANALYSIS

The scope of the analysis briefly describes the geographic area(s) potentially affected by the alternatives for each issue and its indicator(s). The scope of the analysis varies according to resource area and may be different for direct, indirect, and cumulative effects.

AFFECTED ENVIRONMENT

The Affected Environment section provides a description of the environment potentially affected, as based upon current uses and management activities/decisions.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

This section provides an analysis of direct and indirect environmental effects of implementing each of the alternatives, according to the issues or resources requiring additional analysis and indicators identified in Chapter 1. Cumulative effects are discussed separately.

Direct effects are caused by the action and occur at the same time and place. Indirect effects are caused by the action and occur later in time or are farther removed in distance, but are still reasonably foreseeable (i.e., likely to occur within the duration of the project).

[15] 40 CFR 1502.15

CUMULATIVE EFFECTS

Cumulative effects are the result of the incremental direct and indirect effects of any action when added to other past, present, and reasonably foreseeable future actions, and can result from individually minor but collectively major actions taking place over a period of time.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

An irreversible commitment is a permanent or essentially permanent use or loss of resources; it cannot be reversed, except in the extreme long-term. Examples include minerals that have been extracted or soil productivity that has been lost. An irretrievable commitment is a loss of production or use of resources for a period of time. One example is the use of timber land for a logging road. Timber growth on the land is irretrievably lost while the land is a road, but the timber resource is not irreversibly lost because the land could grow trees in the near future. The Forest Service recognizes the fact that certain management activities will produce irreversible or irretrievable commitments of resources.

A. RECREATION

SCOPE OF THE ANALYSIS

Summer uses at ski areas have been increasing in recent years, driven in part by new technology, as well as the growing number of people seeking recreational activities in more managed settings. The Forest Service recognizes that additional seasonal and year-round recreation activities and associated facilities are important to the long-term viability of ski areas, and that the outdoor recreation setting at ski areas could introduce new markets, especially families, youth and urban-based populations, to outdoor recreation. This exposure could build a deeper appreciation for nature that could lead to further exploration of National Forest System (NFS) lands beyond ski areas.[16]

The majority of Vail Ski Area's summer and year-round recreational opportunities are currently located on the front side of the Vail Mountain, and Adventure Ridge is the focal point. This analysis focuses on summer and year-round (non-skiing) recreational opportunities on NFS lands within Vail Ski Area's SUP area (12,590 acres) and throughout the Eagle Valley.

AFFECTED ENVIRONMENT

Since its inaugural season in 1962, Vail Ski Area has become one of the most visited ski resorts in North America, averaging over 1.6 million annual skier visits between the 2008/09 and 2012/13 seasons. Recreation at Vail Ski Area has typically been focused on winter activities within its SUP area—primarily skiing and snowboarding; however, in recent years Vail Ski Area has become increasingly focused on providing summer and year-round (non-skiing) recreational activities.

On-mountain summer and year-round recreational activities at Vail Ski Area are focused at Adventure Ridge, at the top of the Eagle Bahn Gondola, and across the front side of the mountain. Adventure Ridge opened in 1996, at which time it offered snowtubing, ice skating, ski bikes, snowshoeing, a half-pipe and night skiing on Chair 15. It has since grown to be the hub of Vail Ski Area's non-skiing activities, offering summer and year-round activities, including: a zip line, challenge courses, pony rides, horse tours, and hiking/biking.

Annual summer visitation at Vail Ski Area (based on the number of lift tickets sold for the Vista Bahn Gondola) is included in Table 3A-1. This does not account for people who choose to hike or bike on the network of roads and trails throughout the SUP area on their own.

[16] USDA Forest Service, 2013

Table 3A-1:
Annual Summer Visitation at Vail Ski Area

Year	Summer Visits	Percent Increase
2013	134,258	7.8
2012	124,577	7.2
2011	116,186	7.1
2010	108,450	52
2009	71,370	6.3
2008	67,120	--
6-year Average	**103,660**	**16%**[a]

[a] This average is skewed by the sharp increase in summer visitation between 2009 and 2010, which was the result of a combination of factors including weather, increasing interest in natural resource-based recreation, and local events in the Eagle Valley. Discounting the 2010 season, Vail Ski Area's annual summer visitation increases averaged 7.1%.

The Town of Vail and Eagle County are popular year-round regional, national and international tourist destinations. The Town of Vail averages approximately 1.1 million summer visitors each year. An additional 800,000 summer visitors come to Eagle County (including Avon, Eagle-Vail and Edwards), for a total, countywide summer visitation total of 1.9 million people.[17] Summer recreational opportunities in the Eagle Valley are abundant, and likely outnumber winter opportunities for most people because of the breadth and diversity of activities. Summer recreational opportunities in the Eagle Valley include, but are not limited to: hiking, road/mountain biking, sightseeing, fishing, camping, horseback riding, rock climbing, kayaking, disc golfing, rafting, concerts, farmers markets, and art fairs. These are offered on NFS, County and Town (Vail, Avon, and Edwards) lands. The activities offered within Vail Ski Area's SUP area represent a managed, consolidated option for some of these visitors within a much larger array of opportunities available to visitors of the Eagle Valley. The managed activities offered within Vail Ski Area's SUP area likely do not attract a significant number of destination or local/regional visitors to the Eagle Valley in and of themselves; it is more likely that they are an amenity for the 1.9 million people who are already visiting the Eagle Valley throughout the summer. Likewise, the year-round activities offered at Adventure Ridge are not considered to induce any measureable additional winter visitation to the Eagle Valley or the Vail Ski Area (i.e., people who are already coming to the Eagle Valley to ski for multiple days may partake in them for a portion of their day).

As indicated in Table 3A-1, summer visitation to Vail Ski Area grew considerably between 2008 and 2013, increasing by 86 percent over the five-year span. Adventure Ridge, by itself, is not considered a vacation destination. It is more likely that the guests who visit Adventure Ridge typically incorporate it as a single day experience across a multiple day vacation in the Eagle Valley, during which they take

[17] Romer, 2013

advantage of other recreational opportunities (e.g., golf one day, fish one day, raft one day, etc.). The instances of people travelling from outside the Eagle Valley to specifically visit Adventure Ridge are insignificant and discountable.

Guests At One Time

This analysis incorporates a variety of tools to define the summer recreational experiences at Vail Ski Area. A "Guests At One Time" (GAOT) model has been developed to provide insight into the potential distribution of guests across the range of summer recreation opportunities within the SUP area.[18] The GAOT model incorporates data on capacity, utilization, wait times and numerous other factors for each activity/amenity within Vail Ski Area's SUP area throughout the summer.

While the capacities of individual activities and components of Vail Ski Area are factored into the GAOT, it is important to note that GAOT is not a capacity or visitation model. It is a tool that is used to help planners assess how guests distribute across the SUP area *at any given point in time* (not an entire day). It incorporates the use of some basic assumptions, and it is in no way meant to be a precise instrument. Finally, it does not attempt to quantify the maximum number of guests who could be accommodated by summer recreation activities and infrastructure.

In Table 3A-2, the GAOT has been calculated for a "tenth busiest day" scenario. This is a typical approach used by ski area planners and accounts for a day in which a large number of guests are at the ski area, but it is by no means the busiest of days (e.g., a holiday such as Fourth of July or Labor Day). The GAOT incorporates the four summer components at Vail Ski Area: activities at Adventure Ridge, hiking and biking trails, food services, and chairlifts. Table 3A-2 depicts the tenth busiest day scenario when approximately 4,300 guests are at Vail Ski Area, and the model indicates both the total number, and percentage, of guests that are attributable to each component at any given moment. Although 4,300 GOAT is used for the purposes of this analysis, the same basic percentage breakdown for each component would apply regardless of how many guests are at Adventure Ridge at any given time (i.e., the number of guests attributable to each component of Adventure Ridge might increase or decrease, but the percentage of the total would be expected to remain relatively consistent). The percentages of guests distributed to each recreational opportunity are compared between alternatives 1, 2 and 3 in Table 3A-5.

[18] Winter capacity at Vail Ski Area is calculated using the Comfortable Carrying Capacity (CCC) model. CCC is a widely-used, although complex, model in the ski industry. It is based on a combination of uphill hourly capacity (the lift network), downhill capacity (the trail network), and the total amount of time spent in lift lines, on chairlifts, and descending trails.

Table 3A-2:
Guests At One Time – Existing Conditions

	GAOT	Percent of Total (%)
ACTIVITIES		
Rebound Trampoline	25	0.6
Sightseeing	80	1.9
Eagle's Nest Wedding Deck	100	2.3
Pony Rides	15	0.3
Horse Tours	14	0.3
Jeep Tours	32	0.7
Guided Hiking Tours	19	0.4
Guided Biking Tours	12	0.3
Nature Center	19	0.5
Zip Line	59	1.4
Challenge Course North	25	0.6
Challenge Course South	25	0.6
Disc Golf	63	1.5
Sub-Total	*488*	*11.4*
HIKING AND BIKING TRAILS		
Hiking	462	10.7
XC Biking	618	14.4
DH Biking	107	2.5
Sub-Total	*1,187*	*27.6*
FOOD SERVICE		
Game Creek Club	317	7.4
Talon's Deck	383	8.9
Bistro 14	180	4.2
The 10th	303	7.0
Sarge's BBQ	219	5.1
Sub-Total	*1,402*	*32.6*
CHAIRLIFTS		
Eagle Bahn Gondola	459	10.7
Gondola One	765	17.8
Sub-Total	*1,224*	*28.5*
Total	**4,301**	**100**[a]

[a] Due to rounding, the sub-total percentages total to 100.1%

Modeling indicates that currently over half (approximately 61 percent) of GOAT are on chairlifts or at a food service facility (refer to Table 3A-2); these provide the basic components for any guest at Adventure Ridge. The remaining guests are engaged in one of the structured recreational activities available at Adventure Ridge or on hiking or biking trails throughout the SUP area. While less than half of the GAOT can be attributed to activities or hiking/biking trails, these are critical elements of the recreational experience that draw people to the Vail Ski Area SUP area in the first place.

Activities at Adventure Ridge

Adventure Ridge has evolved since 1996 to include the following activities and amenities:

- Sightseeing
- Zip Runner (zip line)
- Challenge Courses (ropes courses)
- Mountain Biking (guided and dispersed)
- Hiking (guided and dispersed)
- On-Mountain Dining
- Rebound Trampoline
- Pony Rides
- Horse Tours
- Jeep Tours
- Nature Center
- Disc Golf
- Eagle's Nest Wedding Deck

Activities offered at Adventure Ridge are designed to cater to a diverse audience; however, recreating in an Alpine environment can require a combination of prior experience, familiarity/comfort with the outdoors, and a certain level of physical fitness (especially at elevation in the high alpine environment). Furthermore, many visitors to the Eagle Valley are looking for activities that the whole family can enjoy, which can complicate meeting the group's diverse needs.

Figure 1 illustrates the existing summer and year-round activities that are available within Vail Ski Area's SUP area, and the extent to which they spread across the mountain.

Photo 3A-1:
Zip Runner at Adventure Ridge

These activities are popular among visitors to the Eagle Valley, providing structured recreation tailored towards families. Vail Ski Area's SUP area, including Adventure Ridge, combines recreational activities with expansive views of the nearby Gore Range and the Holy Cross Wilderness.

Photo 3A-2:
Jeep Tours

Photo 3A-3:
Challenge Course at Adventure Ridge

Hiking and Mountain Biking Trails

In addition to the activities mentioned above, visitors to Vail Ski Area also have a choice of less-structured recreation opportunities. Within Vail Ski Area's SUP area are approximately 59 miles of hiking and biking trails, including cross-country and downhill biking. Table 3A-3 presents the mileage of existing trails by ability level. The reader is referred to Figure 1 for more information. These trails range in difficulty and length to provide opportunities for families, as well as those looking for a more physically challenging and/or technical experience. All trails are lift-served via either the Eagle Bahn Gondola or Gondola One. Trails are well-signed, and detailed hiking and mountain biking trail maps are available. Guests who choose to ride or hike the trails within the SUP area (whether with a guide or on their own) typically do so with a level of comfort and confidence that they know where trails start and stop (i.e., they can see Vail Village from most points on the mountain); and if necessary, help is available through Vail Ski Area's staff.

Table 3A-3:
Existing Trails by Ability Level

	Beginner	Intermediate	Advanced	Expert	Total
Hiking	3 miles	11 miles	0 mile	0 mile	**14 miles**
Cross-Country Biking	6 miles	33 miles	1 mile	0 mile	**40 miles**
Downhill Biking	0 mile	0 mile	4 miles	1 mile	**5 miles**

Particularly popular hiking trails include *Eagle's Loop*, a short loop hike departing from Adventure Ridge, and *Berrypicker*, which connects Adventure Ridge and Mid-Vail to Vail Village and Lionshead. Cross-country and downhill biking trails, while requiring more equipment and expertise than hiking, are similarly popular mountain activities.

In addition to the 59 miles of trails within Vail Ski Area's SUP area, there are hundreds of miles of hiking and biking trails on NFS and County lands throughout the Eagle Valley, including in the Eagles Nest and Holy Cross Wilderness Areas.[19]

Food Service

Vail Ski Area has a number of on-mountain food service facilities located at Adventure Ridge and Mid-Vail. These facilities are important to the overall recreational experience because they allow visitors to remain on the mountain for the entire day. Only a portion of the food service facilities located within the SUP area remain open during the summer. Summer food service options include:

[19] Mountain bikes are not permitted within any designated wilderness areas.

- Game Creek Club
- Talon's Deck
- Bistro 14
- The 10th
- Sarge's BBQ

Talon's Deck and Bistro 14 are located at Adventure Ridge and are frequently used by visitors partaking in Adventure Ridge activities throughout the day. Talon's Deck provides casual, open-seating style dining while Bistro 14 is more formal, sit-down style. The Game Creek Club is located in Game Creek Bowl and offers an upscale dining experience. It can be accessed from Adventure Ridge via horse or jeep, and is often incorporated into other recreational opportunities. The 10th and Sarge's BBQ are both located at Mid-Vail. The 10th provides upscale dining and Sarge's BBQ, like Talon's Deck, is casual and open-seating style.

Chairlifts

Currently, Vail Ski Area operates two chairlifts in the summer to provide access to on-mountain recreation: the Eagle Bahn Gondola and Gondola One. The Eagle Bahn Gondola transports guests to Adventure Ridge and Gondola One provides access to Mid-Vail. These chairlifts provide both one-way (for guests biking or hiking either up or down the mountain) and round-trip transportation.

Other Developed Recreational Opportunities in the Analysis Area

Summer recreation opportunities in the Eagle Valley and throughout the I-70 corridor are numerous and diverse. Dispersed recreation opportunities in the Eagle Valley area are discussed above, but there are also opportunities for concentrated and developed recreation provided by private entities.

Zip Adventures of Vail, located approximately 15 miles west of the Town of Vail in Wolcott, is a private recreational facility offering six zip lines varying in length from 200 to 1,000 feet. Zip Adventures has been in operation since 2005 and operates April through December. Zip Adventures offers a multi-segment zip line course, which is different than the Zip Runner (a single zip line) that is part of Vail Ski Area's Adventure Ridge.

In Glenwood Springs (60 miles west of the Town of Vail), the Glenwood Caverns Adventure Park is a private recreational facility that is open year-round. This is popular attraction for visitors to Glenwood Springs, which has a distinct and robust tourism-based economy. It has been in operation since 1999 and offers a multitude of year-round amusements, activities and rides that are not offered elsewhere in the region, including:

- Cave Tours
- Alpine Coaster
- Roller Coaster
- Family Roller Coaster
- Giant Swing
- Zip Ride
- 4-D Movie Theatre
- Laser Tag
- Gemstone Panning
- Climbing Wall
- Giant Maze
- Ferris Wheel
- Other Kids' Attractions

Both Zip Adventures and the Glenwood Caverns Adventure Park have been in operation over the same time period as Adventure Ridge.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Table 3A-4 provides a comparison of projected average annual summer visitation at Vail Ski Area under alternatives 1, 2 and 3, as measured by gondola ridership.[20] *No additional winter visitation is anticipated as a result of either of the action alternatives. The canopy tours and coasters that would be available throughout the winter would be amenities to the existing skiing experience that would not independently drive additional winter visitation.*

In projecting summer visitation under various alternative scenarios, historic visitation patterns (based on gondola ridership) at Adventure Ridge were analyzed. Future average annual summer visitation increases were considered in relation to the current and proposed mix of projects available at Adventure Ridge, along with demand for summer recreational activities in the Eagle Valley. It is important to note that the Proposed Action is designed to accommodate the existing demand for recreation (1.9 million summer tourists) within the Eagle Valley. Additional annual summer visitation to Vail Ski Area under alternatives 2 and 3 is primarily attributable to redistributing people who are already coming to the Eagle Valley to recreate, and increasing the number of activities from which people can choose within Vail Ski Area's SUP area (spanning a single day or multiple days). Potential new destination visitation to the Eagle Valley, as a result of either of the action alternatives, is considered minimal.

[20] This does not attempt to capture participation in individual activities at Adventure Ridge (i.e., guests can, and do, choose to participate in single or multiple activities after they ride the gondolas).

Table 3A-4:
Vail Ski Area Projected Summer Visitation – Alternatives 1, 2 and 3

Year	Alternative 1	Alternative 2		Alternative 3	
	Average Annual Growth Rate: 7%	Average Annual Growth Rate: 11%		Average Annual Growth Rate: 9%	
	Visitation Projection	Visitation Projection	Increase over Alternative 1	Visitation Projection	Increase over Alternative 1
2019	201,000	251,000	50,000	225,000	24,000
2018	188,000	226,000	38,000	206,000	18,000
2017	176,000	204,000	28,000	190,000	14,000
2016	165,000	183,000	18,000	174,000	9,000
2015	154,000	165,000	11,000	159,000	4,000

Table 3A-5 indicates the GAOT distribution across Vail Ski Area under alternatives 1, 2 and 3. As discussed above, the GAOT model provides a rough quantification of the distribution of guests across Vail Ski Area at any moment in time. It accounts for projected changes in total GAOT due to the addition of activities and amenities included in alternatives 2 and 3, but does not represent capacity or visitation. Italicized text in Table 3A-5 implies new or changed activities and amenities.

Table 3A-5:
Guests At One Time – Alternatives 1, 2 and 3

	Alternative 1		Alternative 2		Alternative 3	
	GAOT	% of Total	GAOT	% of Total	GAOT	% of Total
ACTIVITIES						
Rebound Trampoline	25	0.6	25	0.3	25	0.3
Sightseeing	80	1.9	214	2.8	214	2.9
Eagle's Nest Wedding Deck	100	2.3	100	1.3	100	1.3
Pony Rides	15	0.3	15	0.2	15	0.2
Horse Tours	14	0.3	14	0.2	14	0.2
Jeep Tours	32	0.7	32	0.4	32	0.4
Guided Hiking Tours	19	0.4	19	0.2	19	0.3
Guided Biking Tours	12	0.3	12	0.2	12	0.2
Nature Center	19	0.5	19	0.3	19	0.3
Zip Line	59	1.4	59	0.8	59	0.8
Challenge Course North	25	0.6	25	0.3	25	0.3
Challenge Course South	25	0.6	25	0.3	25	0.3
Disc Golf	63	1.5	63	0.8	63	0.8
Adventure Ridge Mountain Coaster	N/A	N/A	41	0.5	N/A	N/A
Pride Express Mountain Coaster	N/A	N/A	69	0.9	N/A	N/A
Front Side Canopy Tour	N/A	N/A	46	0.6	46	0.6
Game Creek Canopy Tour	N/A	N/A	56	0.7	56	0.7
Aerial Adventure Course	N/A	N/A	40	0.5	40	0.5

Table 3A-5:
Guests At One Time – Alternatives 1, 2 and 3

	Alternative 1		Alternative 2		Alternative 3	
	GAOT	% of Total	GAOT	% of Total	GAOT	% of Total
Riparian Experience	N/A	N/A	21	0.3	N/A	N/A
Wedding Venue at The 10th	N/A	N/A	105	1.4	N/A	N/A
Sub-Total	*488*	*11.4*	*1,000*	*13.0*	*764*	*10.2*
HIKING AND BIKING TRAILS						
Hiking	462	10.7	840	10.9	840	11.2
Cross-Country Mountain Biking	618	14.4	974	12.6	974	13.0
Downhill Mountain Biking	107	2.5	296	3.8	296	4.0
Sub-Total	*1,187*	*27.6*	*2,110*	*27.3*	*2,110*	*28.2*
FOOD SERVICE						
Game Creek Club	317	7.4	317	4.1	317	4.2
Talon's Deck	383	8.9	765	9.9	765	10.2
Bistro 14	180	4.2	180	2.3	180	2.4
The 10th	303	7.0	303	3.9	303	4.0
Sarge's BBQ	219	5.1	439	5.7	439	5.9
Wildwood	N/A	N/A	473	6.1	473	6.3
Sub-Total	*1,402*	*32.6*	*2,477*	*32.1*	*2,477*	*33.1*
CHAIRLIFTS						
Eagle Bahn Gondola	459	10.7	459	5.9	459	6.1
Gondola One	765	17.8	765	9.9	765	10.2
Avanti Express	N/A	N/A	303	3.9	303	4.1
Wildwood Express	N/A	N/A	217	2.8	217	2.9
Mountaintop Express	N/A	N/A	390	5.0	390	5.2
Sub-Total	*1,224*	*28.5*	*2,134*	*27.6*	*2,134*	*28.5*
Grand Total	**4,301**	**100**	**7,721**	**100**	**7,485**	**100**

Note: Proposed projects are *italicized* in this table.

The model estimates that the distribution of guests across activities, hiking and biking trails, food service, and chairlifts remains roughly consistent throughout alternatives 1, 2, and 3 (refer to Table 3A-5). While the percentage of guests engaged in activities (between 10 and 13 percent, depending on the alternative) appears small in the context of the total number of GAOT, activities are the components that attract people to the Vail Ski Area SUP area in the first place, providing opportunities for recreation and engagement with the outdoors. Chairlifts and food service provide the basic amenities that most people will utilize throughout the time they spend at Vail Ski Area.

Alternative 1 – No Action

Alternative 1 does not include any new summer or year-round projects at Adventure Ridge. Adventure Ridge would continue to offer activities; however, selection of this alternative would not capitalize on the

opportunity to expand this program and meet the growing summer and year-round recreational needs of the Eagle Valley. Under Alternative 1, the average Adventure Ridge visitor would be expected to partake in on-mountain activities for a single day, or part of a day. Based on historic trends in summer visitation to Vail Ski Area's SUP area (and expected future demand), an annual summer visitation growth rate of 7 percent can be expected under the No Action Alternative (refer to Table 3A-4).

Alternative 2 – Proposed Action

As a result of the additional activities included in Alternative 2 (primarily mountain coasters and canopy tours), an annual growth rate of 11 percent has been projected for summer visitation within Vail Ski Area's SUP area (refer to Table 3A-4).

Summary of the Recreational Experience

Additional seasonal and year-round recreation activities and associated facilities are important to the long-term viability of ski areas, and more managed outdoor recreation settings at ski areas can introduce new markets, especially families, youth and urban-based populations, to outdoor recreation. This exposure can build a deeper appreciation for nature that could lead to further exploration of NFS lands beyond ski areas.[21] This is central to the range of proposed projects included in Alternative 2.

In general, the projects and activities proposed in Alternative 2 would expand the variety of recreational opportunities available to visitors to the Eagle Valley and, specifically, at Vail Ski Area. While on-mountain summer and year-round recreational activities at Vail Ski Area represent one component of the many opportunities that are available throughout the Eagle Valley, providing additional activities within the SUP area could provide incentive for guests to participate in additional activities, thereby spending longer durations within the SUP area across a single day or multiple days.

Additionally, the continued development of more managed natural resource-based recreation opportunities within Vail Ski Area's SUP area could expose people to new perspectives and be a gateway to get them interested in the many unstructured activities that National Forests have to offer. A combination of traditional recreation and interpretive opportunities would create a unique experience and reach the widest breath of visitors at Vail Ski Area.

Interpretive Opportunities

Vail Ski Area's SUP is a portal to NFS lands administered by the WRNF—millions of people visit it in the winter, and over a hundred thousand in the summer. As mentioned above, an evolving interpretive program focused on themes such as history, environment, and culture would be incorporated throughout all existing and proposed recreational activities.

[21] USDA Forest Service, 2013

These educational and interpretive components would add another dimension to a visitor's recreational experience. They would engage guests throughout their visit, for example while waiting in line for, or participating in, various activities. This has the potential to insert unique meaning into the overall recreational experience at Vail Ski Area.

Activities

Mountain Coasters

The Pride Express and Adventure Ridge mountain coasters would be accessible from Adventure Ridge. These activities would enhance the recreational experience offered on NFS lands within the Vail Ski Area SUP area by giving guests an intense, exciting experience combined with an opportunity to see large areas of forest and surrounding landscape.

The vertical relief, natural topography and vegetation of the SUP area are essential to the user experience associated with mountain coasters, as well as their design and engineering. A variety of terrain and vegetation type along the track would provide a sense of excitement. For example, sharp turns on a track surrounded by trees and boulders add to the thrill of the activity. While the descent would be the primary feature of the coasters, in the case of the Pride Express Mountain Coaster, guests would subsequently ride Mountaintop Express back to Adventure Ridge, which would provide additional opportunities for sightseeing and interpretive opportunities.

While the coasters would not—in and of themselves—connect people with the natural environment, guests who are drawn to the National Forest by these activities may go on to experience other recreational opportunities at (or outside of) Adventure Ridge during their visit. The coasters may serve as the initial attraction, getting them to experience the National Forest in a unique way, leading to interest in recreational activities both within and beyond the Vail Ski Area SUP area.

Zip Line Canopy Tours

The proposed Front Side and Game Creek canopy tours would transport guests around the SUP area via aerial zip lines on tours lasting approximately three hours. These gravity-based activities would provide fun and unique experiences by giving guests a unique view of NFS lands within the Vail Ski Area SUP area and surrounding terrain. While riding a canopy tour, guests would move in and out of the forest canopy. At the towers, they would be slightly below the canopy and able to see the lower forest structure. In the middle of each zip line segment the rider would have an aerial view of the ski area and surrounding landscape.

These projects would positively impact the recreational experience for guests at Adventure Ridge by providing a unique, long-duration, on-mountain activity. As such, for families and groups looking for a day's-worth (or multiple days) of recreation, the canopy tours could represent an important component of their overall recreational experience.

Aerial Adventure Course

The Aerial Adventure Course would provide an alternate recreational and educational experience that is designed for families and groups. Small ropes-course features and interactive elements are designed to engage participants in a forest environment. The Aerial Adventure Course would be suitable for users of all ages. The location of the Aerial Adventure Course takes advantage of the existing infrastructure and development in this portion of Vail Ski Area.

This activity would add variety to the recreational opportunities available at Adventure Ridge and throughout the SUP area. Having a variety of activities helps to keep children entertained, which is particularly important during family vacations. This activity has the potential to instill an awareness/appreciation of nature at an early age.

Riparian Experience

As described in Chapter 2, the Riparian Experience would allow children to experiment with water and hydrological features in a fun and unique setting, meant to reflect what is found in a natural riparian habitat area. No existing riparian areas would be associated with this exhibit. As with the Aerial Adventure Course, the Riparian Experience is a family-friendly activity with a strong interpretive element and emphasis on education. Also, like the Aerial Adventure Course, the Riparian Experience takes full advantage of existing infrastructure at Adventure Ridge. This activity would contribute important variety to family-friendly opportunities within Vail Ski Area's SUP area, by specifically catering to small children. This activity requires no physical exertion, and is accessible to all ages.

Horse Tours

As described in Chapter 2, an improved horse trail is incorporated into Alternative 2. As the horse tours currently follow existing service roads into and out of Game Creek Bowl, the new trail would improve the recreational experience by making it more natural and diverse—riders would descend into Game Greek Bowl on a trail, and ride out on a road.

Hiking and Mountain Biking Trails

The addition of approximately 55 miles of hiking, cross-country mountain biking, and downhill mountain biking trails within Vail Ski Area's SUP area would increase variety and improve the recreational experience for users of these trails. Specific trail locations and ability levels have not been identified at this time. With an increased supply of trails, guests would have more options to choose from to suit their individual experience and/or style. Also, the new trail system would be constructed around the latest trail design techniques, which makes the experience more enjoyable and trails more sustainable. With additional trails, riders would encounter other people less frequently. These new trails would vary across all ability levels, and would be accessible to all different groups of guests.

Food Service

As discussed above under Affected Environment and earlier in this section, food service is an important component of the on-mountain recreational experience. As described in Chapter 2, Alternative 2 includes summer utilization of an existing on-mountain food service venue that is currently only used during the winter. This additional on-mountain food service would accommodate expanded activities at Adventure Ridge and Mid-Vail.

Chairlifts

Additional lift capacity is included in Alternative 2 to accommodate additional summer activities at Adventure Ridge. In addition to the Eagle Bahn Gondola and Gondola One, the Avanti Express, Wildwood Express, Mountaintop Express, Game Creek Express, and Pride Express would be operated in the summer. Game Creek Express and Pride Express would operate primarily for use in the Game Creek Canopy Tour and Pride Express Mountain Coaster, respectively. While providing transportation for other recreation opportunities, chairlifts also provide a unique perspective on the forest and surroundings.

Wedding Venue at The 10th

Vail Ski Area's natural setting make it a popular destination for outdoor weddings. It is anticipated that this amenity would be popular for on-mountain weddings in coordination with use of The 10th for receptions.

Other Developed Recreational Opportunities in the Analysis Area

As discussed in Affected Environment, there are other recreational providers who operate on private land between the Town of Vail and Glenwood Springs. Two of these providers—Zip Adventures of Vail and Glenwood Caverns Adventure Park—offer some activities that are similar to those currently provided, and proposed, at Adventure Ridge.

Alternative 2 includes four activities that would provide similarities between Adventure Ridge, Zip Adventures, and the Glenwood Caverns Adventure Park: the mountain coaster and the canopy tours. Although the intent of the Proposed Action is to capture the existing demand for summer activities in the Eagle Valley, it is reasonable to assume that some guests who might otherwise patronize Zip Adventures and/or the Glenwood Caverns Adventure Park might choose to instead go to Adventure Ridge.

Alternative 3

As described in Chapter 2, Alternative 3 includes all projects from Alternative 2, except for the mountain coasters, Riparian Experience, and the wedding venue at The 10th. See the discussion under Alternative 2 for a description of recreation effects of all other project components.

Table 3A-3 portrays the likelihood that the omission of the mountain coasters from Alternative 3 could have a disproportionate impact on summer visitation compared to Alternative 2. As discussed previously under Alternative 2, the mountain coasters are considered to be a small, but important, potential draw for

summer guests to Adventure Ridge, attracting people who otherwise might not explore the SUP area. By omitting these activities, visitation to other recreational opportunities would be expected to be reduced as compared to Alternative 2 (refer to Table 3A-4).

Alternative 3 includes two activities that would increase the similarities between Adventure Ridge, Zip Adventures, and the Glenwood Caverns Adventure Park: the Front Side Canopy Tour and the Game Creek Canopy Tour. As with Alternative 2, it is reasonable to assume that some guests who might otherwise patronize Zip Adventures and/or the Glenwood Caverns Adventure Park might choose to instead go to Adventure Ridge

CUMULATIVE EFFECTS

While Vail Ski Area has traditionally focused on winter recreation, in recent years increasing attention has been given to summer and year-round recreational opportunities. In 1996 Vail Ski Area opened Adventure Ridge, which initially included winter-based activities, including a snowboard park and half-pipe, tubing park and lift, ice skating rink, night lighting around Eagle's Nest and the Chair 15 pod, and snowmobile tours. Since that time it has become the focal point for Vail Ski Area's summer and multi-seasonal activities within its SUP area, and averaged over 100,000 summer visitors between 2008 and 2013. It now offers a multitude of summer and year-round activities, as previously discussed.

Previously-approved, unimplemented projects from the 2012 Vail Summer Improvements CE may be constructed at Adventure Ridge including summer tubing, a climbing wall, and freestanding climbing features (contingent upon final Forest Service policy). Construction of these projects would add to the variety of recreational opportunities available within the Vail Ski Area SUP area.

The continued development of summer and year-round recreation within the Vail Ski Area SUP area attracts increasing numbers of visitors to the National Forest. Cumulatively, the incorporation of additional developed/structured recreation activities within the Vail Ski Area SUP area complements the range of undeveloped recreation throughout the Eagle Valley and diversifies the available recreational opportunities in the area.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

No irreversible and/or irretrievable commitment of resources have been identified that may impact the recreational resources in association with the alternatives analyzed in this document.

B. VISUALS

SCOPE OF THE ANALYSIS

Analysis of the aesthetic environment requires an evaluation of the Project Area and its ability to absorb the effects of both historic and ongoing human-induced and natural changes. Slope, natural vegetation types and patterns, topography, and viewing distance are important factors in this analysis. Development of the lift and trail network, guest service facilities, infrastructure, and summer and multi-season activities on NFS and private lands at Vail Ski Area has occurred over the past five decades, over which time the area has been managed as a developed recreation site. Throughout its history, Vail Ski Area has developed into a concentrated four-season resort.

The WRNF is comprised of over 2.2 million acres and NFS lands represent over 55 percent of Eagle County (596,026 acres). The remainder of the County is composed of Bureau of Land Management (BLM) (23.2 percent) and non-federal (21.7 percent) lands. Vail Ski Area's SUP area consists of 12,500 acres of NFS lands that are allocated in the 2002 Forest Plan as Management Area 8.25 – Ski Areas (Existing and Potential). This analysis discusses the SUP area in its entirety, but focuses on portions where new projects/activities are proposed, specifically the front side of Vail Mountain, Golden Peak, and Game Greek Bowl.

FOREST SERVICE SCENERY MANAGEMENT SYSTEM

The Scenery Management System (SMS) was adopted in 1995 as the primary scenery management direction by the Forest Service. The SMS is a systematic approach for assessing scenic resources in a Project Area and developing findings to help make management decisions on the project. The system is founded on an ecological aesthetic, which recognizes that management which preserves the integrity, stability, and beauty of the biotic community preserves the scenery, as well.

Scenic Integrity Objectives and Landscape Character

Scenic integrity is a measure of the degree to which a landscape is visually perceived to be complete, indicating the degree of intactness and wholeness of the landscape character. An action can cause scenic resource change that can be objectively measured. By assessing the existing scenic character of an area in terms of pattern elements (form, line, color and texture) and pattern character (dominance, scale diversity and continuity), it is possible to identify the extent to which the scenic character of a facility would exhibit scenic contrast with the landscape, or its converse, scenery compatibility.

The 2002 Forest Plan establishes acceptable limits of change for Scenic Resources.[22] The limits of acceptable change of a particular area (e.g., Forest Plan Management Area) are the documented Scenic

[22] USDA Forest Service, 2002

Integrity Objectives (SIO), which serve as a management goal for scenic resources for that area. SIO provide a measure of visible disruption of landscape character and help locate and rank areas in need of scenic rehabilitation.

SIO range from "Very High" (unaltered environment) to "Unacceptably Low" (extremely altered environment). As indicated in the 2002 Forest Plan, the SIO for Vail Ski Area's SUP area is *Very Low.* This SIO refers to landscapes where the valued landscape character "appears heavily altered." The *Very Low* SIO is defined as:[23]

> *Deviations may strongly dominate the valued landscape character. They may borrow from valued attributes such as size, shape, edge effect and pattern of natural openings, changes in vegetation types, or architectural styles outside the landscape being viewed. However, deviations must be shaped by and blend with the natural terrain so that elements such as unnatural edges, roads, landings and structures do not dominate the composition.*

The Forest Plan states that all NFS lands shall be managed to attain the highest possible scenic quality commensurate with other appropriate public uses, costs, and benefits.[24]

SMS Distance Zones and Critical Viewpoints

Viewing distance is important in determining how change is perceived across a landscape. Distance zones are divisions of a particular landscape being viewed, and are used to describe the part of a characteristic landscape that is being inventoried or evaluated.

- Immediate Foreground: This zone begins at the viewer and extends to about 300 feet. Individual leaves, flowers, twigs, bark texture, and other details dominate this view.
- Foreground: This zone is usually limited to areas within 300 feet to 0.5 mile (not to exceed 0.5 mile) of the observer, but it must be determined on a case-by-case basis, as should any distance zoning. Generally, detail of landforms is more pronounced when viewed from within the foreground zone.
- Middleground: Alterations in the middleground (0.5 to 4 miles from the observer) are less distinctive. Texture is normally characterized by the masses of trees in stands or uniform tree cover.
- Background: This zone extends from middleground (minimum of 4 miles between the observer and the area being viewed) to infinity. Shape may remain evident beyond 10 miles, especially if it

[23] USDA Forest Service, 1995
[24] USDA Forest Service, 2002

is inconsistent with other landscape forms. Beyond 10 miles, alteration in landscape character becomes obscure.

All four distance zones are applicable to this project. Beyond people who actively recreate within Vail Ski Area's SUP area throughout the year (who perceive the natural and altered visual environment in the immediate foreground, foreground and middleground distance zones), the critical viewpoints of the Vail Ski Area SUP area are along the I-70 corridor between East and West Vail (foreground and middleground distance zones). From this perspective (to motorists on I-70), the view to the south of Vail Ski Area's developed lift and trail network is one of the dominant components of the visual environment. Backcounty recreationists in the nearby Eagles Nest and Holy Cross Wilderness Areas can also see the Vail Ski Area SUP area in the middleground and background distance zones, although use of the wilderness areas is considerably less than from other, more popular areas.

The Built Environment Image Guide

The Built Environment Image Guide (BEIG) is a manual for the "thoughtful design and management" of the built environment contained within the National Forests by province.[25] The Forest Service defines the built environment as "the administrative and recreation buildings, landscape structures, site furnishings, structures on roads and trails, and signs installed or operated by the Forest Service, its cooperators, and permitees.[26] The BEIG divides the United States into eight provinces which combine common elements from the ecological and cultural contexts over large geographical areas; the WRNF is within the Rocky Mountain Province. Site development, sustainability, and architectural character should conform to BEIG guidelines described for this Province.

Vail Ski Area has also created its own set of design standards for facilities across the mountain. Referred to as the Vail Mountain Design Guidelines, Vail Ski Area continually coordinates with the WRNF during architectural design and construction of new facilities. Currently, several of Vail Ski Area's on-mountain buildings represent an appropriate architectural theme for Vail Ski Area, as well as incorporating pertinent measures from the BEIG. These include, but are not limited to: Two Elk Lodge, The 10th at Mid-Vail, and Belle's Camp.

AFFECTED ENVIRONMENT

Scenic Characteristics of Vail Ski Area's SUP Area

Vail Ski Area's SUP area can be segmented into three distinct areas: the front side; the back bowls; and Blue Sky Basin. The aesthetic and cultural landscape in the Eagle Valley has been defined by recreation (both developed and dispersed) since the 1960s, when residential, commercial and recreational

[25] USDA Forest Service, 2001
[26] Ibid.

development began. Roughly 5,571 acres of developed skiing terrain exists in Vail Ski Area's SUP area, in addition to aerial and surface lifts, guest service facilities and maintenance/operational buildings. In addition, summer and multi-season recreational activities are concentrated at Adventure Ridge (the top of the Eagle Bahn Gondola, refer to Photo 3B-3). Hiking, downhill and cross-country mountain biking trails are located across the front side of Vail Mountain. As a result, developed recreation within Vail Ski Area's SUP area contributes as much, if not more, to the sense of place in the Eagle Valley, as does adjacent NFS and private lands.

In general, the topography of the SUP area is comprised of steeps, large open bowls, basins, glades, and chutes. A mix of predominantly south and north-facing slopes characterize Vail Ski Area with distinct ridge lines providing definition to the natural bowls and developed ski runs. Elevations at Vail Ski Area range from 8,300 feet in the base area up to 11,600 feet at the eastern extent of the SUP boundary. From within the ski area, winter and summer guests are confronted with views of developed and undeveloped portions of Vail Ski Area's SUP area in the foreground and middleground distance zone, as well panoramic views of NFS lands in the Gore Range, Eagles Nest Wilderness, Mount of the Holy Cross, and the Tenmile Range in the background distance zone. To motorists on I-70 between East and West Vail, Golden Peak is visible in its entirety, but the upper half of Vail Mountain obscured by topography.

Photo 3B-1:
Vail Mountain from the North Side of the Eagle Valley

Vegetation cover throughout the SUP area varies due to the broad range in elevation, slope aspect, and gradient. Vegetation within Vail Ski Area's alpine zone is largely dominated by various types of low-lying grasses and forbs. Below 11,000 feet, vegetation cover becomes denser with canopy cover varying with elevation. Dominant species include Engelmann spruce, lodgepole pine, sub-alpine fir, and aspen. The distinctive vegetation patterns typical of developed ski trails contribute to the scenic character of the developed portions of Vail Ski Area's SUP area. Many lodgepole pine within and around the SUP area,

primarily below 9,800 feet, have succumbed to mountain pine beetle outbreak. This mortality, in conjunction with approved treatment practices on NFS and non-public lands, will continue to affect the scenic character in the near future.

Chairlifts and developed ski terrain dominate the foreground view surrounding Vail Ski Area's SUP area; however, on-mountain facilities are relatively well-obscured and are generally not visible to motorists on I-70. Although the area appears "heavily altered" by ski trail openings, ski trail revegetation, coloring and non-reflectivity of lifts and facility siting have contributed to making development less dominant on the landscape. Currently, Vail Ski Area's SUP area meets the SIO of Very Low. In some cases, portions of the SUP area exceed (i.e., are better than) Very Low.

Photo 3B-2:
Vail Mountain, Looking Southwest

Scenic Characteristics of Areas Proposed for Alteration

Project areas associated with specific proposed project elements are discussed below to define the baseline visual conditions of potentially affected areas. Analysis of the impacts of the proposed projects and activities is included in the Environmental Consequences section.

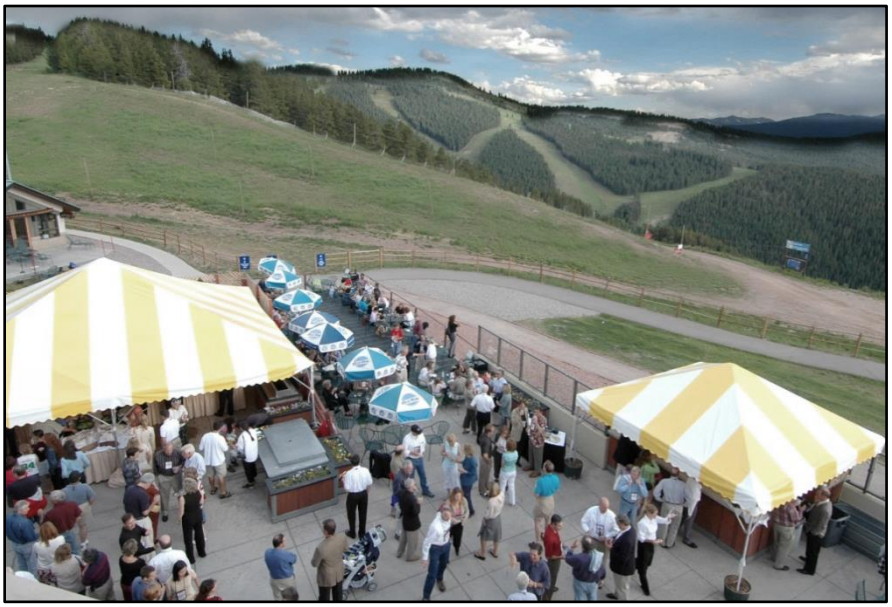
Adventure Ridge

Adventure Ridge—at the top of the Eagle Bahn Gondola—is a concentrated recreational and guest service area that is the hub of Vail Ski Area's summer and multi-season activities (refer to photos 3B-3 and 3B-4). This is a busy area throughout the winter and summer. When guests unload the Eagle Bahn Gondola, they see panoramic views of NFS lands in the Gore Range, Eagles Nest Wilderness, Mount of the Holy Cross, and the Tenmile Range in the background distance zone. In the immediate foreground and foreground distance zone, numerous guest service facilities and summer/winter activities are visible, including: the Talons Deck, snowtubing, ski biking, kids' snowmobiling, bungee trampolines, showshoeing, the Zip Runner (zip line), Aerial Ropes Challenge Course, disk golf (18 holes), kids' pony rides, and horseback tours. Due to the busy and developed nature of Adventure Ridge, in the immediate foreground the area appears extremely altered. However, this area is only visible in the immediate foreground to visitors to the ski area who expect to see and use these activities. Existing facilities at

Adventure Ridge are not visible from the middleground or background views. This area currently meets the SIO of Very Low.

Photo 3B-3:
Adventure Ridge, as Viewed from the South

Photo 3B-4:
View South, Into Game Creek Bowl, from Talon's Deck at Eagle's Nest



Mountain Coasters

Both the Pride Express and Adventure Ridge mountain coasters are proposed to start at Adventure Ridge, in a developed and popular portion of Vail Ski Area's SUP area that currently has concentrated lift and trail development and high levels of recreational use throughout the year.

The proposed Pride Express Mountain Coaster would largely be constructed in the forested area between the *Bwana* and *Simba* ski trails. The Pride Express would run downhill approximately 6,000 feet of track from the top terminal of the Pride Express (near Adventure Ridge) and, after descending roughly 1,200 vertical feet through forest canopy and across open ski trails, would end at the bottom terminal of the Pride Express. This area is highly dissected by existing ski trails and an existing mountain access road.

The proposed Adventure Ridge Mountain Coaster would be largely within the forested block immediately northwest of, and below, Adventure Ridge, while also crossing open ski terrain. Composed of roughly 3,100 feet of track, the Adventure Ridge Mountain Coaster would start just west of the top terminal of the Pride Express, descending roughly 300 vertical feet to the *Simba* ski trail.

Due to the nature of this portion of the SUP area, with small, dissected areas of forest canopy interspersed with developed ski trails, the Project Area for the proposed mountain coasters meets the SIO of Very Low.

Zip Line Canopy Tours

The Game Creek Canopy Tour is proposed in Game Creek Bowl, located immediately to the south of Adventure Ridge (refer to photos 3B-4 and 3B-5). Game Creek Bowl, is visible from the Eagles Nest area, but blends into the background view from outside the SUP area. The Bowl contains roughly one dozen developed ski trails as well as glades—all of which lead to the bottom of the Game Creek Express, which is the only lift conveyance out of the Bowl. Vegetation cover on the north side of the Bowl is generally sparse, with much of the upper portion of the Bowl being gladed tree cover and with more dense vegetation in the lower portion of the Bowl. Currently, Game Creek Bowl is heavily used throughout the winter, but during the summer is only used by horseback riders (on the service road) and occasional mountain bikers. This portion of the SUP area is defined by a forested canopy, interspersed with developed trails. As a result, Game Creek Bowl currently meets or exceeds the SIO of Very Low.

The Front Side Canopy Tour is proposed to start at Mid-Vail, descending roughly 2,000 vertical feet to private land in Vail Village. It would be parallel to, and east of, Gondola One. Mid-Vail is a relatively highly developed portion of the SUP area, with concentrated guest services, lift infrastructure (top terminal of Gondola One and the bottom terminals of Wildwood Express and Mountaintop Express), and the confluence of numerous developed ski trails. However, downhill of Mid-Vail, and east of Gondola One, the front side of Vail Mountain is considerably less developed and is defined by a mosaic of forest canopy and developed ski trails. As a result, the Project Area for the Front Side Canopy Tour meets the SIO of Very Low. In some cases, portions of the Project Area exceed (i.e., are better than) Very Low.

Photo 3B-5:
Game Creek Bowl, As Viewed from Showboat

Horse Corral and Trail

A dedicated equestrian trail is proposed to be constructed in the forest canopy more-or-less parallel to the existing road into Game Creek Bowl from Adventure Ridge. A corral would be constructed just west of the Adventure Ridge facility, adjacent to an existing ski trail.

As it is located in the Game Creek Bowl area, which is defined by forest canopy and ski trails, the Project Area for the proposed horseback trail currently exceeds (i.e., is better than) the SIO of Very Low. The corral Project Area is adjacent to an existing trail and currently meets the SIO of Very Low.

Riparian Experience

The Riparian Experience is proposed on the east side of Adventure Ridge in an area that was previously disturbed to create ski trails. This area has also been developed over the years with guest services and year-round activities, and as a result, receives high use throughout the summer and winter. The Project Area for this component of the Proposed Action currently meets the SIO of Very Low.

Wildwood Observation Deck

Wildwood is on the ridge separating Game Creek Bowl and Sun Down Bowl. Aside from the building and the top terminal of the Game Creek Express, this area has limited development. The Wildwood observation deck is proposed to be constructed on the south side of the existing Wildwood facility, overlooking Sun Down Bowl, the back bowls, Blue Sky Basin and the Gore Range. Natural views dominate the landscape from this location with primarily open bowl or gladed skiing being visible in all directions. The existing Wildwood facility, and the surrounding area, currently meets or exceeds (i.e., is better than) the SIO of Very Low.

Aerial Adventure Course

The Aerial Adventure Course is proposed to be located in a small tree island area to the northwest of Adventure Ridge, below the top of the Pride Express. Located within walking distance from Adventure Ridge, this area is defined by open ski trails and small fragments of forest canopy. The Project Area for the proposed Aerial Adventure Course meets the SIO of Very Low.

Wedding Venue at The 10th

A wedding deck is proposed to be constructed near The 10th restaurant at Mid-Vail. As discussed under the Front Side Canopy Tour, the Mid-Vail area is an area of concentrated development within the SUP area—including chairlifts, guest services and high levels of use throughout the winter and summer seasons. The Project Area for the proposed wedding venue meets the SIO of Very Low.

Hiking and Mountain Biking Trails

There are currently approximately 59 miles of hiking, downhill biking and cross-country biking trails across Vail Ski Area. Most of these trails average 3 to 4 feet in width as they descend through the forest canopy and across open ski trails. Due to the height of trees, minimal amount of tree removal, and topography of the mountain, none of these trails are visible beyond the immediate foreground and foreground distance zones. Approximately 55 miles of additional trails are proposed throughout Golden Peak and Vail Mountain. The area in which the new trails are proposed is comprised of developed ski trails and relatively large tree islands. Much of the upper portion of the Project Area is obscured beyond the foreground distance zone by topography and natural grades.

The existing network of hiking, downhill and cross-country trail are not visible beyond the immediate foreground/foreground distance zone, and have been constructed with the contours of the area. As a result, they meet the SIO of Very Low.

Photo 3B-6:
Mountain Biking Trails within the Vail Ski Area SUP area

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

No changes or modifications are included in Alternative 1 that would affect the scenic quality of Vail Ski Area's SUP area. Generally speaking, the SUP area would continue to meet, and in some cases exceed, the SIO of Very Low ("appears heavily altered"). Previously-approved projects on NFS lands may be implemented in the future, which could alter the scenic character of Vail Ski Area's SUP area. Previously-approved, unimplemented projects include, but are not limited to: the *2012 Vail Summer Improvements CE*; the *2011 Vail Ski Area Forest Health EA*; the *2009 Vail Ski Area Improvements Final EIS*; and the *2006 Vail Ski Area West Lionshead Lift EA*.

Alternative 2 – Proposed Action

Implementation of the Proposed Action would incrementally contribute to the developed character of the Vail Ski Area SUP area, which is identified in the 2002 Forest Plan as Management Area 8.25 – Ski Area (Existing and Potential). With adherence to management requirements (defined below), none of the proposed projects are expected to increase scenery impacts to the character of the SUP area, such that it would not meet the SIO of Very Low. These management requirements are:

1) All proposed structures, features, and facilities should be taken through the White River Design Review process for architectural character, design, material and color selections. Forest Service Landscape Architect involvement through the entire design and implementation process is necessary to appropriately design, site and implement projects so that they would meet of meet the SIO of Very Low. However, the goal would be to surpass the SIO of Very Low.
2) Comply with the character and guidelines for the Rocky Mountain Province BEIG when constructing any approved facilities. This includes considering the landscape, cultural and ecological character, as well as the architectural guidelines which include descriptions of appropriate siting, massing, scale, structure, materials, color, and sustainability efforts.
3) Comply with accessibility guidelines, where possible.

Mountain Coasters

Both proposed mountain coasters would include ground-level and elevated tracks that would require a 10- to 15-foot wide corridor of vegetation removal. For the Pride Express Mountain Coaster, this equates to approximately 2.5 acres of vegetation removal through the forest canopy. For the Adventure Ridge Mountain Coaster, it equates to approximately 1 acre of vegetation removal. Straight-line edges would be avoided both by design and due to topography/slope gradient, and edges would be "feathered" (where possible/appropriate) thereby minimizing visibility of the mountain coasters. Both proposed mountain coasters would be visible in the immediate foreground and foreground distance zones when the track is in open areas. The track would consist of tubular stainless steel rails supported by a combination of galvanized lattice and tower structures ranging from on the ground to approximately 20 feet in the air to

accommodate underpassing ski area vehicles and skiers. The rails would not be anticipated to be visible beyond the immediate foreground view, as the majority of the coasters have been planned within the forest canopy. Regardless, as with all structures, facilities, and features, the coaster would need to meet Forest Service color and reflectivity guidelines. Permanent wood or metal fencing and/or netting may be required at key points along the track for safety. Walkways may be constructed along raised portions of the track for evacuation and maintenance.

The Project Area for the Adventure Ridge Mountain Coaster is obscured by natural topographic features to motorists on I-70. And while the Pride Express Mountain Coaster would extend further downhill to the bottom of Pride Express, neither of the mountain coasters is anticipated to be visible from outside of the Vail Ski Area SUP area in the middleground or background distance zones (e.g., to motorists on I-70 or hikers in the Eagles Nest or Holy Cross Wilderness Areas).

Although nighttime use of the Adventure Ridge Mountain Coaster is being considered, Vail Ski Area would incorporate a low-wattage lighting system on individual cars and at both the start and finish areas. Low-level lights would also be installed at turns along the track so riders can be aware of upcoming turns. While these lights would be visible from higher-elevation vantage points across the Eagle Valley (e.g., the Potato Patch subdivision), there would be no net increase in lighting, as existing lights are proposed to be relocated or removed from the Chair 15 area to the top and bottom locations of the mountain coaster to compensate.

Both mountain coasters can be installed and operated to be consistent with the SIO of Very Low.

Zip Line Canopy Tours

Both canopy tours would require access routes to each pole location for construction, maintenance and emergency access. To minimize disturbance, access routes would be built along the shortest possible routes from existing roads or trails. Because individual lodgepole pine, spruce and aspen trees found in the forest throughout the Project Area are not large enough to serve as anchors for the canopy tours, cables would be connected to specialized towers that are fitted with elevated platforms (refer to Appendix B). Each tower would consist of a wooden platform supported by two wooden or dark galvanized steel poles and guy wires and would typically be between 20 to 35 feet tall.

The proposed Game Creek Canopy Tour would be located mostly below the eastern ridgeline of the Game Creek Bowl and within the Bowl area. Approximately 1.5 acres of overstory vegetation removal would be associated with construction of towers and corridors for the individual zip lines. Although infrastructure related to a canopy tour is minimal (as compared to a chairlift), the Game Creek Canopy Tour would include a variety of components including: vertical poles with platforms, support/reinforcement structures, and a combination of wooden and rope bridges and ziplines. These structures would be within the tree stands to minimize the visibility of project structures. These structures would represent an incremental impact to the visual condition of Game Creek Bowl. Although the

proposed Game Creek Canopy Tour would be visible in the foreground and middleground distance zones from Adventure Ridge, as well as from within Game Creek Bowl, the SIO of the Project Area would continue to meet Very Low.

The proposed Front Side Canopy Tour would be located entirely on the front side of Vail Mountain, from Mid-Vail to Vail Village. The height of the zip lines and stations would vary depending on the topography and landscape of the proposed route. Approximately 2.5 acres of vegetation removal would be associated with construction of poles, platforms, support/reinforcement structures, wooden and rope bridges and zipline towers and corridors. Infrastructure and vegetation removal for constructing zip line corridors would be minimized to provide the unique canopy tour experience; however, the Front Side Canopy Tour would represent an incremental addition to the developed theme of Vail Ski Area's SUP area, and this project would likely be visible in the foreground and middle ground distance zones from some points along I-70 and from across the Eagle Valley.

While it would be visible within these distance zones, the Front Side Canopy Tour would represent an incremental addition to the developed nature of the front side of Vail Mountain. The SIO of this portion of Vail Ski Area's SUP area would continue to meet Very Low, although the Forest Service and Vail Ski Area share the intent of surpassing the Very Low SIO.

Horse Corral and Trail

As described in Chapter 2, the proposed horse corral would be located at Adventure Ridge, with the proposed single-track trail paralleling the existing service road, between approximately 100 and 200 feet west of the road, to the base terminal of the Game Creek Express. The proposed trail would require incidental vegetation removal and grading, which would make it visible in the immediate foreground and foreground distance zones. The corral would be visible in the foreground, but would not impact the scenic quality of the area. The corral would be constructed to BEIG standards. Neither project would be visible outside of the SUP area

Both projects are consistent with the developed nature of Vail Ski Area's SUP area, and would not contribute to deviations from the SIO of Very Low.

Riparian Experience

The visual environment at Adventure Ridge is currently characterized by a mix of the natural views combined with developed features and structures, such as challenge courses, a zip line, the Eagle's Nest facility, and the Eagle Bahn Gondola terminal. Located in the vicinity of Eagle's Nest, the Riparian Experience would not be visible from the critical viewpoints identified, or from high elevation areas outside of the Vail Ski Area SUP area. This proposed manufactured water feature (constructed of a mix of stone, wood and metal) would resemble a small stream, with different features for children to interact

with. The addition of the Riparian Experience would incrementally add to developed theme of the area, but would not contribute to deviations from the SIO of Very Low.

Wildwood Observation Deck

The Wildwood observation deck would represent an incremental addition to the existing Wildwood facility, extending over Sun Down Bowl. The proposed observation deck would provide views of Vail Ski Area's Back Bowls, Blue Sky Basin, the Gore Range, and the Eagles Nest Wilderness, and as such, is expected to enhance the opportunity for guests to appreciate the scenic character of the area. The footprint of the Wildwood observation deck would be approximately 1,000 square feet and designed to incorporate the requirements of the BEIG, as appropriate. This project represents an incremental addition to the Wildwood facility, and it would only be visible from within the SUP area. As such, it does not represent an impact to the aesthetic environment. The area would maintain compliance with the SIO of Very Low.

Aerial Adventure Course

The Aerial Adventure Course would be located entirely in a forested area and would be visible in the foreground distance zone. It would be a low-profile aerial course with a variety of features such as small towers, bridges, slides and zip lines. Natural materials and colors would be incorporated into its design. It would not be visible from critical viewpoints or high elevation areas outside the Vail Ski Area SUP area. Little to no overstory vegetation removal would be required, as the features would be integrated into the natural topography and landscape of the forest. This proposed project would meet the SIO of Very Low.

Wedding Venue at The 10th

The venue would consist of a deck would of approximately 625 square feet in size, constructed from natural stone, wood and other natural materials. This project would incrementally add to the developed nature of Mid-Vail, but would not be visible beyond the foreground distance zone; it would only be visible to people visiting the area who are presumably expecting to see a range of infrastructural components. This ground-level deck would be constructed in compliance with Vail Mountain Design Guidelines and the Forest Service BEIG. As a result, the wedding deck would be consistent with the historic developed recreation landscape of Vail Ski Area and would be consistent with the SIO of Very Low.

Hiking and Mountain Biking Trails

The proposed biking and hiking trails would require grading and overstory vegetation removal. In order to minimize potential for erosion and maintain the scenic qualities of the area to the greatest extent possible, final trail layout of any approved trails would avoid direct fall line descents and minimize vegetation removal. As the existing hiking/mountain biking trail network on the front side of Vail Mountain is not visible beyond the foreground distance zone, the proposed trails are anticipated to meet the SIO of Very Low.

Alternative 3

Alternative 3 is identical to the Proposed Action with the exception of the mountain coasters, Riparian Experience, and wedding venue at The 10th. As such, all potential impacts associated with projects included in Alternative 3 have been disclosed under Alternative 2. Under Alternative 3, the SUP area would continue to maintain compliance with the SIO of Very Low.

CUMULATIVE EFFECTS

Evidence of developed recreation at Vail Ski Area dominates the scenic characteristic of the Eagle Valley. As noted previously, historic development of Vail Ski Area over the past five decades has involved overstory vegetation removal and grading for the creation of trails and chairlifts, as well the construction of lifts, roads, infrastructure, buildings and, more recently, the installation of summer and multi-season recreational activities. These alterations have cumulatively altered the scenic character of the landscape over time, with many of these activities pre-dating both the original Visual Management System (VMS) and newer SMS guidance. Some of the buildings on Vail Ski Area were constructed between the mid-1960s and early 1990s, which pre-dated the BEIG. However, in conjunction with the BEIG and the Vail Mountain Design Guidelines, Vail Ski Area will increasingly move toward a consistent architectural theme as new facilities are constructed. Finally, the mountain pine beetle epidemic killed thousands of pine trees throughout Vail Ski Area's SUP, which has affected the scenic characteristics of the Project Area and will continue to until understory vegetation becomes dominant and dead standing trees either fall or are removed.

As discussed under the No Action Alternative, previously-approved, unimplemented projects that could be pursued regardless of which alternative is selected include: the *2011 Vail Ski Area Forest Health EA*; the *2009 Vail Ski Area Improvements Final EIS*; and the *2006 Vail Ski Area West Lionshead Lift EA*. Cumulatively, implementation of any or all of these projects will further (incrementally) affect the scenic characteristics of the SUP area regardless of which alternative is selected.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The addition of summer and multi-season activities/infrastructure in the SUP area would represent irretrievable effects to scenic resources at Vail Ski Area. However, this commitment of the scenic resource is not irreversible because facilities could be removed and, in time, areas could be reclaimed and revegetated, restoring their natural appearance.

C. TRAFFIC, PARKING AND SKI AREA ACCESS

SCOPE OF THE ANALYSIS

This analysis includes traffic related to Vail Ski Area's existing and proposed summer operations. The Analysis Area for traffic focuses on Interstate 70 (I-70) in the Eagle Valley; however, traffic data east and west of the Eagle Valley is provided for context. Public parking within the Town of Vail is also discussed.

Because the Proposed Action is not designed, nor is it likely, to increase winter visitation to the Eagle Valley, only summer traffic and parking are addressed here. Information on Vail Ski Area's winter traffic generation and parking requirements can be found in the *2007 Vail Ski Area Improvements Project Final EIS* (ROD signed December 2009).

AFFECTED ENVIRONMENT

The Town of Vail and Eagle County are extremely popular year-round regional, national and international tourist destinations. The Town of Vail averages approximately 1.1 million summer visitors each year. An additional 800,000 summer visitors come to Eagle County (including, but not limited to, Avon, Eagle-Vail and Edwards), for a total, countywide summer visitation total of 1.9 million people.[27]

In the five years between 2008 and 2013, Vail Ski Area's on-mountain Adventure Ridge program averaged approximately 103,660 summer guests (refer to Table 3C-1). During this time period, summer visitation data shows a trend of steady (and substantial) increase, from 67,000 guests in 2008 to over 134,000 guests in 2013, representing a 100 percent increase in six years. During the summer, the breakdown of destination versus day visitors to Adventure Ridge is roughly 30 percent day visitors versus 70 percent destination visitors. This correlates with the Town of Vail's mix of destination and day tourists.[28]

Ski Area Access

Interstate 70 (I-70) is Colorado's major east-west travel corridor. It is open year-round and maintained by the Colorado Department of Transportation (CDOT). I-70 provides access to the Town of Vail and Vail Ski Area from the Denver metropolitan area (approximately 100 miles, or 1.5 to 3 hours driving time, depending on time of year, weather and traffic volumes), through the Eisenhower-Johnson Memorial Tunnel at the Continental Divide. All visitors to the Eagle Valley utilize I-70, regardless if they fly into the Eagle County Airport (west of the Town of Vail) or Denver International Airport (DIA, east of the Town of Vail), drive personal/rental vehicles, or use a shuttle/bus service between DIA and Eagle County.

[27] Romer, 2013
[28] Town of Vail, 2013b

Table 3C-1:
Annual Summer Visitation at Vail Ski Area

Year	Summer Visits	Percent Increase
2013	134,258	7.8
2012	124,577	7.2
2011	116,186	7.1
2010	108,450	52
2009	71,370	6.3
2008	67,120	--
6-year Average	**103,660**	**16%**[a]

[a] This average is skewed by the sharp increase in summer visitation between 2009 and 2010, which was the result of a combination of factors including weather, increasing interest in natural resource-based recreation, and local events in the Eagle Valley. Discounting the 2010 season, Vail Ski Area's annual summer visitation increases averaged 7.1%.

Visitors access the Town of Vail and Vail Ski Area by exiting I-70 between exits 180 (East Vail) and 173 (West Vail). These interchanges tend to be the most critical components in the Town's system. Besides providing access to/from I-70, the interchanges are also the only points within Town where traffic can cross I-70. This concentration of traffic through these bottleneck areas can negatively impact travel time for drivers and for transit service.[29]

The Town of Vail Transit Department provides free year-round bus service throughout the Town of Vail. The Town's bus service is considered to be the largest free transportation system in the country, providing transportation for day visitors, residents, and overnight guests throughout the Town.[30] In 2012, the Town bus service provided transportation for approximately 3.2 million riders with half of the riders being locals and half visitors. During the summer months, the Town bus service accommodates approximately 1.5 million riders.[31] In addition, Eagle County (ECO) Transit provides multi-modal public transportation throughout Eagle and Park counties, 21 hours per day, 7 days per week, 365 days per year. Prices for ECO Transit vary (per ride or across multiple days).

The South Frontage Road runs parallel to I-70, providing access to the ski area, lodges, hotels, condominiums, restaurants, hospital, among others, throughout the Eagle Valley.

[29] Town of Vail, 2009 p. i
[30] Town of Vail, 2013c
[31] Rihanek, 2013

Traffic

Existing traffic congestion along I-70, particularly from Glenwood Springs to Denver through the Eisenhower-Johnson Memorial Tunnel, is degrading the accessibility of mountain travel.[32] This congestion is particularly apparent during peak weekends throughout the winter and summer, when the greatest number of people are traveling from Front Range communities (Fort Collins, Boulder, Denver and Colorado Springs) to mountain towns in Summit and Eagle counties. Traffic congestion on I-70 is compounded during these times because the interstate is also a critical travel corridor for freight, local residents, and interstate commerce.

In 2011, the Federal Highway Administration (FHA) signed off on a framework to implement improvements along the 144-mile corridor of I-70 from Glenwood Springs to the western edge of the Denver metropolitan area. The I-70 Mountain Corridor Final Programmatic EIS (PEIS) presents the data and analysis developed for the I-70 Corridor and presents recommended transportation solutions. The PEIS describes the existing conditions and traffic related conditions on I-70.

> *"Population and employment growth (with accompanying traffic growth) in the [I-70] Corridor and Denver metropolitan area has noticeably increased traffic volumes on the I-70 highway for more than 15 years. Recreational travelers currently experience substantial traffic delays on weekends and holidays on the eastern side of the Corridor. The western side of the Corridor experiences work trip delays during the week. Congestion periods on both sides of the Corridor will expand with corresponding population and employment resulting in weekday congestion on the eastern side of the Corridor. Existing and projected travel demands in this Corridor exceed the design capacity of the facility and result in severe congestion for extended periods of time. In the future, travelers will experience substantial travel time delays that restrict mobility and accessibility along the Corridor. This substantial congestion has a negative impact on the local and statewide economy, decreases mobility, including for freight traffic, compromises the ability of emergency service providers to respond promptly to emergencies and increases accidents."*[33]

Traffic Volumes on I-70

CDOT records traffic volumes on state highways and Colorado interstate highway systems. Average Daily Traffic (ADT) is the number of vehicles passing a count location in both directions in a 24-hour period. Raw ADT data is processed and converted to Average Annual Daily Traffic (AADT) volumes, defined as the total volume of traffic on a road segment for one year, divided by 365 days. Both directions of traffic volumes are reported. AADT can be adjusted to compensate for monthly and daily fluctuations

[32] Interstate 70 Coalition, 2008
[33] Colorado Department of Transportation, 2011a

in traffic; the basic intent being to provide traffic volumes which best approximate the use of a given highway section for a typical day of the year.

Table 3C-2 shows Year 2012 AADT volumes at key points along I-70 in relation to the Eagle Valley, between Officer's Gulch in Summit County to Wolcott in Eagle County.

For context, current and projected AADT for I-70 between mile markers 156 (Wolcott) and 195 (Officer's Gulch) is displayed in Table 3C-2. Peak hour traffic is presented in Table 3C-3.

Table 3C-2:
2012 AADT Data on I-70

Traffic Counter Location	AADT 2012	Design Hourly Volume* (%)	Projected AADT 2033	Percent Increase (%)
Castle Peak, Wolcott (mm 156)	23,000	11	N/A	N/A
Edwards Interchange (mm 166)	35,000	13	64,400	46
Dowds Junction, Minturn (mm 171)	35,000	13	57,050	39
West Vail Interchange (mm 173)	33,000	11	53,097	38
Vail Interchange (mm 176)	30,000	13	43,230	31
Vail Pass (mm 180)	21,000	13	30,041	30
Officer's Gulch (mm 195)	19,000	13	28,776	34

*Design Hourly Volume is the thirtieth highest hourly traffic volume for the design year, commonly 20 years from the year of construction.
Source: Colorado Department of Transportation, 2013

Level of service (LOS) is a term used to qualitatively describe the operating conditions of a roadway based on factors such as speed, travel time, maneuverability, delay, and safety. The LOS of a roadway is designated with a letter, A to F, with A representing the best operating conditions and F the worst. The Highway Capacity Manual and American Association of State Highway and Transportation Officials (AASHTO) Geometric Design of Highways and Streets ("Green Book") define LOS:

- A= Free flow
- B=Reasonably free flow
- C=Stable flow
- D=Approaching unstable flow
- E=Unstable flow
- F=Forced or breakdown flow

Table 3C-3 provides data on ADT and LOS on I-70 between mile marker 163 (Edwards exit) and 180 (East Vail exit).

Table 3C-3:
ADT and LOS of I-70 Between
Mile Marker 163 (Edwards) and 180 (Vail Pass)

Direction and Time		ADT	Peak-Hour Volume	LOS
Eastbound	Weekday	21,700	1,680	C
	Friday	23,800	1,860	D
	Winter Weekend	13,900	1,070	B
	Summer Weekend	31,100	1,720	D
Westbound	Weekday	20,000	1,900	C
	Friday	24,600	2,080	C
	Winter Weekend	16,300	1,690	C
	Summer Weekend	21,500	1,660	C

Source: Colorado Department of Transportation, 2011a

As indicated in Table 3C-3, eastbound and westbound traffic on I-70 through the Eagle Valley is considerably higher during the summer than in the winter. On Fridays and summer weekends, this segment of I-70 functions at LOS D for eastbound traffic and LOS C for westbound traffic. This correlates with traffic volumes observed at the Eisenhower-Johnson Memorial Tunnel. A typical summer weekend is about 45 percent higher than on a winter weekend. Weekday traffic is about 15 percent higher in the summer than the winter.[34]

In the PEIS, traffic over Vail Pass was broken down according to traveler type. As displayed in Table 3C-4, overnight recreation trips (accounting for Front Range skiers and summer recreationists throughout the year) compose the bulk of traffic over Vail Pass. An I-70 user study found Front Range travelers along the I-70 mountain corridor (from Glenwood Springs to Denver) represent 59 percent of users at Idaho Springs, 46 percent at Frisco, and 26 percent at Town of Vail.[35]

[34] Ibid.
[35] Ibid.

Table 3C-4:
Travel Over Vail Pass, by Traveler Type

Traveler Type	Percent of Travelers (%)
Commuter	27 to 30
Overnight Recreation Trips	56 to 61
Day Recreation Trips	<4
Local Non-Work Trips	13

Source: Colorado Department of Transportation, 2011b

I-70 Traffic in the Eagle Valley

The greatest point of traffic concentration within the Town of Vail is at the Main Vail South Ramps/South Frontage Road/Vail Road roundabout intersection. During the AM peak hour, approximately 2,700 vehicles per hour pass through this intersection and 3,200 vehicles per hour pass through it during the PM peak hour, making it the busiest intersection in Town. Of the peak hour traffic passing under I-70 at this interchange, over one-half of the AM traffic is from I-70 East. During the PM peak hour, over 40 percent is oriented to I-70 West. Between 30 and 40 percent is estimated to simply cross I-70 (both peak hours).[36]

The West Vail interchange serves a relatively significant pattern of traffic to/from down-valley (Avon, Edwards, Eagle). Given this traffic pattern combined with the traffic generated by the West Vail commercial development, the West Vail north roundabout serves about 2,500 vehicles per hour during the PM peak hour (compared to 1,150 during the AM peak hour), making it the second busiest intersection within the Town of Vail. Of the PM peak hour traffic passing under I-70 at this point, approximately 10 percent is oriented to/from I-70 east, 45 percent to/from I-70 west, and 45 percent is estimated to simply be crossing I-70.[37]

The South Frontage Road carries far more traffic than the North Frontage Road. East of the Main Vail Interchange, the South Frontage Road serves nearly 2,000 vehicles per hour at peak times. This is the heaviest traveled roadway segment within the Town of Vail (other than I-70). Of the 2,000 vehicles per hour, approximately 30 percent are comprised of trips between the Main Vail roundabout and the Vail Village parking structure.[38]

Parking

Currently, the Town of Vail owns and maintains two large parking structures in Main Vail: the Village Structure (1,300 spaces in Vail Village) and the Lionshead Structure (1,200 spaces in Lionshead). The Village Structure is located east of the Main Vail interchange. During the summer parking is free, but during ski season, there is a fee to park during the day if a vehicle stays more than an hour and a half.

[36] Town of Vail, 2009
[37] Ibid.
[38] Ibid.

Employees and residents have an option of purchasing seasonal parking passes, each providing a different set of privileges. Without a pass, an all-day fee is currently $25.00. Data from the Town of Vail Parking and Transportation Department indicates that this structure filled an average of 17 times over the past five ski seasons (2008/09 through 2012/13).[39] Lately, the structure fills more often during the summer, when parking is free. When full, drivers are directed to the Lionshead Parking Structure. The Village Structure also serves as the Town's Transportation Center serving as a hub for a variety of bus and transportation services.[40]

The Lionshead parking structure is located approximately 0.5 mile west of the Main Vail interchange. During the winter, the Lionshead parking structure generally fills only after the Village structure fills. The Lionshead structure fills an estimated 14 times per season, and once full, vehicles are directed to parallel-park along the South Frontage Road.[41] An extreme peak day can sometimes see over 1,000 vehicles parked along the South Frontage Road.[42]

The Town of Vail has continued to explore means of adding public parking to the supply within the central areas of Lionshead and Vail Village. A current need of at least 400 additional spaces has been identified by the Town in attempt to reduce the number of days that the Frontage Road is pressed into service to accommodate overflow parking. The 400 spaces are needed to maintain a supply accommodating 90 percent of the demand days, a Town parking objective. This is based on many seasons of Frontage Road parking data collection. However, 1,000 additional spaces would accommodate 99 percent of the current demand days. Over the long-term (20 years), the 1,000 spaces are estimated to accommodate 90 percent of the future demand days.[43]

Generally, between 70 and 80 percent of the summer visitors to the Town of Vail are destination guests who are staying and parking in local accommodations, rather than in public lots. Summer parking in the Town of Vail has generally been accommodated within the existing parking structures; however, over the last several summers, on weekends and during special events, overflow parking accommodations have been necessary, and vehicles have been directed to parallel-park along the South Frontage Road.[44] In May 2011, the Vail Town Council modified their summer parking policy to resemble the winter parking policy, only allowing frontage road parking after both the Village and Lionshead parking structures are full. Prior to the summer of 2010, frontage road parking was allowed after the Village parking structure was full. During the summer of 2010, the Town of Vail had 34 days of frontage road parking. Special events that contribute to summer parking volume in the summer months include Fork Park, Teva

[39] Town of Vail, n.d.
[40] Town of Vail, 2009
[41] Town of Vail, n.d.
[42] Town of Vail, 2009
[43] Ibid. p. 16
[44] Town of Vail, 2008b

Mountain Games, Vail America Days, USA Pro Cycling Challenge, Oktoberfest and the Farmer's Market. This policy change addresses concerns by the Town Council to limit frontage road parking to three days in the summer and fifteen days during the winter.[45]

Traffic and Parking Related to Vail Ski Area's Summer Operations

As discussed previously, I-70 is a critical travel corridor for anyone coming to the Town of Vail, Eagle County, or travelling throughout the Eagle Valley. Therefore, in addition to local and through traffic, all destination and day visitors to the Eagle Valley contribute to traffic along I-70 at some point during their stay, whether for a single day or multiple days. While some of the 1.1 million destination summer visitors to the Town of Vail (and an additional 800,000 who visit the County throughout the summer) presumably utilize the free bus system at some point throughout their stay, the majority drive personal/rental vehicles and therefore contribute to traffic on I-70 as they engage in various, recreational and leisure activities throughout the Eagle Valley across one or more days.

Chapter 3, Section A – Recreation discusses summer recreational opportunities throughout the Eagle Valley, which are abundant. As discussed, the summer activities offered at Adventure Ridge are simply one option within the context of a large array of opportunities available to visitors to the Eagle Valley. The Adventure Ridge program, in and of itself, does not drive a significant amount of destination or local/regional visitation (or traffic) to the Eagle Valley; it is an amenity for the 1.9 million people who currently visit the Valley throughout the summer.

For the purposes of this analysis, no distinction is made between traffic related to summer destination and day visitors to Adventure Ridge because all of them contribute to traffic on I-70 en route to parking in the Town of Vail's public parking structures at some point during their trip. However, 20 percent of the summer guests to Adventure Ridge are conservatively estimated to be staying in the Town of Vail and either utilize the Town of Vail's free bus service or stay in accommodations within walking distance of the Eagle Bahn Gondola. Beyond getting to/from their accommodations when they arrive and depart for their stays, these visitors do not contribute to traffic on I-70 or parking within the Town's public parking structures.

Based on the previous assumptions and estimates, Table 3C-5 provides the breakdown of vehicular traffic and parking requirements associated with summer visitation to Adventure Ridge (seasonal and daily). Note that Table 3C-5 estimates "average daily vehicles" between June 15 and September 15. The number of vehicles associated with Vail Ski Area's summer guests is likely higher on weekends and during holiday periods, and presumably lower during mid-week periods.

[45] Town of Vail, 2011

Table 3C-5:
Estimated Summer Traffic and Parking Associated with Adventure Ridge

	2008	2009	2010	2011	2012	5-Year Annual Average
Annual Summer Visits to Adventure Ridge (guests)	67,120	71,370	108,450	116,186	124,577	97,541
Total # of personal vehicles associated with Vail Ski Area's day use visitors throughout the summer season (assumes AVO of 3.0) (vehicles)	22,373	23,790	36,150	38,729	41,526	32,514
20% Reduction of personal vehicles to account for Adventure Ridge guests who walk or use TOV free bus system (vehicles)	17,899	19,032	28,920	30,983	33,221	26,011
Average Daily Vehicles associated with Adventure Ridge on I-70 (June 15–Sept 15 = 90 days) (vehicles)	**199**	**211**	**321**	**344**	**369**	**289**

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Independent of projects proposed at Vail Ski Area, traffic along I-70 is expected to increase by 30 percent or more by 2033 due to continual growth along the I-70 corridor.[46]

Table 3C-6 estimates the additional visitation to Adventure Ridge associated with each alternative between 2015 and 2019.

Table 3C-6:
Increased Annual Summer Visitation (Amount Above Existing)[a]

Year	2015	2016	2017	2018	2019
Alternative 1	19,423	26,423	34,423	43,423	51,423
Alternative 2	39,000	54,000	62,400	67,500	73,000
Alternative 3	29,250	40,500	46,800	50,625	54,750

[a] Based off of 2012 summer visitation to Adventure Ridge of 124,577 guests.

These estimates have been used for the following analysis of traffic and parking impacts under alternatives 1, 2 and 3.

Alternative 1 – No Action

Under the No Action Alternative, no additional summer or year-round recreational activities are proposed within Vail Ski Area's SUP area. As discussed in the Affected Environment, the summer activities offered at Adventure Ridge are, and would continue to be, one option within the context of a large array

[46] Colorado Department of Transportation, 2013

of opportunities available to visitors to the Eagle Valley. Because of this, the Adventure Ridge program in and of itself would not be expected to drive a significant amount of destination or local/regional visitation (or traffic) to the Eagle Valley; it would continue to be an amenity for the 1.9 million people who currently visit the Valley throughout the summer.

Due to the growing popularity of mountain communities as regional, national and international summer destinations, visitation to Adventure Ridge is projected to continue to increase at a rate of approximately 7 percent per year through 2019. Table 3C-7 estimates the total and average daily vehicles associated with summer visitation increases at Adventure Ridge under the No Action Alternative between 2015 and 2019.

Table 3C-7:
Alternative 1 Summer Traffic & Parking Associated with Vail Ski Area

	2015	2016	2017	2018	2019
Annual Summer Visits to Vail Ski Area (guests)	154,000	165,000	176,000	188,000	201,000
Total # of personal vehicles associated with Vail Ski Area's day use visitors throughout the summer season (assumes AVO of 3.0) (vehicles)	51,333	55,000	58,667	62,667	67,000
20% Reduction of personal vehicles to account for guests who walk or use TOV free bus system (vehicles)	41,067	44,000	46,933	50,133	53,600
Average Daily Vehicles associated with Vail Ski Area's day use summer activities on I-70 (June 15–Sept 15 = 90 days) (vehicles)	**456**	**489**	**521**	**557**	**596**

Traffic

As indicated in Table 3C-7, average daily vehicles attributable to Vail Ski Area's summer operations under Alternative 1 are expected to exceed 500 by 2017. This is compared to approximately 370 vehicles under the existing condition (summer 2012). As discussed under the Affected Environment, the number of vehicles associated with Vail Ski Area's summer guests would likely be higher on weekends and during holiday periods, and presumably lower during mid-week periods.

The additional vehicles associated with Vail Ski Area's summer activities are inconsequential in terms of average daily traffic on I-70 through the Eagle Valley. Likewise, traffic impacts on South Frontage Road during the summer impacts would be minor.

Parking

On some weekends and during special events throughout the summer, parking within the Town of Vail would continue to be an issue under Alternative 1. However, the additional vehicles associated with Vail Ski Area's summer operations are not anticipated to be a consequential factor in parking. The Town of

Vail will continue to explore means of adding public parking to the supply within the central areas of Lionshead and Vail Village throughout the summer.

Alternative 2 – Proposed Action

Under Alternative 2, an average annual growth rate of 11 percent is projected for Vail Ski Area's summer visitation. This accounts for the growing popularity of the ski area as a regional, national and international summer destination. Table 3C-8 estimates the total and average daily vehicles associated with summer visitation increases at Adventure Ridge under the Proposed Action between 2015 and 2019.

Table 3C-8:
Alternative 2 Summer Traffic & Parking Associated with Adventure Ridge

	2015	2016	2017	2018	2019
Annual Vail Ski Area Summer Visits to Adventure Ridge (guests)	165,000	183,000	204,000	226,000	251,000
Total # of personal vehicles associated with Vail Ski Area's day use visitors throughout the summer season (assumes AVO of 3.0) (vehicles)	55,000	61,000	68,000	75,333	83,667
20% Reduction of personal vehicles to account for Adventure Ridge guests who walk or use TOV free bus system (vehicles)	44,000	48,800	54,400	60,267	66,933
Average Daily Vehicles associated with Vail Ski Area's day use summer activities on I-70 (June 15–Sept 15 = 90 days) (vehicles)	**489**	**542**	**604**	**670**	**744**

By 2019, the average number of daily vehicles associated with Vail Ski Area's summer activities under Alternative 2 is estimated to be approximately 25 percent higher than under Alternative 1.

Traffic

As is the current case at Vail Ski Area during the summer, expanded opportunities and activities at Adventure Ridge under the Proposed Action are primarily intended to serve as an attraction for visitors already coming to the Eagle Valley, or for those who would already traveling through the area. However, due to the mix of existing and proposed activities, Vail Ski Area is likely to attract some additional summer visitation, with commensurate traffic increases. By design, summer activities would offer guests multiple days' worth of activities, rather than a single day (or a portion of a day) under the existing condition.

As indicated in Table 3C-8, average daily vehicles attributable to Vail Ski Area's summer operations under Alternative 2 could exceed 500 by 2016 (the first year of implementation of any approved projects), and exceed 700 by 2019, which is 148 additional vehicles beyond the Alternative 1 projection for 2019. These traffic increases would be minimal and discountable to I-70 and South Frontage Road, as an additional 148 daily vehicles equates to 16 more vehicles per hour between roughly 9:00 AM and

6:00 PM. As discussed under the Affected Environment, the number of vehicles associated with Vail Ski Area's summer guests would likely be higher on weekends and during holiday periods, and presumably lower during mid-week periods.

Parking

Under Alternative 2 the increase in parking needs would largely be met by the Town of Vail's structures in Main Vail. On weekends and during special events throughout the summer, parking within the Town of Vail would likely continue to be an issue under Alternative 2. The Town of Vail will continue to explore means of adding public parking to the supply within the central areas of Lionshead and Vail Village throughout the summer.

Alternative 3

Traffic and parking impacts associated with Alternative 3 are similar to Alternative 2, with slight differences attributable to the lack of the mountain coasters in this alternative, which are anticipated to be major attractions under Alternative 2. Under Alternative 3, an average annual growth rate of 9 percent is projected for Vail Ski Area's summer visitation. As with Alternative 2, this analysis accounts for the popularity of the Eagle Valley as a regional, national and international summer destination.

Table 3C-9 estimates the total and average daily vehicles associated with summer visitation increases at Adventure Ridge under Alternative 3 between 2015 and 2019. Table 3C-9 estimates the total and average daily vehicles associated with summer visitation increases at Adventure Ridge under Alternative 3 between 2015 and 2019.

Table 3C-9:
Alternative 3 Summer Traffic & Parking Associated with Adventure Ridge

	2015	2016	2017	2018	2019
Annual Vail Ski Area Summer Visits to Adventure Ridge (guests)	159,000	174,000	190,000	206,000	225,000
Total # of personal vehicles associated with Vail Ski Area's day use visitors throughout the summer season (assumes AVO of 3.0) (vehicles)	53,000	58,000	63,333	68,667	75,000
20% Reduction of personal vehicles to account for Adventure Ridge guests who walk or use TOV free bus system (vehicles)	42,400	46,400	50,667	54,933	60,000
Average Daily Vehicles associated with Vail Ski Area's day use summer activities on I-70 (June 15–Sept 15 = 90 days) (vehicles)	**471**	**516**	**563**	**610**	**667**

By 2019, the average number of daily vehicles associated with Vail Ski Area's summer activities under Alternative 3 is estimated to be approximately 12 percent higher than under Alternative 1.

Traffic

The proposed projects under Alternative 3 are primarily intended to serve as an attraction for visitors already coming to the Eagle Valley, or those who would already be traveling through the area. However, due to the mix of existing and proposed projects, Vail Ski Area would be likely to attract additional local, regional and destination-related visitors, with associated traffic increases. By design, summer activities would offer guests multiple days' worth of activities, rather than a single day (or a portion of a day) under the existing condition.

As indicated in Table 3C-9, average daily vehicles attributable to Vail Ski Area's summer operations under Alternative 3 could exceed 500 by 2016, and approach 700 by 2019, which is 71 additional vehicles beyond the Alternative 1 projection for 2019. These traffic increases would be minimal and discountable to I-70 or South Frontage Road, as an additional 71 daily vehicles equates to 8 more vehicles per hour between 9:00 AM and 6:00 PM. As discussed under Affected Environment, the number of vehicles associated with Vail Ski Area's summer guests would likely be higher on weekends and during holiday periods, and presumably lower during mid-week periods.

Parking

Under Alternative 3 the increase in parking needs would largely be met by the Town of Vail's structures in Main Vail. On weekends and during special events throughout the summer, parking within the Town of Vail would likely continue to be an issue under Alternative 3. The Town of Vail will continue to explore means of adding public parking to the supply within the central areas of Lionshead and Vail Village throughout the summer.

CUMULATIVE EFFECTS

Forest Service decisions within Vail Ski Area's SUP area have spanned five decades, and have, in many ways, defined the developed winter and summer recreational opportunities that exist in the Eagle Valley. These compliment the abundant undeveloped summer and year-round recreational opportunities that exist on a mix of NFS, Town and County lands through the Eagle Valley. Cumulatively, these decisions have, in part, helped make Vail Ski Area the year-round regional, national and international recreational destination that it is today.

The opening of the Eisenhower-Johnson Memorial Tunnel in 1973 greatly improved access to the mountain communities (including Town of Vail) and National Forests from Front Range communities. Over the years, people living in the expanding Front Range communities have increasingly looked to the mountains for weekend recreational opportunities regardless of the season, creating traffic congestion on I-70 (as defined in the "Existing Conditions" section).

Traffic

As discussed in the Affected Environment section of this analysis, traffic on I-70 (Colorado's major east-west corridor) is increasingly becoming a major issue. CDOT and the FHA began analyzing alternatives for the I-70 Mountain Corridor in January 2000 in order to address the underlying need to reduce congestion and to improve mobility and accessibility on I-70 between Glenwood Springs and C-470. The PEIS was undertaken because existing congestion along I-70 is degrading the accessibility of mountain travel for Colorado residents, tourists, and businesses, with projected increases in travel demand over the next 25 years and beyond.

The PEIS identifies that the need to relieve this congestion is especially acute for extended weekend travelers seeking access between the Denver metropolitan area and US 40 (to Grand County), as well as through the Eisenhower Tunnel to the Western Slope. Ultimately, the selected alternative identified in the 2011 ROD should result in greater accessibility to mountain communities along the I-70 corridor, benefiting Summit and Eagle County economies, as well as ski areas.

The Town of Vail is anticipating a significant amount of growth in the next five to ten years. Considering approved development, submitted development proposals, and potential redevelopment proposal in the future, the Town could experience an additional net 3,000 new units and an additional net new 700,000 square feet of commercial uses. The combination of this additional development is projected to add approximately 2,800 PM peak hour trips onto the Town of Vail's roadway system during peak times in the winter.[47]

Parking

As discussed in Affected Environment, the Town of Vail continues to explore means of adding public parking to the supply within the central areas of Lionshead and Vail Village. A current need of at least 400 additional spaces has been identified by the Town in attempt to reduce the number of days that the Frontage Road is pressed into service to accommodate overflow parking. The 400 spaces are needed to maintain a supply accommodating 90 percent of the demand days, a Town parking objective. This is based on many seasons of collected Frontage Road parking data. However, 1,000 additional spaces would accommodate 99 percent of the current demand days. Over the long-term (20 years), the 1,000 spaces are estimated to accommodate 90 percent of the future demand days.[48] The long-term target of providing an additional 1,000 spaces is appropriate for the Main Vail area and is anticipated to be supplied by Ever Vail Redevelopment (300 to 500 public spaces), Lionshead Structure Redevelopment (200 to 300 additional public spaces) and Ford Park (300 to 600 public spaces).[49]

[47] Town of Vail, 2009 p. ii
[48] Town of Vail, 2009
[49] Ibid.

Future parking improvements being considered by the Town of Vail include enhancements to the Lionshead parking structure, and a parking area at Ford Park. At West Lionshead (also referred to as Ever Vail), plans include redeveloping the Vail Ski Area's maintenance yards and relocating the South Frontage Road up against I-70. Current plans are evolving, but the potential exists for approximately 590 units, 165,000 square feet of commercial space (including 35,000 square feet of office space) and additional access to the mountain (including a new gondola). The proposal would also include 400 additional public parking spaces.[50]

The Town is currently considering to entirely replace the Lionshead parking structure with a larger structure (adding 300 more public spaces), approximately 365 units, 70,000 square feet of commercial space, and 20,000 square feet for a conference center.[51]

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

No irreversible and/or irretrievable commitments of resources in relation to traffic, parking, and ski area access have been identified in association with either alternative analyzed in this document.

[50] Ibid. pp. 18–19
[51] Ibid.

D. SOCIAL AND ECONOMIC RESOURCES

SCOPE OF THE ANALYSIS

A correlation exists between public use of National Forest System (NFS) lands and the economies and societies of adjacent communities. This correlation encompasses many factors—such as seasonal tourism, population, visitor spending, employment, personal income, and tax revenues—which are assessed and disclosed herein. The area of economic effect, or Analysis Area, for the proposed project is defined as Eagle County, Colorado.

Definitions

Economic Impact Theory – By drawing non-local visitation to an area, ski facilities generate economic activity in the form of employment and dollar flows. These benefits accrue to both the ski area and to local businesses that benefit from spending by visitors. The *direct* dollars spent at ski areas and local businesses also have a secondary (multiplier) impact, creating additional dollar flows/jobs within the local and regional economy.

Economic Impacts – Employment and dollar flows are defined at three levels:

- Direct – Employment and dollar flows created as a direct impact of a business. On and off-site construction jobs, resort-based jobs and non-resort jobs generated by visitor expenditures are included in this category. The majority of these jobs/dollar flows will be created within a small geographic area, typically in the immediate area of the resort.
- Indirect – Employment and dollar flows created by industry-to-industry spending. For instance, increased food and beverage spending at Vail Ski Area results in the purchase of more supplies from food vendors. This revenue allows the food vendors to create more employment. These are indirect jobs. These jobs/dollar flows would be created both locally and throughout the geographic area in which the resort regularly conducts business.
- Induced – Employment and dollar flows created by increased household spending. The additional jobs and income created by direct spending allow consumers to increase their spending on goods and services. This spending allows a number of businesses to create more jobs. These are induced jobs. Induced jobs/dollar flows are generated over a relatively broad geographic area.

Economic impacts of alternatives 1, 2 and 3 were projected using a computer-based model—IMPLAN3.[52] IMPLAN3 is a broadly accepted model used for making projections regarding employment and economic impacts and is often used by the Forest Service in the preparation of environmental analyses. IMPLAN economic modeling requires the estimation of annual visitation, visitor spending, ski area employment and construction costs in order to simulate the effect of these activities on the economy in terms of dollar flows, employment, labor income and tax revenues. While IMPLAN modeling utilizes the most current observed industry interdependencies calibrated to the local and regional economy of Eagle County, the results of any economic model are only as accurate as the data used to describe the proposed change (i.e., an Alternative). Therefore, certain estimations and assumptions related to alternatives 1, 2 and 3 were made. As a result, the projected values presented in this analysis should not be considered precise, but rather accurate estimates of the potential economic impacts under alternatives 1, 2 and 3.

Construction activity at the resort and year-round visitation to the ski area generate economic activity in Eagle County. In order to analyze the economic impacts of the proposed projects, the Forest Service and Vail Associates have made reasonable estimates of the proposed construction budget and anticipated visitation to Vail Ski Area. For the purposes of this analysis, construction of the project components is expected to occur over the three-year period 2014 through 2016. The projection period for visitation-based impacts is 2015–2019 and projections of annual spending are based on 2019 values. IMPLAN3 model values related to the Affected Environment, or existing condition, are estimated for 2013.

For the purposes of this analysis, winter visitation is expected to remain in its current trend under each Alternative (i.e., none of the alternatives are designed, or expected, to increase winter visitation to the ski area). Therefore, the existing economic impact of Vail Ski Area's winter visitors is disclosed in the Affected Environment, but only changes in summer visitation are analyzed for each Alternative. Under each Action Alternative, the majority (80 percent) of new summer visits to Vail Ski Area are assumed to be made by visitors who are already coming to the region. These visits represent new visitors to Vail Ski Area but not new visitors to Eagle County—they are ski area guests who already live in or would be staying in Eagle County, but might visit Vail Ski Area multiple times as a result of the action alternatives instead of visiting the ski area once (or not at all) as they stay in or pass through Eagle Valley. As existing visitors to the region, the impact of their spending outside of Vail Ski Area is already part of the existing economy of Eagle County and is not reported as a new economic impact herein. The remaining 20 percent of new summer visits to Vail Ski Area are assumed to be made by new visitors to the region—these represent visitors who 1) may be traveling on I-70 to other destinations and decide to stop at Vail Ski Area for the day/night or 2) decide to come to Vail Ski Area and Eagle County as a result of the projects

[52] IMPLAN3 software guides users though the task of creating an impact study that tracks the effects of a modeled event (such as each alternative) against 440 unique sectors in the United States. The result is a detailed summary of economic impacts including: changes in jobs, household incomes, tax impacts, and gross regional product that can be used to show the effect of firms moving into an area, special events, introduction of new technologies, recreation and tourism, military base closures, changes in government spending and many more events.

included in the action alternatives. The spending impacts of these visitors are reported as new economic impacts to the Eagle County economy.

Based on continued interest in summertime mountain recreation and recent visitation trends, new summer visitation is also expected under the No Action Alternative. However, under the No Action Alternative, the percentage of additional ski area visits representing new visits to the region is expected to be lower than that of the action alternatives (90 percent are assumed to be visitors who are already coming to the region and 10 percent are assumed to be new regional visitation).

For the purposes of this analysis, visitor spending is broken down by spending that occurs both within Vail Ski Area (e.g., lift tickets, food, resort lodging, etc.) and spending that occurs outside of the resort (e.g., gasoline purchases, groceries, other lodging, etc.). In this analysis, existing and prospective new jobs are discussed as "employment positions" or "Full-Time-Equivalents" (FTEs). An employment position may be a year-round or seasonal job and either full-time or part-time, whereas one FTE provides sufficient work to keep one person employed full-time for one year. In seasonal industries, such as ski areas, one FTE may represent several employment positions.

AFFECTED ENVIRONMENT

Vail Ski Area

Visitation

Vail Ski Area is a four-season resort whose primary purpose is for winter recreation. Over the past five years for which data is available, Vail Ski Area has experienced modest fluctuations in winter visitation, averaging about 1.6 million winter visits annually. About 82 percent of Vail Ski Area's winter visitors are overnight visitors and about 18 percent are day visitors.[53] Based on projections from the IMPLAN3 Model, Vail Ski Area's winter visitors currently spend approximately $120.5 million within the resort and approximately $195.8 million outside of the resort each year. This *direct* spending generates a total annual dollar flow of approximately $469 million into the economy, which includes *direct*, *indirect* and *induced* impacts. Table 3D-1 summarizes the impact of existing winter visitation.

[53] Unpublished data provided by Vail Associates, Inc.; This is a critical distinction, as overnight visitors' per diem expenditures are higher than day visitors' per diem expenditures. Overnight visitors incur costs for lodging, food, travel, etc., resulting in substantially higher expenditures than day visitors.

Table 3D-1:
Impact of Baseline Winter Visitation Spending

Impact Type	In-Resort Winter Spending	Out of Resort Winter Spending	Total Winter Spending
Direct Effect	$120,460,000	$195,760,000	$316,220,000
Indirect Effect	$25,900,000	$45,190,000	71,090,000
Induced Effect	$31,290,000	$50,420,000	81,710,000
Total Effect	*$177,640,000*	*$291,370,000*	*$469,010,000*

Source: IMPLAN3, 2013

While winter visitation at Vail Ski Area has experienced ups and downs in the past five years, summer visitation to the ski area has experienced substantial and consistent growth during this same period (an average of about 18 percent growth each year). In 2012, Vail Ski Area recorded approximately 125,000 annual summer visits. It is estimated that about 70 percent of Vail Ski Area's summer visitors are overnight visitors and about 30 percent are day visitors.

Vail Ski Area's approximately 125,000 summer visitors currently spend roughly $9.3 million within the resort and $10.1 million outside of the resort each year. This *direct* spending generates a total annual dollar flow of approximately $28.5 million into the economy, which includes *direct*, *indirect* and *induced* impacts. Table 3D-2 summarizes the impact of existing summer visitation.

Table 3D-2:
Impact of Baseline Summer Visitation Spending

Impact Type	In-Resort Summer Spending	Out of Resort Summer Spending	Total Summer Spending
Direct Effect	$9,270,000	$10,090,000	$19,360,000
Indirect Effect	$1,890,000	$2,510,000	$4,400,000
Induced Effect	$2,340,000	$2,430,000	$4,770,000
Total Effect	*$13,490,000*	*$15,030,000*	*$28,520,000*

To put winter versus summer visitor spending into context, the total effect of Vail Ski Area's winter visitor spending ($469 million) is more than 16 times that of the summer visitors ($28.5 million).

Employment

As is true for most mountain resorts, Vail Ski Area employs more workers in winter than in the summer. Vail Ski Area currently employs approximately 2,841 workers (or 1,257 FTEs) in the winter and approximately 550 workers (or 364 FTEs) in the summer. These are *direct* resort jobs (i.e., employees of Vail Resorts, Inc.) and are ongoing employment positions that are created each year in response visitation to Vail Ski Area. Table 3D-3 summarizes the existing employment at Vail Ski Area.

Table 3D-3:
Vail Ski Area Baseline Employment

Employment Type	Full-Time	Part-Time	Total Employment Positions	FTEs
YEAR-ROUND				
Year-round Employment	223	4	227	225
WINTER				
Winter Seasonal Employment	1,515	1,099	2,614	1,032
Total Winter Employment Positions (including year-round)	1,738	1,103	2,841	1,257
SUMMER				
Summer Seasonal Employment	233	90	323	139
Total Summer Employment Positions (including year-round)	456	94	550	364
ANNUAL EMPLOYMENT (WINTER AND SUMMER COMBINED)				
Annual Employment[a]	1,971	1,193	3,164	1,396

[a] Total winter employment and total summer employment rows do not sum to the annual employment row because year-round employment is accounted for in each seasonal total.
Source: Vail Associates, Inc.; Annual average employment

The *direct* spending of visitors to Vail Ski Area *in the resort* (i.e., what visitors pay to Vail Resorts, Inc. for lift tickets, food, services, etc.) creates these *direct* jobs at the resort, but this in-resort spending also creates *indirect* and *induced* jobs ***outside*** the resort, as dollar flows circulate through Vail Ski Area's suppliers and vendors. Winter in-resort spending currently accounts for 453 FTEs outside the resort (215 *indirect* and 238 *induced*) and summer visitation currently generates approximately 33 FTEs outside the resort (15 *indirect* and 18 *induced*). These are ongoing employment positions that are created each year in response to visitation to Vail Ski Area.

The *direct* spending of visitors to Vail Ski Area *outside the resort* also creates *direct*, *indirect* and *induced* employment outside of the resort. Winter visitation to Vail Ski Area currently generates approximately 2,881 FTEs outside the resort (2,140 *direct*, 359 *indirect* and 382 *induced*) and summer visitation currently generates approximately 133 FTEs outside the resort (94 *direct*, 20 *indirect* and 19 *induced*). These are ongoing employment positions that are created each year in response visitation to Vail Ski Area.

In total, 5,121 FTEs are created each year by the operation of, and visitation to, Vail Ski Area. The *direct*, *indirect* and *induced* employment impacts of spending both inside and outside of the resort are summarized in Table 3D-4.

Table 3D-4:
Baseline Employment Impact Summary (FTEs)

	In-Resort Spending	Outside of Resort Spending
WINTER		
Direct	1,257	2,140
Indirect	215	359
Induced	238	382
Total	1,710	2,881
SUMMER		
Direct	364	94
Indirect	15	20
Induced	18	19
Total	*397*	*133*
Grand Total (In-Resort, Outside of Resort, Winter, Summer)		**5,121**

Labor Income

The Congressional Labor Office defines labor income as income that is derived from employment. This includes all compensation that is a return from work effort, and typically includes labor earnings (wages and salaries), employer provided benefits (health insurance, life insurance, etc.), and taxes paid to the government on behalf of the employees. Employment created by the operation of and visitation to Vail Ski Area produces labor income for employees and businesses in Eagle County. Approximately $217.6 million in total labor income is currently generated in conjunction with the 5,121 total FTEs discussed above. The *direct*, *indirect* and *induced* labor income impacts of employment both inside and outside of the resort are summarized in Table 3D-5.

Table 3D-5:
Baseline Labor Income Summary

	In-Resort Spending	Outside of Resort Spending
WINTER		
Direct	$56,290,000	$85,670,000
Indirect	$9,310,000	$15,830,000
Induced	$10,450,000	$16,850,000
Total	*$76,050,000*	*$118,350,000*
SUMMER		
Direct	$16,300,000	$4,040,000
Indirect	$660,000	$660,000
Induced	$780,000	$780,000
Total	*$17,740,000*	*$5,480,000*

Table 3D-5:
Baseline Labor Income Summary

	In-Resort Spending	Outside of Resort Spending
ANNUAL TOTAL (SUMMER AND WINTER)		
Total	$93,790,000	$123,830,000
Grand Total (In-Resort, Outside Resort, Winter, Summer)		**$217,620,000**

Population

From 1970 to 2000, Eagle County experienced substantial population growth, likely due to changes in traditional employment opportunities (e.g., tele-commuting) and an increase in the popularity of healthy/recreation lifestyles. However, according to population projections from the Colorado State Demography Office, the County is expected to experience more modest growth rates over the next two decades (refer to Table 3D-7). Eagle County's population growth from 2000 to 2010 was 25 percent and population projections anticipate growth in Eagle County to average within this range into 2040.[54] Table 3D-6 presents the total year-round resident population for Eagle County from 1970 through 2010.

Table 3D-6:
Eagle County Permanent Resident Population Estimates (1970–2010)

Area	1970		1980		1990		2000		2010	
	Pop.	% Change	Pop.	% Change	Pop.	% Change	Pop.	% Change	Pop.	% Change
Eagle County	7,498	--	13,320	78	21,928	65	41,659	90	52,197	25

Source: Colorado Department of Local Affairs – State Demography Office, 2013

Population projections are approximations that are affected by factors such as changes in assumptions (numbers of persons per household), transient residents, the number of second homes, and second home owners converting into permanent residents. Table 3D-7 displays population projections and percent change for 2020, 2030 and 2040 for Eagle County.

[54] Colorado Department of Local Affairs – State Demography Office, 2013

Table 3D-7:
Eagle County Permanent Resident Population Projections (2020–2040)

Area	2020		2030		2040	
	Pop.	% Change	Pop.	% Change	Pop.	% Change
Eagle County	68,350	31	82,362	21	102,472	24

Source: Colorado Department of Local Affairs – State Demography Office, 2013

Race

Racial diversity is somewhat limited in Eagle County—about 83 percent of the County's population is white, Hispanic or Latino.[55] Another 12.3 percent of the population in Eagle County identified themselves as "Some Other Race," which are most often persons of Hispanic or Latino origins.[56] The racial breakdown of Eagle County is provided in Table 3D-8.

Table 3D-8:
Race Within Eagle County, 2010

Race	Pop.	Percent
White	43,402	83.2
Black or African American	359	0.7
American Indian and Alaska Native	343	0.7
Asian	528	1
Native Hawaiian and Other Pacific Islander	15	0
Some Other Race	6,443	12.3
Two or More Races	1,107	2.1

Source: U.S. Census Bureau, 2010

Economy

In 2010, Eagle County's economy had a Gross Regional Product (GRP) of approximately $3 billion. Travel and tourism is an important economic component of Eagle County, contributing approximately $1.4 billion to the GRP of the County. In this context, travel and tourism consists of sectors that provide goods and services to visitors to the local economy, as well as to the local population.[57] For the purposes of this analysis these sectors include: retail trade, passenger transportation, arts, entertainment and recreation, and accommodation and food services. Travel and tourism account for about 15 percent of total employment nationally and about 16 percent in the State of Colorado. In comparison, Eagle County

[55] U.S. Census Bureau, 2010
[56] In 2000, 97 percent of the people who reported as "Some Other Race" were Hispanic or Latino.
[57] Without additional research such as surveys, it is not known what exact proportion of the jobs in these sectors is attributable to expenditures by visitors, including business and pleasure travelers, versus by local residents. Some researchers refer to these sectors as "tourism-sensitive." They could also be called "travel and tourism-potential sectors" because they have the potential of being influenced by expenditures by non-locals. In this report, they are referred to as "travel and tourism."

is much more dependent on tourism with approximately 47 percent of the total employment in the County attributed to travel and tourism sectors.[58] It should also be noted that the percentage of employment related to travel and tourism in Eagle County is likely higher than reported, as second home construction and some other tourism related activities are not included in this calculation.

Vail Associates, Inc. (including Beaver Creek Resort) is currently the largest employer in Eagle County. Table 3D-9 provides the ten largest employers in the County, the approximate number of employees and the industry the employer operates in.

Table 3D-9:
Eagle County Largest Employers

Employer	Number of Employees (range)	Industry
Vail Associates, Inc.	> 1,500	Recreation, Real Estate, Accommodations & Food Services
Eagle County School District	500–1,000	Education
Vail Valley Medical Center	500–1,000	Medical
Eagle County	400–500	Government
Vail Cascade Hotel	300–400	Accommodations & Food Services
Ritz Carlton Hotel	300–400	Accommodations & Food Services
WalMart	300–400	Retail
Sonnenalp Resort	200–300	Accommodations & Food Services
Town of Vail	200–300	Government
Vail Marriott	200–300	Accommodations & Food Services

Source: Economic Council of Eagle County, 2012

Employment Status

Employment status is a measure of the number of people who are jobless or employed in the local labor force. In 2012 Eagle County had a labor force of 28,503, with 25,920 persons employed and 2,583 persons unemployed.[59] The most common metric of employment status is the unemployment rate, calculated as the number of people who are jobless, looking for jobs, and available for work divided by the labor force. Between June 2012 and July 2013 Eagle County experienced an unemployment rate of 9.1 percent, which is considerably higher than the state average (7.1 percent). This higher unemployment rate is partially influenced by the seasonal nature of employment in Eagle County.[60]

[58] U.S. Department of Commerce, 2013
[59] U.S. Bureau of Labor Statistics, 2013
[60] Ibid.

Table 3D-10:
Eagle County Labor Force, 2012–2013[a]

Area	Labor Force	Employed	Unemployed	Unemployment Rate
Eagle County	28,503	25,920	2,583	9.1%
State of Colorado	2,770,518	2,574,396	196,122	7.1%

[a] June 2012 through July 2013, not seasonally adjusted
Source: U.S. Bureau of Labor Statistics, 2013

Income and Poverty

Household income and the proportion of the population below the poverty level are important measures of the ability of households and individuals to achieve economic security. In 2011, Eagle County had a higher median household income ($70,664) and a lower percentage of the population below the poverty level (10.7 percent) than both the State of Colorado and the U.S. as a whole.[61] It is important to note that this figure is based on total personal income, from both labor (e.g., wages) and non-labor (e.g., investment income) sources. These figures are presented in Table 3D-11.

Table 3D-11:
Eagle County Median Household Income and Percentage of Population below the Poverty Level

Geographic Area	Median household income including benefits	Percentage of Population Below the Poverty Level
United States	$51,484	15.2%
Colorado	$56,345	13.2%
Eagle County	$70,664	10.7%

Source: U.S. Census Bureau, 2011

Tax Revenue

Tax revenues are related to economic activity (sales tax, personal income tax, etc.) and property values (property tax) and can have a substantial impact on the ability of a municipality to provide public services. *Direct*, *indirect* and *induced* economic activity associated with visitation to Vail Ski Area currently generates approximately $36.5 million in local and state tax revenues and approximately $43.9 million in federal tax revenues. The *direct*, *indirect* and *induced* tax impacts of Vail Ski Area visitor spending are summarized in Table 3D-12.

[61] U.S. Census Bureau, 2011

Table 3D-12:
Tax Revenues Associated with Vail Ski Area Baseline Visitation

	Local and State Tax Revenues	Federal Tax Revenues
Summer Spending Impacts	$2,020,000	$2,440,000
Winter Spending Impacts	$34,480,000	$41,450,000
Total Impact	*$36,500,000*	*$43,890,000*

Environmental Justice

Environmental justice speaks to concerns that federal decisions could disproportionately impact people of a particular ethnic or cultural heritage group, or people with low incomes. Executive Order 12898 (EO 12898) relates to environmental justice and requires, in brief, that each federal agency make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.

The CEQ provides the following definitions in order to provide guidance for compliance with environmental justice requirements in NEPA:[62]

- "Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis."
- "Low-income populations in an affected area should be identified with the annual statistical poverty thresholds from the Bureau of the Census' Current Population Reports, Series P-60 on Income and Poverty. In identifying low-income populations, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect."[63]

No existing minority populations were identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. Likewise, no low-income populations were identified in the affected area.

[62] Council on Environmental Quality, 1997
[63] Ibid.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Impacts Common to All Alternatives

While each of the action alternatives would generate economic activity in the form of dollar flows, employment labor income, and tax revenues, the overall socioeconomic trends in Eagle County (population growth, racial diversity, a travel and tourism based economy and individual prosperity) are expected to remain within their current trends under each Alternative.

Population

Population growth projections expect Eagle County's baseline resident population to grow to 68,350 year-round residents by 2020. This growth would represent a 31 percent increase over current population levels.[64] Although some workers may relocate to Eagle County to fill the new employment positions created by each Alternative, this population projection accounts for a reasonable amount of job creation by the large employers in the County such as what would be experienced under the action alternatives. Thus, population growth resulting from any of the action alternatives is expected to have a negligible effect on the baseline population trend.[65]

Race

Racial diversity is somewhat limited in Eagle County, with about 83 percent of the Eagle County population identifying as white, Hispanic or Latino. None of the action alternatives are anticipated to measurably affect the racial breakdown of the County.

Economy

Historically, travel and tourism has been an important component of the Eagle County economy. Currently, at least 47 percent of all employment in Eagle County is related to travel and tourism operations.[66] None of the action alternatives are anticipated to affect this overall economic condition. Vail Resorts, Inc. (including Beaver Creek Resort), is expected to remain the largest employer and one of the primary economic drivers in Eagle County for the foreseeable future under each Alternative.

Income and Poverty

Measures of individual prosperity are closely related to the overall economic condition in a local economy. Travel and tourism is expected to remain a primary economic driver in Eagle County under each Alternative, and as such the nature of employment opportunities and compensation is also expected to remain in its current trend. Eagle County can be expected to retain its relatively higher median

[64] Colorado Department of Local Affairs – State Demography Office, 2013
[65] Even under an unlikely scenario in which every new FTE created by the alternatives caused one person to relocate to Eagle County, population growth resulting from the alternatives would represent a negligible 0.02 percent or less increase over current population levels.
[66] U.S. Department of Commerce, 2013

household income ($70,664) and a lower percentage of the population below the poverty level (10.7 percent) than both the State of Colorado and the U.S. as a whole under each Alternative.[67]

Environmental Justice

No changes or modifications would be approved under any Alternative that would directly or indirectly affect minority or low-income populations in Eagle County. The baseline conditions presented in the Affected Environment section above would be expected to continue into the future under each Alternative.

Summary of Direct and Indirect Environmental Consequences

Major conclusions and determinations of this Social and Economic Resources analysis are summarized in Table 3D-13. Projected impacts over the baseline conditions, by Alternative, are discussed in further detail below.

Table 3D-13:
Summary of Direct and Indirect Impacts to Social and Economic Resources

	Baseline	Alternative 1	Alternative 2	Alternative 3
CONSTRUCTION				
Dollar Flow	$0	$0	$19,050,000	$10,290,000
Employment (FTEs)	0	0	157	85
Labor Income	$0	$0	$8,800,000	$4,760,000
State and Local Tax Revenues	$0	$0	$598,000	$323,000
Federal Tax Revenues	$0	$0	$1,600,000	$838,600
SUMMER VISITATION				
Dollar Flow	$28,520,000	+$790,000	+$3,340,000	+$2,510,000
Employment (FTEs)	5,121	+4.6	+137.4	+111.6
Labor Income	$217,620,000	+$198,000	+$6,122,000	+$4,973,000
State and Local Tax Revenues	$36,500,000	+$55,900	+$237,000	+$177,800
Federal Tax Revenues	$43,890,000	+$67,700	+$287,000	+$215,200
COUNTYWIDE EMPLOYMENT LEVELS	25,920	0.01% increase	0.5% increase	0.4% increase

Notes:
1. Dollar values, FTEs and employment levels listed are the amount over the baseline conditions and represent total impacts including all *direct*, *indirect* and *induced* economic effects.
2. Construction related impacts are cumulative totals that would be provided over the three-year period, 2014–2016. These impacts would be short-term—only affecting the economy in the three years in which construction activity occurs.
3. Visitation related impacts are on-going annual values—they are created each year in response to visitation to Vail Ski Area.

[67] U.S. Census Bureau, 2011

Alternative 1 – No Action

The No Action Alternative represents a continuation of existing management practices without changes, additions, or upgrades to existing conditions. No new recreational opportunities, facilities or other improvements would be implemented if this Alternative is selected. For the No Action Alternative, baseline trends are projected forward through the projection period 2015 to 2019.

Vail Ski Area

Visitation

For the purposes of this analysis, the same mildly fluctuating trend in winter visitation at Vail Ski Area is assumed to continue into the future, with approximately 1.6 million annual skier visits and roughly equivalent economic impacts assumed under each Alternative. As a result, winter impacts are not discussed further in this analysis.

Under the No Action Alternative, approximately 3,400 new visitors to Eagle County would be anticipated (this is based, in part, on recent growth in summer visitation). These new visitors to the region are expected to spend approximately $260,000 within the resort and approximately $280,000 outside of the resort each year by the end of the projection period. This *direct* spending would generate a total annual dollar flow of approximately $790,000 into the economy, which includes *direct*, *indirect* and *induced* impacts.[68] As these impacts would result from new visitation to Eagle County, they would be created each year *in addition to* the baseline impact of Vail Ski Area's current visitors presented in the Affected Environment (refer to Table 3D-2). Table 3D-14 summarizes the projected impact of new summer visitation.

Table 3D-14:
Impact of Alternative 1 New Summer Visitation Spending

Impact Type	In-Resort Summer Spending	Out of Resort Summer Spending	Total Summer Spending
Direct Effect	$260,000	$280,000	$540,000
Indirect Effect	$50,000	$70,000	$120,000
Induced Effect	$460,000	$70,000	$130,000
Total Effect	*$370,000*	*$420,000*	*$790,000*

Employment

Under the No Action Alternative, no changes to employment at Vail Ski Area are expected to occur. The ski area would be expected to continue to employ approximately 2,841 workers (or 1,257 FTEs) in the winter and approximately 550 workers (or 364 FTEs) in the summer. However, as summer visitation is expected to increase slightly under the No Action Alternative, *direct*, *indirect* and *induced* employment

[68] Ibid.

resulting from the summer spending would be expected to increase. New summer visitation would generate approximately 4.6 FTEs (2.6 *direct*, 1.1 *indirect* and 0.9 *induced*) outside the resort.[69] Each of these FTEs may represent multiple part-time and/or seasonal employment positions throughout the Eagle Valley. These employment positions would be ongoing and be created each year in response to new summer visitation to Eagle County, in addition to the baseline impact of Vail Ski Area's current visitors presented in the Affected Environment.

Labor Income

Changes in labor income result from changes in employment. Just as employment is expected to increase slightly under the No Action Alternative, so is labor income. Approximately $198,000 in total labor income would be generated in conjunction with the 4.6 FTEs discussed above.[70]

Employment Status

The additional 4.6 FTEs generated under Alternative 1 would represent a negligible increase (approximately 0.01 percent) over current countywide employment levels (25,920 in 2012).[71] In addition, these new FTEs are expected to be created in conjunction with population growth within the County. Therefore, these jobs are not anticipated to meaningfully affect employment status (or unemployment rates) in Eagle County.

Tax Revenues

Under the No Action Alternative, total economic activity (*direct*, *indirect* and *induced*) associated with new visitation to Eagle County would generate approximately $55,900 in local and state tax revenues and approximately $67,700 in federal tax revenues.

Alternative 2 – Proposed Action

The construction and operation of the projects contained in the Proposed Action are expected to result in changes to summer visitation, the local and regional economy and tax revenues. The impacts of these changes for the projection period 2015 through 2019 are discussed and disclosed below.

Vail Ski Area

Construction

Under the Proposed Action, construction of the project components is expected to occur over the three-year period 2014 through 2016. The Proposed Action construction budget was input to the IMPLAN3 model to provide estimates of *direct*, *indirect* and *induced* employment, labor income and dollar flows. Over the three-year period, construction of the project components would cumulatively

[69] Ibid.
[70] Ibid.
[71] U.S. Bureau of Labor Statistics, 2013

generate approximately 157 total FTEs (annual average of 52 FTEs per year), and approximately $19 million in dollar flows to the economy (annual average of $6.4 million). Cumulative labor income during the construction period would total approximately $8.8 million (annual average of $2.9 million). These impacts would be short-term—only affecting the economy in the three years in which construction activity occurs. The results of the IMPLAN3 analyses on construction impacts are shown in Table 3D-15.

Table 3D-15:
Alternative 2 Construction Impacts

	Annual Average	Three-Year Cumulative Total
JOBS (IN FTES)		
Direct Impact	35	106
Indirect Impact	8	23
Induced Impact	9	28
Total Impact	*52*	*157*
LABOR INCOME		
Direct Impact	$2,180,000	$6,530,000
Indirect Impact	$350,000	$1,050,000
Induced Impact	$410,000	$1,230,000
Total Impact	*$2,930,000*	*$8,800,000*
DOLLAR FLOWS		
Direct Impact	$4,210,000	$12,630,000
Indirect Impact	$910,000	$2,730,000
Induced Impact	$1,230,000	$3,680,000
Total Impact	*$6,350,000*	*$19,050,000*

Visitation

New visitors to the region as a result of the Proposed Action are expected to spend approximately $1.1 million within the resort and approximately $1.2 million outside of the resort each year by the end of the projection period. This *direct* spending would generate a total annual dollar flow of approximately $3.3 million into the economy, which includes *direct*, *indirect* and *induced* impacts. As these impacts would result from new visitation to Eagle County, they would be created each year *in addition to* the baseline impact of Vail Ski Area's current visitors presented in the Affected Environment (refer to Table 3D-2). Table 3D-16 summarizes the projected impact of new summer visitation.

Table 3D-16:
Impact of Alternative 2 Summer Visitation Spending

Impact Type	In-Resort Summer Spending	Out of Resort Summer Spending	Total Summer Spending
Direct Effect	$1,090,000	$1,180,000	$2,270,000
Indirect Effect	$220,000	$290,000	$510,000
Induced Effect	$270,000	$280,000	$550,000
Total Effect	*$1,580,000*	*$1,760,000*	*$3,340,000*

Employment

Ongoing operation of Adventure Ridge as a result of the Proposed Action would *directly* create approximately 118 FTEs at Vail Ski Area. Vail Ski Area would add three year-round employment positions (two full-time, one part-time), 100 employment positions in the winter (79 full-time, 21 part-time—related to operation of canopy tours and mountain coasters) and 158 employment positions in the summer (115 full-time, 43 part-time) upon implementation of the Proposed Action.

As summer visitation is expected to increase under the Proposed Action, *direct*, *indirect* and *induced* employment resulting from the summer spending would also increase. New summer visitation would generate approximately 19.4 FTEs outside the resort (11 *direct*, 4.2 *indirect* and 4.2 *induced*). Each of these FTEs may represent multiple part-time and/or seasonal employment positions. These employment positions would be ongoing and would be created each year in response to new summer visitation to Eagle County, in addition to the baseline impact of Vail Ski Area's current visitors presented in the Affected Environment.

Labor Income

Changes in labor income result from changes in employment. Just as employment is expected to increase under the Proposed Action, so is labor income. Approximately $5.2 million in total labor income would be generated in conjunction with the 118 Vail Ski Area FTEs discussed above. Approximately $838,000 in total labor income would be generated in conjunction with the 19.4 FTEs generated outside the resort discussed above.

Employment Status

An additional 137.4 FTEs would be created each year by the operation of Vail Ski Area and new visitation to Eagle County under the Proposed Action. All of these employment positions would be ongoing and would be created each year in response to new visitation. The addition of 137 new jobs to the Eagle County economy would represent a 0.5 percent increase over current countywide employment levels. During the three-year construction period (2014–2016), construction of the project components is expected to create approximately 157 total *direct*, *indirect* and *induced* FTEs (annual average of 52 FTEs per year). These construction jobs would represent a 0.2 percent increase over current employment levels, but they would not be ongoing and would cease following the completion of the project components.

Tax Revenues

Under the Proposed Action, total economic activity (*direct*, *indirect* and *induced*) associated with new visitation to Eagle County is projected to generate an additional $237,000 in local and state tax revenues and approximately $287,000 in federal tax revenues. Construction of the Proposed Action is projected to generate approximately $598,000 in local and state tax revenues and approximately $1.6 million in federal tax revenues.

Alternative 3

As described in Chapter 2, Alternative 3 includes all projects from Alternative 2 except for the mountain coasters, Riparian Experience, and wedding venue at The 10th. As discussed previously in Chapter 3, Section A – Recreation, the mountain coasters are considered to be a potential draw for summer guests to Adventure Ridge, attracting people who otherwise might not explore the SUP area. Thus, by omitting these activities, visitation would be expected to be reduced from that under Alternative 2. The impact of the anticipated visitation, and construction resulting from Alternative 3, is discussed and disclosed below.

Vail Ski Area

Construction

Over the three-year construction period (2014 through 2016), construction of the project components would cumulatively generate approximately 85 total FTEs (annual average of 28 FTEs per year), and approximately $10.3 million in total dollar flows to the economy (annual average of $3.43 million). Cumulative labor income during the construction period would total approximately $4.8 million (annual average of $1.6 million). These impacts would be short-term—only affecting the economy in the three years in which construction activity occurs. The results of the IMPLAN3 analyses are shown in Table 3D-17.

Table 3D-17:
Alternative 3 Construction Impacts

	Annual Average	Three-Year Cumulative Total
JOBS (IN FTES)		
Direct Impact	19	57
Indirect Impact	4	13
Induced Impact	5	15
Total Impact	*28*	*85*
LABOR INCOME		
Direct Impact	$1,180,000	$3,530,000
Indirect Impact	$190,000	$560,000
Induced Impact	$220,000	$660,000
Total Impact	*$1,590,000*	*$4,760,000*

Table 3D-17:
Alternative 3 Construction Impacts

	Annual Average	Three-Year Cumulative Total
DOLLAR FLOWS		
Direct Impact	$2,270,000	$6,820,000
Indirect Impact	$490,000	$1,480,000
Induced Impact	$660,000	$1,990,000
Total Impact	*$3,430,000*	*$10,290,000*

Visitation

Under Alternative 3, new visitors to the region are expected to spend approximately $810,000 within the resort and approximately $890,000 outside of the resort each year by the end of the projection period. This *direct* spending would generate a total annual dollar flow of approximately $2.5 million into the economy, which includes *direct*, *indirect* and *induced* impacts. As these impacts would result from new visitation to Eagle County, they would be created each year *in addition to* the baseline impact of Vail Ski Area's current visitors presented in the Affected Environment (refer to Table 3D-2). Table 3D-18 summarizes the projected impact of new summer visitation.

Table 3D-18:
Impact of Alternative 3 Summer Visitation Spending

Impact Type	In-Resort Summer Spending	Out of Resort Summer Spending	Total Summer Spending
Direct Effect	$810,000	$890,000	$1,700,000
Indirect Effect	$170,000	$220,000	$390,000
Induced Effect	$210,000	$210,000	$420,000
Total Effect	*$1,190,000*	*$1,320,000*	*$2,510,000*

Employment

Ongoing operation of Alternative 3 would *directly* create approximately 97 FTEs at Vail Ski Area. Vail Ski Area would add two year-round employment positions (one full-time, one part-time), 80 employment positions in the winter (63 full-time, 17 part-time—related to operation of canopy tours) and 138 employment positions in the summer (99 full-time, 39 part-time) upon implementation of Alternative 3.

As summer visitation is expected to increase under Alternative 3, *direct*, *indirect* and *induced* employment resulting from the summer spending would also increase. New summer visitation would generate approximately 14.6 FTEs outside the resort (8.3 *direct*, 3.1 *indirect* and 3.2 *induced*). Each of these FTEs may represent multiple part-time and/or seasonal employment positions. These employment positions would be ongoing and would be created each year in response to new summer visitation to

Eagle County, in addition to the baseline impact of Vail Ski Area's current visitors presented in the Affected Environment.

Labor Income

Changes in labor income result from changes in employment. Just as employment is expected to increase under Alternative 3, so is labor income. Approximately $4.3 million in total labor income would be generated in conjunction with the 97 Vail Ski Area FTEs discussed above. Approximately $629,000 in total labor income would be generated in conjunction with the 14.6 FTEs generated outside the resort discussed above.

Employment Status

In total, 111.6 FTEs would be created each year by the operation of Vail Ski Area and new visitation to Eagle County under Alternative 3. All of these employment positions would be ongoing and would be created each year in response to new visitation. The addition of 112 new jobs to the Eagle County economy would represent a 0.4 percent increase over current countywide employment levels. During the three-year construction period (2014–2016), construction of the project components is expected to create approximately 85 total *direct, indirect* and *induced* FTEs (annual average of 28 FTEs per year). These construction jobs would represent a 0.1 percent increase over current employment levels, but they would not be ongoing and would cease following the completion of the project components.

Tax Revenues

Under Alternative 3, total economic activity (*direct*, *indirect* and *induced*) associated with new visitation to Eagle County would generate approximately $177,800 in local and state tax revenues and approximately $215,200 in federal tax revenues. Construction of the Proposed Action would generate approximately $323,000 in local and state tax revenues and approximately $838,600 in federal tax revenues.

CUMULATIVE EFFECTS

Forest Service decisions within Vail Ski Area's SUP area, as well as the approval of private land development by the Town of Vail and Eagle County, have contributed to economic growth trends within Eagle County over that past few decades. As demonstrated in the Affected Environment, Vail Ski Area has driven both employment and dollar flows that accrue to both the ski areas and other area businesses. Vail Ski Area is anticipated to remain Eagle County's largest employer for the foreseeable future

As noted above, the estimation of economic impacts is related to visitation, as expenditures by visitors generate dollar flows and support new jobs. No major increases in winter visitation as a result of Alternative 1, Alternative 2 or Alternative 3 are anticipated. However, increases in summer visitation are anticipated under each alternative. While there are quantifiable economic impacts associated with increased visitation under each alternative, no cumulative effects are anticipated.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

No irreversible and/or irretrievable commitment of economic resources has been identified in association with any of the alternatives analyzed in this document.

E. CULTURAL RESOURCES

SCOPE OF THE ANALYSIS

Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires that federal agencies take into account the effects of a federal undertaking on any cultural resource that is included in, or eligible for, inclusion in the National Register of Historic Places (NRHP). Cultural resources may refer to sites, areas, buildings, structures, districts, and objects which possess scientific, historic, and/or social values of a cultural group or groups as specified by 36 CFR 296.3.

NRHP eligibility is evaluated in terms of the integrity of the resource; its association with significant persons, events, or patterns in history or prehistory; its engineering, artistic, or architectural values; or its information potentially relative to important research questions in history or prehistory.[72] The significance of NRHP eligibility of cultural resources is determined by the Forest Archaeologist in consultation with the State Historic Preservation Officer (SHPO).

The Area of Potential Effects (APE) for this analysis is within Vail Ski Area's SUP boundary, and is primarily confined to the existing lift and trail network across the front side of Vail Mountain. One proposed project is located in Game Creek Bowl.

Twelve archaeological inventories have been conducted within the SUP area in the past. All inventories are on file with the Office of Archaeology and Historic Preservation (OAHP). Three of these inventories were larger block inventories that together cover nearly all of the APE. The remaining inventories were much smaller and less extensive, covering specific footprints such as trail, tree clearing and snowmaking activities.

AFFECTED ENVIRONMENT

As per the twelve previous archaeological inventories, six previously recorded cultural resources are known to exist within the APE—all of which were determined to be **not eligible** for the NRHP. Five of them are isolated finds or isolated historic features. One site was a fairly extensive prehistoric lithic scatter including a few chipped stone tools and at least one piece of ground stone. Its evaluation as not eligible was made based primarily on the abundance of rodent disturbance over the site area, along with some disturbance by heavy equipment.

The northwestern area of the APE that is proposed for downhill mountain biking trails, and specifically two small parts of that area on its western edge, was not included in previous inventories.

[72] 36 CFR Section 60.4

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

Because no ground disturbance is proposed under the No Action Alternative, there would be no effects to any known/unknown NRHP-eligible or non-eligible resources within the APE.

Alternative 2 – Proposed Action

Based on the result of previous inventories completed within Vail Ski Area's SUP area, with the exception of the northwestern portion of the APE where downhill mountain biking trails are proposed, it was determined that the Proposed Action would have **no effect** on any known NRHP-listed or eligible properties.

Because the northwestern portion of the APE has not yet been inventoried, it is not yet possible to determine impacts. However, given the size and location of these un-inventoried parcels, it is unlikely that cultural resources would be found, and even more unlikely that resources would be found that might be eligible for the NRHP. Unless projects are re-designed to avoid the un-inventoried northwestern portion of the APE, an inventory would need to be performed prior to implementation of any approved projects.

Alternative 3

The cultural resource findings for Alternative 3 are identical to those described above under Alternative 2.

CUMULATIVE EFFECTS

Appendix A includes a list of past, present, and reasonably foreseeable future projects that have been identified by the Forest Service as relevant from a cumulative effects context. As noted in the Affected Environment section, twelve previous inventories have been conducted within Vail Ski Area's SUP area. All are on file with the OAHP.

Although NRHP-eligible and non-eligible cultural resources may have been disturbed by ski area development in the past, no NRHP-eligible cultural resources have been identified within the APE. Thus, Alternative 2 would not cumulatively affect any NRHP-eligible resources.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

No irreversible and/or irretrievable commitments of cultural resources have been identified in association with the alternatives analyzed in this document.

F. WILDLIFE AND AQUATIC RESOURCES

SCOPE OF THE ANALYSIS

The Analysis Area for terrestrial resources is defined by the Project Area—an approximately 4,580-acre area within Vail Ski Area's SUP area encompassing all existing and proposed project components associated with the action alternatives on NFS and private lands. The analysis does occasionally extend beyond the Project Area on a species-by-species basis. For the purposes of aquatic resources, the Analysis Area focuses on approximately 5,153 acres of NFS land within the Vail Ski Area SUP area in the Gore Creek and Game Creek watersheds, which encompass total drainage areas of approximately 7,260 acres. For purposes of this analysis the Gore Creek and Game Creek watersheds were divided into five primary watersheds: Game Creek, Cascade Village, Golden Peak, Mountain Front, and Mill Creek. These watersheds all drain to Gore Creek, with the exception of Game Creek, which drains directly to the Eagle River. Each of the primary watersheds was further divided into sub-basin drainage areas based on watershed characteristics and their proximity to the proposed projects. The Analysis Area is defined for each species throughout this section.

This wildlife analysis is tiered to the 2002 WRNF Forest Plan, and incorporates by reference the 2002 Forest Plan, as amended, as well as the 2008 Southern Rockies Lynx Amendment.[73] Species analyzed include those identified as listed proposed, threatened, endangered (TEP), Forest Service Region 2 (R2) sensitive and management indicator species (MIS). Biological Assessment (BA), Biological Evaluation (BE) and MIS reports were prepared for this project. The BA analyzes the potential effects on federally listed TEP species. The BE provides a similar analysis regarding the potential effects of the Proposed Action on Forest Service R2 Sensitive Species in the area. The MIS report addresses species that the Forest Service uses as a means to monitor selected issues on the Forest as required by regulation.[74] In addition, migratory birds were addressed per the 2008 Forest Service Memorandum of Understanding with the United States Fish and Wildlife Service (USFWS) to promote the conservation of migratory birds.

The following analysis is a summary of the BA, BE and MIS reports that are contained in the project file.[75] Additional information can be obtained by reviewing the larger documentation there. All references are contained therein.

[73] USDA Forest Service, 2002 and 2008
[74] 36 CFR 219.19
[75] Thompson, 2014

AFFECTED ENVIRONMENT

Animal-related field surveys were conducted specifically for this project between August 14 and 16, 2012. Pre-NEPA field surveys were conducted at a reconnaissance level, sampling habitats present, and the impact analysis of the proposed project components (all of which would be located within the developed ski area) was based on the results of those surveys and the extensive animal database available for Vail Ski Area. Collectively, the animal database used for the present analysis represents the best scientific information currently available.

Threatened, Endangered, and Proposed Species

Federally listed and proposed animal species considered in this analysis include those identified by the United States Fish and Wildlife Service (USFWS, updated August 24, 2013) as potentially present on the WRNF, potentially present on the Holy Cross Ranger District, and/or potentially affected by management decisions associated with alternatives 1, 2, and 3. At indicated in Tale 3F-1, Uncompahgre fritillary butterfly (*Boloria acrocnema*), humpback chub (*G. cypha*), bonytail (*Gila elegans*), Colorado pikeminnow (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), greenback cutthroat trout (*Oncorhynchus clarkii stomias*), North American wolverine (*Gulo gulo luscus*), and Canada lynx (*Lynx canadensis*) were identified. Of the species listed, only the lynx is addressed in detail. Other listed and proposed species known to occur elsewhere on the WRNF and/or in Colorado were considered, but dropped from detailed analysis. The rationale for dropping these species includes:

- they were not identified by the USFWS or Forest Service as potentially present on the Holy Cross Ranger District;
- their habitats do not occur on the Holy Cross Ranger District or in the Project Area;
- they have no affinities to Project Area habitats;
- the Project Area is outside of the species' range; and
- the management decisions associated with alternatives 1 through 3 would have "no effect" on the species, on their habitats, or on designated critical habitat.

Table 3F-1:
TEP Animal Species that May be Affected by Proposed Activities

Common and Scientific Name	Status[a]	Rationale for Occurrence (Habitat)
Uncompahgre fritillary butterfly, *Boloria acrocnema*	E	No suitable habitat (alpine snow willow stands > 12,000' on peaks ≥ 12,600'). Project far outside species' distribution.
Humpback chub, *Gila cypha*	E	No additional Colorado River water depletions (far downstream in Colorado River)
Bonytail chub, *G. elegans*	E	No additional Colorado River water depletions (far downstream in Colorado River)
Colorado pikeminnow, *Ptychocheilus lucius*	E	No additional Colorado River water depletions (far downstream in Colorado River)
Razorback sucker, *Xyrauchen texanus*	E	No additional Colorado River water depletions (far downstream in Colorado River)
Greenback cutthroat trout, *Oncorhynchus clarkii stomias*	T	Habitat occupied by non-native fish. Outside of historical range (isolated mountain stream headwaters)
North American wolverine, *Gulo gulo luscus*	P	Historic range (remote mountains and alpine areas). One known individual uses portions of the action area.
Canada lynx, *Lynx canadensis*	T	Present, potential forage/travel habitat (montane and subalpine forests)

[a] Federal status, listed after species, is as follows: E = Endangered, T = Threatened, P = Proposed. Potential pre-field survey occurrence on the Project Area and habitat affinity is summarized for each species. Candidate species are addressed in the Biological Evaluation (Thompson, 2014).

Canada Lynx

Canada lynx in the contiguous United States was listed as threatened effective April 24, 2000. The Canada lynx has been classified by the State of Colorado as a State endangered species since 1976. On September 17, 2010, Colorado Parks and Wildlife (CPW) announced that the lynx reintroduction project had successfully accomplished its goal of establishing a breeding population in the Southern Rockies.

The Southern Rockies Ecosystem represents the extreme southern edge of the range of lynx in North America. The majority of historic lynx occurrence records in the Southern Rockies are associated with the "Rocky Mountain Conifer Forest" type. Canada lynx occur primarily in spruce-fir and lodgepole pine forests, at elevations between 8,000 and 12,000 feet.

The Vail Pass and Dowds Junction Lynx Linkages are located in proximity to Vail Ski Area. The Vail Pass Lynx Linkage Area straddles I-70 from East Vail over Vail Pass to Copper Mountain. This linkage is considered because a portion of Vail Ski Area-related traffic travels through this linkage between the resort and Denver. The Dowds Junction Lynx Linkage Area, located just west of the Town of Vail, contains an underpass to facilitate wildlife movement across I-70. Traffic attributed to Vail Ski Area currently travels through at least one of these linkages. Vehicular traffic passing through lynx habitat can result in road-kills, fragment and restrict lynx habitat use, impair home range effectiveness, and inhibit local and dispersing movements. It is assumed that the baseline level of traffic volume on I-70 likely results in some lynx avoidance of the I-70 corridor. This avoidance likely results in reduced lynx use of

habitat along and near the highway, negatively influencing the ability of lynx to forage, den, travel, and maintain adjacent home ranges.

Project Area lynx habitat is presented in Table 3F-2. As the best information available, field-validated lynx habitat type data are being used for this analysis. In general, all conventional ski trails and non-forested ski terrain in the Project Area is "non-habitat," most of the front side of Vail Mountain is "currently unsuitable" as a result of the mountain pine beetle (MPB) epidemic, and most of Northeast Bowl, the spruce-fir stands along the crest of the mountain, and most of Game Creek Bowl are winter foraging habitat.

Table 3F-2:
Project Area Lynx Habitat Types – Existing Conditions

Lynx Habitat Type	NFS Lands[a]		Private Lands[b]		All Lands[c]	
	acres	(%)	acres	(%)	acres	(%)
Winter Foraging	1,074.2	45.7	0.0	1.1	1,074.2	45.7
Denning[d]	0.6	0.0	0.0	0.0	0.6	0.0
Other	65.7	2.8	0.0	0.0	2.8	0.0
Currently Unsuitable	1,207.6	51.4	3.7	98.9	1,211.2	51.5
Total Lynx Habitat[e]	**2,348.1**	**100.0**	**3.7**	**100.0**	**2,351.8**	**100.0**
Non-habitat	2,064.7	46.8	5.2	3.1	2,069.9	45.0
NFS Lands	4,412.8	100	0	0	4,412.8	100
Private	0	0	160.9	94.7	160.9	100
Total	**4,412.8**	**100**	**169.9**	**100**	**4,582.6**	**100**

[a] % of total lynx habitat on NFS lands.
[b] % of total lynx habitat on private lands.
[c] % of total lynx habitat on all lands.
[d] All denning habitat supports winter foraging values.
[e] On NFS and private lands, Total Lynx Habitat = ∑ WFH + denning + other + currently unsuitable. It does not include non-habitat.

Eagle Valley LAU

A portion of the Project Area is located within the Eagle Valley LAU. The Eagle Valley LAU encompasses 117,235 acres west of Vail Pass, including the south side of the Gore Range and the Eagles Nest Wilderness on the north, the Gore Creek Valley along and south of I-70, and the Beaver Creek drainage, which juts south into the Holy Cross Wilderness. The Eagle Valley LAU is bisected by I-70 and contains the western portion of the Vail Pass lynx linkage and the entire Dowds Junction lynx linkage. Private lands are concentrated along the valley bottom continuously from East Vail to Edwards. Eagle Valley LAU statistics are provided in Table 3F-3.

Table 3F-3:
Current Environmental Baseline Status of Lynx Habitat in the Eagle Valley LAU

Lynx Habitat Description	Acres of Lynx Habitat in LAU	% of Lynx Habitat in LAU
Winter Foraging (NFS, not incl. Den.)	8,757.0	26.14
Denning (NFS)	11,394.05	34.01
Other (NFS)	13,346.38	39.84
Currently Unsuitable (NFS)	19,127.98	57.1
Total Year-Round Foraging Habitat[a] (NFS)	20,151.05	60.16
Total Lynx Habitat[b] (NFS)	**33,497.43**	**28.57[c]**
Non-Habitat (NFS)	44,994.41	38.38[d]
USFS Acres in LAU	97,673.39	83.31
Private Acres in LAU	19,561.63	16.69
Total Acres in LAU	**117,235.02**	**-**

[a] Total Year-Round Foraging Habitat = WFH + Denning.
[b] Total Lynx Habitat = WFH + Denning + Other + Unsuitable.
[c] % of LAU that is lynx habitat.
[d] % of total LAU acreage.

Camp Hale LAU

The remainder of the Project Area is located within the Camp Hale LAU. The Camp Hale LAU encompasses 68,325 acres east of Highway 24, including Vail Ski Area's back bowls. Other boundaries of this LAU include the hydrologic divide running north-south between the upper Eagle River and Tenmile Creek drainages on the east, the hydrologic divide running east-west between the Gore Creek and Two Elk Creek drainages on the north, and upper Eagle River headwaters north of the Continental Divide on the south. The Camp Hale LAU does not contain any designated wilderness, but it does contain major snow compaction areas associated with portions of Vail and Ski Cooper ski areas, Camp Hale, and the Vail Pass Winter Recreation Area. Camp Hale LAU statistics are provided in Table 3F-4.

Table 3F-4:
Current Environmental Baseline Status of Lynx Habitat in the Camp Hale LAU

Lynx Habitat Description	Acres of Lynx Habitat in LAU	% of Lynx Habitat in LAU
Winter Foraging (NFS, not incl. Den.)	13,469.54	35.34
Denning (NFS)	5,253.8	13.78
Other (NFS)	3,745.91	9.83
Currently Unsuitable (NFS)	15,644.81	41.05
Total Year-Round Foraging Habitat[a] (NFS)	18,723.34	49.12
Total Lynx Habitat[b] (NFS)	**38,114.06**	**55.78[c]**
Non-Habitat (NFS)	21,911.02	32.07[d]
USFS Acres in LAU	47,210.13	69.1
Private Acres in LAU	21,116.02	30.90
Total Acres in LAU	**68,326.15**	**-**

[a] Total Year-Round Foraging Habitat = WFH + Denning.
[b] Total Lynx Habitat = WFH + Denning + Other + Unsuitable.
[c] % of LAU that is lynx habitat.
[d] % of total LAU acreage.

Region 2 Sensitive Species

R2 sensitive species represent those that are declining in number or occurrence or whose habitat is declining, either of which could lead to federal listing if action is not taken to reverse the trend, and species whose habitat or population is stable but limited. From the updated R2 animal list, a subset of species, including one insect, five fish, two amphibians, seventeen birds, and nine mammals (refer to Table 3F-5), was determined to be present or potentially present on the WRNF. The North American wolverine was proposed for listing under the Endangered Species Act on February 4, 2013, and is thus addressed above under Threatened, Endangered and Proposed Species. Only those species that are present or potentially present are considered in this analysis.

Table 3F-5:
Region 2 Sensitive Animal Species that Occur on the WRNF and their Potential Occurrence in the Project Area

Common name, *Scientific name*	Rationale for Potential Project Effects (Habitat Affinity)
INSECTS	
Great Basin silverspot, *Speyeria nokomis nokomis*	No habitat (Wetlands supporting violet populations)
FISH	
Roundtail chub, *Gila robusta robusta*	No suitable habitat (CO River up through Glenwood Canyon)
Mountain sucker, *Catostomus platyrhynchus*	No suitable habitat (small to medium streams below 7000'; 4 populations documented on the Rifle and Blanco Districts)
Bluehead sucker, *Catostomus discobolus*	No suitable habitat (CO River up to Alkali Creek)
Flannelmouth sucker, *Catostomus latipinnis*	No suitable habitat (CO River & larger tribs.)
Colorado River cutthroat trout, *Oncorhynchus clarkii pleuriticus*	Present (Isolated, headwater streams and lakes)

Table 3F-5:
Region 2 Sensitive Animal Species that Occur on the WRNF and their Potential Occurrence in the Project Area

Common name, *Scientific name*	Rationale for Potential Project Effects (Habitat Affinity)
AMPHIBIANS	
Boreal western toad, *Anaxyrus boreas boreas*	Potential breeding habitat (Subalpine marshes and wet meadows; ponds, margins of streams; 8,500 to 11,000')
Northern leopard frog, *Lithobates pipiens*	Outside range (Permanent wetlands)
BIRDS	
Northern goshawk, *Accipiter gentilis*	Potential habitat (Closed montane forests > 7,500')
Northern harrier, *Circus cyaneus*	No habitat (Grasslands, agricultural lands, marshes, & alpine)
Ferruginous hawk, *Buteo regalis*	No habitat (Plains, grasslands)
American peregrine falcon, *Falco peregrinus anatum*	Potential habitat (Cliffs, habitats concentrating/exposing vulnerable prey)
Bald eagle, Haliaeetos leucocephalus	No habitat (Open water bodies, big game winter range)
White-tailed ptarmigan, *Lagopus leucurus*	No habitat (Alpine habitat and upper elevation willow stands)
Greater sage grouse, *Centrocercus urophasianus*	No habitat (Sagebrush)
Columbian sharp-tailed grouse, *Tympanuchus phasianellus columbianus*	No habitat (Sagebrush and mountain shrub)
Flammulated owl, *Otus flammeolus*	Potential Habitat (Old-growth ponderosa pine and aspen)
Boreal owl, Aegolius funereus	Present (Mature spruce-fir & mixed conifer)
Black swift, *Cypseloides niger*	No local nesting habitat (Waterfalls, cliffs)
Lewis' woodpecker, *Melanerpes lewis*	No habitat (Ponderosa pine and cottonwoods)
Olive-sided flycatcher, *Contopus cooperi*	Present (Open, upper elev. conifer forests)
Loggerhead shrike, *Lanius ludovicianus*	No habitat (Plains, low valleys, shrublands)
Purple martin, *Progne subis*	No habitat (Old-growth aspen)
Brewer's sparrow, *Spizella breweri*	No habitat (Sagebrush and other structurally similar shrublands)
Sage sparrow, *Amphispiza belli*	No habitat (Low elevation big sagebrush and sage/greasewood)
MAMMALS	
Pygmy shrew, *Microsorex hoyi montanus*	Potential habitat (Variety of subalpine habitats)
Fringed myotis, *Myotis thysanodes*	No habitat (Forests/woodlands to 7,500'; unknown on WRNF
Hoary bat (Lasiurus cinereus)	Potential habitat (Including mixed conifer and lodgepole pine forest)
Spotted bat, *Euderma maculatum*	No habitat (Cliffs, arid terrain)
Townsend's big-eared bat, *Corynorhinus townsendii townsendii*	No habitat (Structures, tree cavities < 9,500')
American marten, *Martes americana*	Present (Conifer forests)
North American wolverine, *Gulo gulo luscus*	Potential travel habitat (Mountains)
River otter, *Lontra canadensis*	No habitat (Year-round open water and streamflows of ≥ 10 cfs
Rocky Mountain bighorn sheep, *Ovis canadensis canadensis*	No habitat (High visibility habitat near escape terrain)

Note: Other R2 species are not listed because they have not been found on the WRNF, they have no affinities to Project Area habitats, the Project Area is outside of the species' range or elevational distribution. Potential pre-field survey occurrence on the Project Area, potential for project effects, and habitat affinity is summarized for each species. Species in **bold** are potentially present and/or are discussed in the text. Wildlife are listed phylogenetically.

Colorado River Cutthroat Trout

Colorado River cutthroat trout (CRCT, *Oncorhynchus clarkii pleuriticus*) are adapted to clear, cold, well-oxygenated streams and lakes, which are devoid of introduced trout. In general, habitat requirements of this subspecies are similar to those of other cutthroat trout. The decline of genetically pure, native Colorado River cutthroat populations was caused by massive introductions of non-native trout. Brook and brown trout introductions have caused competitive displacement. In streams, CRCT are quite susceptible to angling pressure and are at a disadvantage when competing with other species of trout that are more difficult to catch. However, non-native trout have displaced even unexploited populations of these cutthroats. In other areas, habitat destruction, toxic mine wastes, water diversions, logging, road building, and overgrazing have adversely affected this subspecies. Whirling disease, a parasitic infection of trout and salmon caused by a microscopic amoeba has not been identified in any wild populations of CRCT. Genetic purity of this subspecies is graded A (most pure) through F (least pure), designating various degrees of hybridization. Pure grades are found only in a few, small, isolated headwater streams in northwest Colorado. Additional general background information and habitat characterizations can be found in the project file.

CRCT are found only within limited areas across their historic range, mainly within headwater streams or lakes isolated from lower reaches by impassable barriers to upstream fish movement. This isolation, particularly in small areas of watersheds, decreases the probability that native cutthroat populations will persist over time. On occasion, they are found downstream of where isolated populations persist, mixed with other non-native salmonid species. A recently completed status assessment for CRCT suggests that CRCT occupy only 14 percent of their former range, while only 8 percent of its former range is currently occupied with “conservation populations” of CRCT. These conservation populations listed in the CRCT Conservation Assessment and Strategy are those that are a naturally reproducing and recruiting populations with genetic material which is less than 10 percent hybridized with other species or sub-species. Core conservation populations are assigned to CRCT populations believed to be greater than 99 percent pure.

CRCT have been documented in two of three streams that flow through the ski area boundary. Both Mill Creek and Two Elk Creek have had CRCT captures in 2002 and 2003, respectively. However, since these surveys, cutthroat trout have not been recaptured in either of these streams. CRCT have not been documented in Game Creek. Fish have not been captured in Mill Creek since 2002, and Game and Two Elk Creeks are dominated by non-native brook trout. MIS trout are discussed further below.

Boreal Western Toad and Northern Leopard Frog

The boreal western toad (*Anaxyrus boreas boreas*) inhabits marshes, wet meadows, and the margins of streams, beaver ponds, lakes, and glacial kettle ponds between 7,000 and 11,860 feet in Colorado. They may be active both day and night, hiding beneath rocks, logs, or in rodent burrows when inactive. These toads emerge from winter chambers during May and begin moving back to the hibernaculum in late

August and early September. By October, most toads have entered hibernation. Breeding begins in late spring as the winter snow pack recedes.

Although this toad was once widespread in Colorado's mountains, and while suitable habitat is still widespread, this species has declined in recent years, with chytrid fungus (*Batrachochytrium dendrobatidis)* thought to be the primary agent.

There are five known, extant boreal toad breeding sites in the vicinity of the Project Area. One is within the 1.5-mile radius dispersal distance of some project component areas considered for analysis areas on the WRNF. This population is established along the banks of Gore Creek in East Vail. The breeding habitat includes a large pond and beaver created wetlands. While this population is in within dispersal distance of the Project Area, there are geographical migration barriers that disconnect the population from project component areas. It is highly unlikely that individuals dispersing from the East Vail population would cross into the Project Area boundary.

Wetland and breeding habitat for boreal toads is extremely limited within the ski area boundary and project component areas. Habitat is limited to narrow riparian corridors along streams and one pond located in Commando Bowl at the top of the Two Elk watershed. USFS and Colorado Natural Heritage Program (CNHP) survey teams have conducted multiple amphibian surveys in the upper Two Elk Creek watershed in Commando Bowl. The most recent surveys were conducted in 2011 and 2013, in which only tiger salamanders were detected. Tiger salamanders are predatory on both northern leopard frog and boreal toad eggs and tadpoles. Similar habitats have been surveyed across the Eagle/Holy Cross Ranger District and in all cases where tiger salamanders have been documented neither northern leopard frog or boreal toads have been documented.

Since 2003, USFS biologists have conducted extensive surveys for amphibians across the Eagle/Holy Cross Ranger District. To date, northern leopard frogs (*Lithobates pipiens*) have not been documented on the Eagle/Holy Cross Ranger District. In Eagle County, leopard frogs have a very limited distribution based on only a few historical records. The most recent observation of northern leopard frogs in Eagle County is from a 1996 record on the Colorado River approximately 3.5 km north of Dotsero near the Garfield County border. Northern leopard frogs are being dropped from further analysis based on current and historic occurrence data.

Northern Goshawk

Goshawks (*Accipiter gentilis*) are a forest-interior species generally associated with mature aspen and conifer forests between 7,500 and 11,300 feet on the WRNF. Goshawks nest in mature to old-growth aspen and mixed aspen and coniferous forests with a depauperate understory on gently sloping north or east aspects near the bottom of stream courses.

There are no known goshawk nests or effective nesting habitat associated with the Project Area. However, some habitats within the Project Area support potential goshawk prey species (e.g., snowshoe hare and red squirrel) and those habitats could be within a local pair's large hunting territory.

American Peregrine Falcon

Peregrine falcons (*Falco peregrinus anatum*) generally occur on the Forest as rare breeders and as uncommon, non-nesting migrants. The number of peregrines nesting in Colorado and summering on the Forest has been increasing. Based on recent bird atlas work, there are an estimated 236 breeding pairs of peregrines in Colorado.

Viable peregrine nesting sites possess two components: (1) adequate nesting habitat, and (2) extensive hunting habitat with an adequate prey base to support the adults and their offspring. Nesting sites are located on precipitous cliffs ranging in height from 40 to 2,100 feet, averaging 200 to 400 feet tall. All habitats within the 10-mile radius need not be considered essential habitat, since only those areas that attract or support peregrine prey need be protected or enhanced. Any habitat that supports or concentrates birds should be considered essential to locally nesting peregrines.

There are two active peregrine eyries within 10 miles of the Project Area. It is unknown, but likely, that birds from at least one of these eyries forage over portions of the Project Area.

Flammulated Owl

Apparently secure in Colorado, the flammulated owl (*Otus flammeolus*) is now thought to occur more widely than previously thought. Statewide levels of flammulated owls are estimated at between 1,807 and 5,009 breeding pairs. Summer breeding has been confirmed in Eagle County. On the WRNF, flammulated owls have been found in several locations using pure aspen stands and aspen-conifer stands. Most likely, the Forest is only used during the breeding season, with individuals migrating off the forest for the winter.

These owls occur regularly from 6,000 to 10,000 feet elevation and prefer old growth (> 200 years) or mature (> 150 years) ponderosa pine and ponderosa pine/Douglas-fir forests, often mixed with mature aspen. In some areas, birds occur in pure aspen. Key habitat features seem to be the presence of larger trees and snags, scattered clusters of shrubs or saplings, clearings, and a high abundance of nocturnal arthropod prey. Moths, beetles, grasshoppers, crickets, and caterpillars are also food items. These birds arrive in Colorado from Central America in late April to early May and lay two to three eggs in a woodpecker hole at the end of May and June. They nest in densities of two or more pairs per square mile. Young hatch in June and early July, and most young fledge by the end of July. The period when this species would be vulnerable to direct mortality of eggs and/or nestlings extends from June 1 to July 30. Most owls migrate from Colorado by early October.

Flammulated owls have not been detected during field surveys (some of which overlapped crepuscular hours) in and around the Project Area. However, no specific, taped, calling surveys have been conducted

because the only potential habitat for this species in the Project Area is limited to the Golden Peak area, where aspen stands are not as decadent as those this species is usually associated with in pure aspen. The Project Area does not support the ponderosa pine/Douglas-fir habitat association representing primary habitat that this species is associated with.

Boreal Owl

Boreal owls (*Aegolius funereus*) are rare to locally uncommon residents of Colorado's mountains, mainly above 9,000 feet. They inhabit mature and late-successional spruce-fir and spruce-fir/lodgepole pine forests interspersed with small meadows, streams, and wetlands. They prefer stands with a relatively high density of mature trees (≥ 12 in. dbh) with an open understory and multilayered canopy. Recent surveys in Colorado have shown that the species is widely distributed in suitable habitats, with records from most of the higher mountain ranges in the state.

Boreal owls are tolerant of human and machine noise. In Colorado, these owls have nested within 30 meters of a major highway. There is no evidence that human disturbance is an important factor in boreal owl nest loss or movements.

Boreal owls have been detected at Vail Ski Area in characteristic spruce-fir and mixed conifer habitat in Northeast Bowl and several Bowls in Blue Sky Basin. Boreal owls surveys have not been conducted for the action alternatives specifically, but they are assumed to be present in spruce-fir and mixed conifer habitats that would be affected by the action alternatives.

Olive-Sided Flycatcher

Olive-sided flycatchers (*Contopus cooperi*) are uncommon summer residents of higher Colorado mountains and migrants through lower elevations. In Colorado, they breed from 7,000 to 11,000 feet, primarily in dense, mature spruce-fir and Douglas-fir forests, especially on steep slopes or near cliffs, and less often in other coniferous forests, montane and foothill riparian forests, and aspen forests.

Olive-sided flycatchers have been detected in some portions of the Project Area, in spruce-fir habitat in Northeast Bowl and lodgepole habitat on the front side of Vail Mountain, although the latter habitat has since been affected by MPB and may no longer be occupied. Potential habitat in the Project Area consists of mature, closed canopy spruce-fir, mixed conifer, and intact (non-MPB affected) lodgepole pine habitat

Pygmy Shrew

Pygmy shrews (*Microsorex hoyi montanus)* are a species associated with the northern boreal forests of Canada and the northern United States. In Colorado, the three locations where this shrew has been captured represent a variety of habitats including spruce-fir and lodgepole pine forests, clearcuts and selectively logged forests, forest-meadow edges, boggy meadows, willow thickets, aspen-fir forests, and subalpine parkland. However, they are thought to occur primarily in spruce-fir and lodgepole pine forests,

where they are most abundant in mature and old-growth structural stages. Pygmy shrews are known to live in Eagle County within several miles of portions of the Project Area.

The pygmy shrew Analysis Area for this project extends outward to the furthest extent of any home range that could overlap the proposed disturbance areas. The existing Vail Ski Area SUP area boundary would contain virtually all potential impacts to pygmy shrews that could be affected by the action alternatives.

Hoary Bat

The hoary bat (*Lasiurus cinereus*) is a solitary species, roosting primarily among foliage in deciduous and coniferous trees, often along the edges of clearings. They have been observed in a number of forested cover types, including mixed conifer, lodgepole pine, ponderosa pine, pinyon-juniper, and riparian areas with cottonwood and willow. Hoary bats forage on a wide variety of insects, especially moths.

Because of this species' dependence on trees with foliage for summer roosts, insect, disease and large-scale disturbances, such as the current MPB epidemic, pose a substantial, imminent threat to hoary bat populations. The only known roost locations of hoary bats in R2 were in live lodgepole pine trees, and the individuals located in that study preferred trees that were larger and had greater canopy cover than random. The MPB epidemic in R2 has killed more than 3 million acres of pine forests, decreasing the quality and quantity of this vital roosting habitat. Forest lands in R2 are often surrounded by unsuitable roosting habitat, so forests likely provide important roosting opportunities across the Region.

Hoary bats are either known to occur or are likely to occur on all of the Forest and Grassland units in the Region. The species has been documented on the WRNF and is considered in detail because of insufficient information on their distribution on the Forest. Because this species has been detected on the Forest within some of the habitat types present in the Project Area and because the Project Area is within the species' known elevational and general distribution, the species and its habitat will be considered to be potentially present in the Analysis Area.

The hoary bat Analysis Area for this project extends outward from the Project Area to the furthest extent of any nocturnal foraging range that bats roosting in the Project Area might use. Based on nightly foraging ranges of other similar bats, the hoary bat Analysis Area could extend several miles beyond proposed disturbance areas.

American Marten

American martens (*Martes americana*) are well distributed across the WRNF in suitable habitats in mid- to upper elevation zones. Although they are most commonly observed in spruce-fir forests, they are occasionally seen in lower-elevation, mixed-conifer forests. Marten are present in the Project Area, most common in spruce-fir and upper elevation mixed conifer stands, but also occasionally extending into the lodgepole pine zone.

The American marten Analysis Area for this project extends outward from the Project Area to the furthest extent of any marten home range that could overlap the action alternative disturbance areas. Therefore, the marten Analysis Area could extend approximately 1 mile beyond the Project Area.

Management Indicator Species

The Forest Service has identified MIS to provide a means to monitor selected issues on the Forest as required by regulation.[76] MIS are those whose response to management activities can be used to predict the likely response of a larger group of species with similar habitat requirements. In addition, selected MIS should be those whose change in population would be directly attributable to the management action. MIS are meant to be a Forest-wide issue and MIS trends are to be evaluated at the Forest-wide scale. Analysis-level activities are evaluated in relation to how they affect Forest-wide population and habitat trends.

As indicated in Table 3F-6, three MIS are considered in detail in this analysis.

Table 3F-6:
WRNF MIS and Their Potential to Occur in Habitats Affected by the Action Alternatives

MIS Species	Habitat Occupied by Species? Are species and habitat present in the Analysis Area?	Will Proposed Action affect (direct, indirect, or cumulative) the species or its habitat?
Elk	Wide range of forest and non-forest habitats Species Presence: Yes Habitat Presence: Yes	Species - Alternative 1: No; Alternatives 2 and 3: Yes Habitat - Alternative 1: No; Alternatives 2 and 3: Yes
Cave Bats	Caves, abandoned mines Species Presence: No Habitat Presence: No	Species - No Habitat - No Project will not affect any cave resources or this species group.
American Pipit	Alpine Grassland Species Presence: No Habitat Presence: No	Species - Alternatives 1–3: No Habitat - Alternatives 1–3: No Project would not affect alpine grassland or this species.
Brewer's Sparrow	Sagebrush Species Presence: No Habitat Presence: No	Species - Alternatives 1–3: No Habitat - Alternatives 1–3: No Project would not affect sagebrush habitats or this species.
Virginia's Warbler	Dense Shrub Habitats Species Presence: No Habitat Presence: No	Species - Alternatives 1–3: No Habitat - Alternatives 1–3: No Project would not affect shrub habitat types or this species.

[76] 36 CFR 219.19

Table 3F-6:
WRNF MIS and Their Potential to Occur in Habitats Affected by the Action Alternatives

MIS Species	Habitat Occupied by Species? Are species and habitat present in the Analysis Area?	Will Proposed Action affect (direct, indirect, or cumulative) the species or its habitat?
Aquatic Macroinvertebrates	Perennial streams, intermittent streams, lakes and reservoirs Species Presence: Yes Habitat Presence: Yes	Species - Alternative 1: No; Alternatives 2 and 3: Yes Habitat - Alternative 1: No; Alternatives 2 and 3: Yes
All Trout (brook, brown, rainbow, CR cutthroat)	Perennial streams and lakes Species Presence: Yes Habitat Presence: Yes	Species - Alternative 1: No; Alternatives 2 and 3: Yes Habitat - Alternative 1: No; Alternatives 2 and 3: Yes

Note: Species in **bold** are project MIS.

American Elk

Rocky Mountain elk inhabit the central and northern Rocky Mountains, including western Canada, south through eastern Oregon and Washington, Idaho, western Montana, Wyoming, Colorado, Utah, Nevada, New Mexico and Arizona. Colorado supports the largest elk population of any state or province where they range over much of the western two-thirds of the state. Elk range over most of the WRNF and use essentially all habitats.

The elk was chosen as a MIS by the WRNF to serve as an indicator of forest management on big game and other wildlife species sensitive to the impacts of recreation and travel management at a Forest-wide scale. Elk were selected as a project-level MIS for this project because they are seasonally present, not because of any viability concerns. There is not a viability concern for this species on the WRNF, viability is not expected to become a concern through implementation of this project or continued implementation of the Forest Plan, and viability of this MIS will not be addressed further in this document. The elk analysis areas considered herein includes the Project Area, the furthest home ranges of elk seasonally overlapping the Project Area (generally Eagle County), and the WRNF.

The Project Area is located in CPW Data Analysis Unit (DAU) E16, which covers approximately 1,378 square miles, of which 1,043 acres (76 percent) are on the WRNF. It forms a rough triangle between Glenwood Springs, Aspen and the Town of Vail. No major towns are found within the interior of the DAU, but several towns exist along its boundaries. The Hunter Frying Pan and the Holy Cross Wildernesses are found inside this DAU. Approximately 40 percent of the winter range for this herd is on the WRNF. The remainder is on BLM and private lands. The private lands on the north and west portions of the DAU are primary and secondary resort communities. Much of the winter range on private land in the Eagle Valley is under heavy development pressure.

Elk and deer migrate in a general east-west direction across most areas of Vail Ski Area during spring and fall. Most migratory movements across the front side of Vail Mountain coincide with the "mud seasons" when little recreational activity is occurring on the mountain Low numbers of deer persist throughout the Project Area during summer. Some elk use some portions of the Project Area during summer.

Aquatic Macroinvertebrates

Because of their wide distribution and their sensitivity to disturbance and pollutants, aquatic macroinvertebrates are widely used to monitor the health of streams and rivers. On the WRNF, aquatic macroinvertebrates were selected to address trend and condition of flowing waters only. Therefore, macroinvertebrates in still water habitats will not be discussed further in this document. This group was not chosen as a MIS because of any viability concerns, and there is not a viability concern for this species on the WRNF. The aquatic macroinvertebrate analysis areas for this project include those streams on NFS lands (on-site and off-site) draining the Project Area that could be affected by sediments and flows resulting from the implementation of proposed alternatives 2 and 3 components. This includes Mill Creek, Two Elk Creek, and Game Creek. Information about baseline stream health can be found in Chapter 3, Section H – Watershed and Wetlands and the MIS Report in the project file.[77] An overview of Analysis Area stream health is presented below.

One sampling location on Mill Creek indicated an overall *at-risk* stream health rating for macroinvertebrate communities with three of six metrics scoring *robust*, two showing *at-risk* (impaired) values, and one showing *diminished* values. The other two sampling locations on Mill Creek scored *robust* for four of six macroinvertebrate metrics, indicating overall *robust* macroinvertebrate community metrics at these sites. It appears that fine sediment may be affecting macroinvertebrate communities at along Mill Creek.

When compared to reference sites, Two Elk Creek scored *robust* for macroinvertebrate community metrics indicating overall *robust* biological stream health. Percent fine sediment measurements indicated *robust* physical habitat in all sampling events.

Game Creek was the most impaired of the three Analysis Area streams indicating *diminished* stream health conditions for both biological and physical habitat attributes. All sampling events indicated *diminished* conditions for percent fine sediment and the macroinvertebrate community metrics supported this data. All three macroinvertebrate samples indicated *diminished* and *at-risk* conditions across most community metrics, suggesting that fine sediment is limiting communities in this reach.

All site samples in the project area were in attainment of aquatic life standards according to the CDPHE Water Quality commission's macroinvertebrate multimetric index (MMI) standards for mountain biotype

[77] Thompson, 2014

streams. The section of Gore Creek which receives streams that flow off the front side of Vail Mountain is listed for impairment for aquatic life standards under the Clean Water Act, Section 303(d). The segment flows from the confluence with Black Gore Creek to the confluence of the Eagle River and is heavily influenced by urbanization from the Town of Vail. Impacts include unmanaged and untreated storm water, waste water treatment effluent, golf courses, loss of riparian habitat, loss of floodplain, and other urban development. It does not appear at this time that sediment is a limiting factor or source of degradation in Gore Creek. Sampling stations located on USFS land upstream of this segment, and tributaries that flow into this segment meet attaining MMI scores. Again, urban development and influence begins just below the Forest boundary and appears to be the main source of degradation in this reach.

All Trout (Brook, Brown, Rainbow, and Colorado River Cutthroat)

Total trout (including brook [*Salvelinus fontinalis*], brown [*Salmo trutta*], rainbow [*Oncorhynchus mykiss*], Colorado River cutthroat trout [*O. clarkii pleuriticus*], and their hybrids, hereinafter MIS trout, or trout) density, or the number of all trout individuals per 100 meters of stream, is an MIS, and a useful measure of habitat quality. Decreased habitat quality can result from changes in channel morphology and increased sedimentation. Fall spawning fish (brook and brown trout) can be affected by water depletions when eggs are in the gravels. Egg mortality can result from flow reductions dewatering egg deposition areas and increasing anchor ice occurrence. This group was not chosen as a MIS because of any viability concerns, and there is not a viability concern for this MIS group on the WRNF (with the exception of CRCT). The all trout analysis areas for this project include those streams on NFS lands (on-site and off-site) draining the Project Area that could be affected by sediments and flows resulting from the implementation of proposed Alternative 2 and 3 components. This includes Two Elk Creek, Mill Creek, and Game Creek. Information about baseline stream health can be found in Chapter 3, Section H – Watershed and Wetlands and the MIS Report in the project file.[78] An overview of Analysis Area fish populations is presented below.

The overall trend of the fish population at the Two Elk MIS site is stable, indicating no strong increasing or decreasing trends. Movements of trout from Gore Creek upstream to lower Mill Creek are likely limited by natural and artificial physical barriers. Temperature data also suggests that Mill Creek is too cold for successful trout recruitment. The data suggests that Mill Creek is extremely limited and/or cannot support successful cutthroat trout reproduction. The fish survey in Game Creek suggested a high population estimate in a shortened reach length due to brook trout spawning periods. Although Game Creek is in a *diminished* physical stream health condition for fine sediment and an *at-risk* stream health condition for aquatic macroinvertebrates, fine sediments do not appear to be limiting the fish population

[78] Ibid.

at the time of survey. Survey results indicated a well distributed age class with a strong young of the year age class represented. No other fish sampling has been performed in Game Creek to establish trend.

Migratory Birds

In 2008, the Forest Service Chief signed a MOU (#08-MU-1113-2400-264) with the USFWS to promote the conservation of migratory birds. This MOU was pursuant to Executive Order 131866, Responsibilities of Federal Agencies to Protect Migratory Birds. The Executive Order directs agencies to take certain actions to further comply with the migratory bird conventions, the Migratory Bird Treaty Act (MBTA), the Bald and Golden Eagle Protection Act (BGEPA) and other pertinent statutes. The purpose of the MOU is to strengthen migratory bird conservation by identifying strategies that promote conservation and avoid or minimize negative impacts on migratory birds. The MOU outlines that the Forest Service shall evaluate the effects of agency actions on migratory birds within the NEPA process, with a focus on species of management concern along with their priority habitats and key risk factors.

This section considers migratory bird species that have been identified as candidates for conservation priority by at least one of the following five lists: (1) the Service Birds of Conservation Concern list for the Southern Rockies/Colorado Plateau Bird Conservation Region 16; (2) Colorado Partners in Flight Bird Conservation Plan for the Southern Rocky Mountains Physiographic Area (Area 62); (3) the Colorado State Threatened and Endangered list; (4) species designated as Sensitive by the U.S. Forest Service Rocky Mountain Region; (5) species listed under the federal Endangered Species Act; and (6) species designated as MIS on the WRNF. Table 3F-7 lists migratory birds that have been identified as candidates for conservation priority.

Table 3F-7:
Migratory Bird Species That Have Been Identified as Candidates for Conservation Priority

Analysis Group	Species
Riparian/wetlands	American Bittern, **American dipper**, bald eagle, black swift, **cordilleran flycatcher**, **lazuli bunting**, MacGillivray's warbler, **mallard**, **northern harrier**, short-eared owl, southwestern willow flycatcher, willet, Wilson's phalarope, **Wilson's warbler**, western yellow-billed cuckoo
Snag & Cavity Dependent	**American three-toed woodpecker**, **boreal owl**, **flammulated owl**, **hairy woodpecker**, Lewis's woodpecker, **mountain bluebird**, red-naped sapsucker, violet-green swallow, Williamson's sapsucker
Ponderosa Pine	**Band-tailed pigeon**, Grace's warbler, Merriam's turkey, **northern goshawk**
Pinyon-Juniper	Black-throated gray warbler, gray vireo, pinyon jay
Mixed-conifer	**Dusky grouse**, **Hammond's flycatcher**, Mexican spotted owl
Sagebrush	Brewer's sparrow, ferruginous hawk, Gunnison sage grouse, loggerhead shrike, sage sparrow
Mountain Shrub	**Broad-tailed hummingbird**, Columbian sharp-tailed grouse, green-tailed towhee, Virginia's warbler
Rock/cliff	**Golden eagle, peregrine falcon**, prairie falcon
Alpine Tundra	American pipit, brown-capped rosy finch, white-tailed ptarmigan

Table 3F-7:
Migratory Bird Species That Have Been Identified as Candidates for Conservation Priority

Analysis Group	Species
Aspen	Purple marten
Grasslands	Ferruginous hawk, Swainson's hawk, western burrowing owl

Note: Species in **bold** may occur in the Project Area.

Additionally, the USFWS developed a list of birds of conservation concern based on Bird Conservation Regions (BCR; refer to Table 3F-8). There are 37 BCRs in North America with four of these occurring at least partially in Colorado. The Project Area occurs within the Southern Rockies Colorado Plateau BCR 16, which encompasses portions of Colorado, New Mexico, Arizona, Utah, and Wyoming.

Table 3F-8:
USFWS Birds of Conservation Concern for BCR 16

Species	General Habitat	Occurrence in Project Area
Northern Harrier	Grasslands	Possible rare fall migrant
Swainson's Hawk	Grasslands	No
Ferruginous Hawk	Prairie	No
Golden Eagle	Cliffs/grasslands	Yes Project Area part of large hunting range; no local nests
Peregrine Falcon	Cliffs	Yes Project Area may be part of large hunting range; two local eyries
Prairie Falcon	Cliffs	No
Gunnison sage-grouse	Sagebrush	No
Snowy Plover	Shorelines	No
Mountain Plover	Prairie	No
Solitary Sandpiper	Shorelines	No
Marbled Godwit	Wetlands	No
Wilson's Phalarope	Waterbodies/Shorelines	No
Yellow-billed Cuckoo	Deciduous Riparian	No
Flammulated Owl	Ponderosa pine/snags	Possible in some aspen stands
Burrowing Owl	Plains/grasslands	No
Short-eared Owl	Parks/grasslands	No
Black Swift	Waterfalls/wet cliffs	No
Lewis's Woodpecker	Riparian Cottonwood	No
Williamson's Sapsucker	Montane forests/snags	No
Gray Vireo	Oak woodlands/scrub	No
Pinyon Jay	Pinyon/Juniper	No
Bendire's Thrasher	Rare spp of arid areas	No
Crissal Thrasher	No records in CO.	No
Sprague's pipit	No records in CO.	No
Virginia's warbler	Riparian scrub	No
Black-throated gray warbler	Oak scrub/riparian	No
Grace's warbler	Ponderosa pine	No

Table 3F-8:
USFWS Birds of Conservation Concern for BCR 16

Species	General Habitat	Occurrence in Project Area
Sage sparrow	Sagebrush	No
Chestnut-collared longspur	Plains	No

Note: Species in **bold** may occur in the Project Area.

Other migratory birds are considered individually in this document as R2 sensitive species and MIS.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

The effects of alternatives 1, 2 and 3 on TEP, R2 Sensitive and MIS are summarized in tables 3F-9 and 3F-10.

Table 3F-9:
Determinations Summary of Effects on TEP Animal Species

Common and Scientific Name	Determination by Alternative[a]		
	1	2	3
Canada lynx, *Lynx canadensis*	NE	NLAA	NLAA

[a] Determinations are NE = "No effect," NLAA = "May affect, not likely to adversely affect," NLJ = "Not likely to jeopardize," and LAA = "May affect, likely to adversely affect."

Table 3F-10:
Determinations Summary of Effects on R2 Sensitive Animal Species

Common and Scientific Name	Determination by Alternative[a]		
	1	2	3
INSECTS			
Great Basin silverspot, *Speyeria nokomis nokomis*	NI	NI	NI
FISH			
Roundtail chub, *Gila robusta*	NI	NI	NI
Mountain sucker, *Catostomus platyrhynchus*	NI	NI	NI
Bluehead sucker, *Catostomus discobolus*	NI	NI	NI
Flannelmouth sucker, *Catostomus latipinnis*	NI	NI	NI
Colorado River cutthroat trout, *Oncorhynchus clarkii pleuriticus*	NI	MAII	MAII
AMPHIBIANS			
Boreal western toad, *Anaxyrus boreas boreas*	NI	MAII	MAII
Northern leopard frog, *Lithobates pipiens*	NI	NI	NI
BIRDS			
Northern goshawk, *Accipiter gentilis*	NI	MAII	MAII
Northern harrier, *Circus cyaneus*	NI	NI	NI
Ferruginous hawk, *Buteo regalis*	NI	NI	NI

Table 3F-10:
Determinations Summary of Effects on R2 Sensitive Animal Species

Common and Scientific Name	Determination by Alternative[a]		
	1	2	3
American peregrine falcon, *Falco peregrinus anatum*	NI	MAII	MAII
Bald eagle, Haliaeetos leucocephalus	NI	NI	NI
White-tailed ptarmigan, *Lagopus leucurus*	NI	NI	NI
Greater sage grouse, *Centrocercus urophasianus*	NI	NI	NI
Columbian sharp-tailed grouse, *Tympanuchus phasianellus columbianus*	NI	NI	NI
Flammulated owl, *Otus flammeolus*	NI	MAII	MAII
Boreal owl, *Aegolius funereus*	NI	MAII	MAII
Black swift, *Cypseloides niger*	NI	NI	NI
Lewis' woodpecker, *Melanerpes lewis*	NI	NI	NI
Olive-sided flycatcher, *Contopus cooperi*	NI	MAII	MAII
Loggerhead shrike, *Lanius ludovicianus*	NI	NI	NI
Purple martin, *Progne subis*	NI	NI	NI
Brewer's sparrow, *Spizella breweri*	NI	NI	NI
Sage sparrow, *Amphispiza belli*	NI	NI	NI
MAMMALS			
Pygmy shrew, *Microsorex hoyi montanus*	NI	MAII	MAII
Fringed myotis, *Myotis thysanodes*	NI	NI	NI
Hoary bat, Lasiurus cinereus	NI	MAII	MAII
Spotted bat, *Euderma maculatum*	NI	NI	NI
Townsend's big-eared bat, *Corynorhinus townsendii townsendii*	NI	NI	NI
American marten, *Martes americana*	NI	MAII	MAII
North American wolverine, *Gulo gulo luscus*	NI	NI	NI
River otter, *Lontra canadensi*s	NI	NI	NI
Rocky Mountain bighorn sheep, *Ovis canadensis canadensis*	NI	NI	NI

[a] Determinations are NI = No impact; BI = Beneficial impact; MAII = may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.
Note: Other R2 sensitive animals are not listed because they have not been found on the WRNF, they have no affinities to habitats on the Project Area, the Project Area is outside of the species' range or elevational distribution, and the Proposed Action would have no impact on those species. Species in **bold** are potentially present and/or are discussed individually in the text. Wildlife are listed phylogenetically. Determinations in this table only consider NFS lands that may be directly, indirectly, or cumulatively affected by the action alternatives, which R2 species determinations are based on.

Alternative 1 – No Action

The No Action Alternative reflects a continuation of existing operations and management practices without changes, additions, or upgrades of the existing conditions on NFS land (other than those previously approved). No new facilities or recreational opportunities would be approved under the No Action Alternative.

As indicated in tables 3F-9 and 3F-10, there would be no impacts to TEP or R2 Sensitive species under Alternative 1. Likewise, there would be no effects to MIS as a result of selection of Alternative 1. Additional information on the effects determinations for species under Alternative 1 can be found in the BA and BE, contained in the project file.

Alternative 2 – Proposed Action

Threatened, Endangered, and Proposed Species

Canada Lynx

Alternative 2 would be consistent with all applicable Southern Rockies Lynx Amendment (SRLA) management direction.[79] Up to 51 acres of habitat would have the majority of their current values permanently converted, largely into facilities and disturbed areas. Most of this habitat conversion would occur on NFS lands (approximately 98 percent). Because most of the disturbance acreage (36 acres) is associated with proposed hiking/biking trails on the front side of Vail Mountain that have only been conceptually located within disturbance polygons, it is unknown precisely what habitat types, structural stages, and lynx habitat types would be affected by those trails. Known Alternative 2 habitat type, structural stage, and lynx habitat type disturbance acreage would total 15 acres. Assuming the proposed trails are located proportionally to the distribution of lynx habitat types in the Project Area, approximately 45 percent of the 36 acres of trail disturbances would affect non-habitat, while up to 7.5 acres of forest habitat modifications would affect an unknown amount of currently unsuitable, winter foraging, and "other" lynx habitat.

Modifications to lynx habitat types would have barely discernable changes on lynx habitat statistics in the Eagle Valley and Camp Hale LAUs. With Alternative 2, modifications to currently unsuitable habitat would remain unchanged at approximately 57 percent and 56 percent for the Eagle Valley and Camp Hale LAUs, respectively. This would be consistent with Southern Rockies Lynx Management Direction applicable to ski areas.

Alternative 2 would result in incremental traffic increases on I-70 through the Vail Pass and Dowds Junction lynx linkages. However, considering baseline traffic volumes, the effects of those traffic increases on lynx would be insignificant and discountable. Proposed Alternative 2 project components are not expected to result in any increased skier use of undeveloped habitat blocks outside of the currently dissected portion of the ski area that could have further adverse effects on the lynx prey base, lynx DSH, habitat connectivity, or lynx home range efficacy.

Even considering the collective habitat losses, land use, and human activity within the Eagle Valley and Camp Hale LAUs, including considerable recent losses associated with the MPB epidemic, the additive loss of lynx habitat and disturbances associated with Alternative 2 are not considered to be adverse.

[79] USDA Forest Service, 2008

Alternative 2's collective effects on lynx foraging, sheltering, and breeding would not exceed the definitions of insignificant and discountable. Therefore, Alternative 2 warrants a "**may affect, not likely to adversely affect**" determination for Canada lynx.

Region 2 Sensitive Species

Colorado River Cutthroat Trout

Under Alternative 2, proposed trails, zip lines and temporary access routes would be constructed that could affect CRCT habitat in Mill Creek and Game Creek. Alternative 2 would cause short-term and permanent, localized, ground disturbing activities and increased runoff with potential to increase erosion, sedimentation, and local slope failures that could extend to local creeks and cause changes to the hydrology, aquatic habitat, and macroinvertebrate communities within Project Area streams. With respect to water quantity and hydrology, there would be 51 acres of additional temporary and permanently disturbed areas associated with proposed projects. The average yield increase for the Analysis Area watersheds would range from 0.20 to 0.63 percent. This modeled increase would be too small to be measurable and result in no negative effects. The action alternatives include a number of required, site-specific, watershed and aquatic resources management measures (refer to Table 2-1) that would be implemented to avoid, minimize, and mitigate negative project component effects to aquatic habitat within and below the Project Area that could alter aquatic faunal communities. Therefore, physical stream health is expected to maintain its current condition with no measurable effects.

The dominance of non-native trout in Project Area streams reduces the possibility that CRCT populations are present. Through the incorporation of PDFs specified in Table 2-1, CRCT habitat in the Project Area would remain in its current state with non-native trout dominating most of the available stream habitat. Some sedimentation would be expected, but with implementation of PDFs, would be considered short term in duration and not measurable. Therefore, Alternative 2 "**may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**" for Colorado River cutthroat trout and their habitat.

Boreal Western Toad

Alternative 2 project components would have no effect on any known or potential boreal toad breeding habitat, but could affect dispersing individuals. PDFs (refer to Table 2-1) are intended to eliminate to the extent possible any impacts to wetland/riparian habitat which would protect all potential breeding habitat found within the Project Area. There is still some risk of impacting dispersing individuals to these habitats during times of migration. However, this risk is considered minimal due to the fact that these species have not been documented in the Project Area, and no active or historic breeding sites have been documented. Suitable habitat does exist within or near the Project Area and therefore, these species could be affected by Alternative 2. As such, construction activity impacts (e.g., direct mortality of individuals in clearance areas and along access roads, direct effects) or impaired habitat connectivity via reduced forest

cover and maintenance vehicle-induced mortality along mountain roads (indirect effects) could impact individuals.

Alternative 2 "**may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**" for boreal western toads.

Northern Goshawk

Alternative 2 would affect goshawks by removing and fragmenting forest cover on NFS lands within the Project Area that supports potential prey species (e.g., snowshoe hare and/or red squirrel). No goshawk nests or nesting habitat associated with a known nesting block would be affected. PDFs (refer to Table 2-1) have been identified which would incrementally reduce the above direct effects on this species. Indirect effects (including secondary development, traffic generation, and dispersed recreation) associated with this project would have no impacts on goshawks.

Alternative 2 "**may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**" for northern goshawks.

American Peregrine Falcon

Temporary construction activity and increased summer recreational activities associated with Alternative 2 should have little negative effect on the availability of the local peregrine falcon prey base in the Project Area. The implementation of PDFs (refer to Table 2-1) should have no effect on peregrine habitat use. Indirect effects associated with this project (including secondary development, traffic generation, and dispersed recreation) would have no impacts on peregrine falcons. Alternative 2 would be consistent with Forest Plan standards related to peregrine falcons.

Alternative 2 "**may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**" for American peregrine falcons.

Flammulated Owl

Proposed biking trails bisecting and impacting 0.8 acre of mature aspen habitat on Golden Peak would affect suboptimal, but potential, flammulated owl foraging and nesting habitat. The implementation of PDFs (refer to Table 2-1) could minimize negative effects. Indirect effects associated with this project (including secondary development, traffic generation, and dispersed recreation) would have no impacts on flammulated owls.

Alternative 2 "**may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**" for flammulated owls.

Boreal Owl

Alternative 2 could affect boreal owls by removing linear forest strips, largely associated with hiking and biking trails, representing potential year-round foraging and nesting habitat, scattered throughout up to

several owl home ranges. Potential boreal owl habitat affected would total 7.3 acres. Because the habitat conversion would be so linear, it is unlikely that it would have any effect on home range configuration. The implementation of PDFs (refer to Table 2-1) could minimize negative effects to nest trees. If nest trees associated with active territories occur within impact areas during the construction season, direct mortality of eggs and/or nestlings would be avoided by conducting tree removal outside the May 21 to July 15 nesting period when eggs/young could be present. Given this species' primarily nocturnal habitat use, cavity nesting habit, the relatively small amount of subalpine and montane terrain that would be developed largely within the developed interior of the ski area (i.e., compared to the intact terrain that would remain outside of developed terrain), and tolerance to human disturbance, it is likely that all forested terrain in the Project Area currently suitable for boreal owls would continue to support this species. Indirect effects associated with this project (including secondary development, traffic generation, and dispersed recreation) extending into boreal owl habitat would have no impact on this species.

Alternative 2 **"may impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend toward federal listing**" for boreal owls.

Olive-Sided Flycatcher

Alternative 2 could affect olive-sided flycatchers by removing linear forest strips, largely associated with proposed hiking and biking trails and zip line corridors, representing potential summer foraging and nesting habitat, scattered throughout several flycatcher home ranges. Potential olive-sided flycatcher habitat affected would total 7.3 acres. Because the habitat conversion would be so linear, it is unlikely that it would have any effect on home range configuration. The implementation of PDFs (refer to Table 2-1) could minimize negative effects to nest trees. If nest trees associated with active territories occur within impact areas during the construction season, direct mortality of eggs and/or nestlings would be avoided by conducting tree removal outside the June 1 to July 15 nesting period when eggs/young could be present. It is likely that all forested terrain in the Project Area currently suitable for olive-sided flycatchers would continue to support them. Indirect effects associated with this project (including secondary development, traffic generation, and dispersed recreation) extending into olive-sided flycatcher habitat would have no impact on this species.

Alternative 2 "**may impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend toward federal listing**" for olive-sided flycatchers.

Pygmy Shrew

Alternative 2 could impact individual pygmy shrews through direct, construction-related mortality and/or loss of potential habitat. The Alternative 2 impact areas represent an insignificant proportion of the total potential range and habitat available to this species on the Forest. The probability that this species would be present in those potentially suitable habitats proposed for projects when it is so rare on the WRNF is unlikely. Indirect effects associated with this project (including secondary development, traffic generation, and dispersed recreation) would have no impact on this species.

Nevertheless, because potential pygmy shrew habitat would be removed and altered, Alternative 2 "**may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**" for pygmy shrews.

Hoary Bat

Alternative 2 could affect hoary bats by removing forest representing summer habitat possibly involving dozens of individuals. Foraging habitat may be improved along proposed zipline corridors by the increase in herbaceous and shrub vegetation that typically occurs after forest stands are opened up to more sunlight, which may increase prey abundance. These project effects to potential foraging and roosting habitat would occur within the relatively large potential home range of dozens of individuals. Hoary bats, if present, may be temporarily displaced by construction season project activities, but would be expected to return to suitable habitat once activities are complete. Direct impacts would be limited to the loss of foraging and roosting habitat. The impact areas represent an insignificant proportion of the total potential range and habitat available to this species on the WRNF. Indirect effects associated with this project (including secondary development and traffic generation) and limited to increases in dispersed recreation extending into hoary bat habitat would have no impact on this species. Hoary bats, if present now, would persist in the Analysis Area.

Alternative 2 "**may impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend toward federal listing**" for hoary bats.

American Marten

Alternative 2 would affect martens by removing linear forest strips, which represent foraging habitat and possible denning habitat, likely extending into portions of several individuals' home ranges. Virtually all of this forest cover loss would be associated with intertrail islands within currently developed ski terrain that support lower prey densities and that are less used by marten than large blocks of intact habitat unaffected by recreational activities outside of the developed ski area. No known marten dens are present within disturbance areas; however marten dens are virtually impossible to locate without the use of radio-collared animals. Young-of-the year would be vulnerable to den tree removal that occurred between approximately March 1 and June 15. Because denning selection, if not denning per se, generally begins before the ski season has ended, marten may not select den sites within areas currently used for tree skiing, although such diurnal skiing when martens are asleep in arboreal and subnivian dens probably has little influence. Habitat conversion/treatment disturbances to active dens would be avoided with the implementation of PDFs (refer to Table 2-1) that have been incorporated into Alternative 2.

Increases in dispersed recreation extending into marten habitat would have no indirect impact on this species. Individual marten that may be affected by the project do not likely have home ranges that would extend to the I-70 corridor where any additional summer traffic associated with Proposed Action-related guests might increase road-kill probabilities.

Alternative 2 "**may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**" for American martens.

Management Indicator Species

American Elk

Alternative 2 would have additive, negative effects to this big game use, but no measurable effect on habitat effectiveness within the DAU.

Guest use of the additional proposed biking and hiking trails has the potential to further reduce summer habitat effectiveness for elk that occasionally use developed portions of the Project Area. Additional impacts are most likely in Northeast Bowl and the Golden Peak areas (both of which are lightly used by summer recreationists), where large blocks of forest exist contiguous to undeveloped habitats outside the ski area. However, this impact may benefit the overall herd under the assumption that concentrating recreational use within an existing, moderate to high use summer recreational area would minimize increased recreational use in undeveloped and lightly used habitats that are more valuable to elk during summer.

Both proposed canopy tours would add new (noisier) human activity into large forest blocks that currently receive lesser amounts of summer recreational use. Most elk would have migrated through both zip line areas before tours start each summer season (approximately June 15) and would move back through the area after the tours conclude for the summer season (approximately September 15) and before the ski area opens (late November). However, there are occasionally a few elk present in more isolated portions of Game Creek Bowl during summer that may be displaced by the new human activity associated with the operating zip line and Game Creek Express.

While there is concern that both proposed mountain coasters could restrict or block elk movements, the effects of the Pride Express Mountain Coaster are of greater concern. First, the Adventure Ridge Mountain Coaster is relatively short and located adjacent to Adventure Ridge where there is greater big game avoidance and less big game use. The Pride Express Mountain Coaster runs nearly two-thirds of the length down Vail Mountain, perpendicular to the orientation of migratory movements. Assuming that each of the seven road crossings along the Pride Express Mountain Coaster's alignment is 100 feet wide and that each of the remaining four underpasses are only 25 feet wide, that would amount to 800 lateral feet of underpasses along the roughly 6,000 feet of track. None of these underpasses would be more than 900 feet apart, a distance suggested by CPW to prevent the blockage of wildlife migration patterns. While both mountain coasters would result in local restrictions to big game movements, the design and number of underpasses proposed for the Pride Express Mountain Coaster should provide adequate permeability for migratory movements. It is likely that animals would take years to incorporate underpass locations into the herd's collective memory and there is the possibility that some animals would avoid this facility

and go around it to the south or north. A PDF has been incorporated into Alternative 2 (refer to Table 2-1) that would minimize potential elk conflicts with the Adventure Ridge Mountain Coaster.

Proposed biking and hiking trails that spatially or temporally extend use beyond currently developed and used areas have the potential to displace elk from those largely summer habitats. PDF have been incorporated into the action alternatives that would reduce the resulting negative impacts and allow elk to remain using some larger, undeveloped, intertrail islands on the front side of the ski area.

Aquatic Macroinvertebrates

Alternative 2 includes a number of required, site-specific, watershed and aquatic resources PDFs (refer to Table 2-1) that would be implemented to avoid, minimize, and mitigate negative project component effects to aquatic habitat within the Analysis Area that could alter aquatic faunal communities. Nevertheless, Alternative 2 would cause short-term and permanent, localized, ground disturbing activities and increased runoff with potential to increase erosion, sedimentation, and local slope failures that could extend to local creeks and cause changes to the hydrology, aquatic habitat, and macroinvertebrate communities within Analysis Area streams. Alternative 2 effects on water quantity and hydrology, channel stability, disturbed areas and connected disturbed areas, and water quality are provided in Chapter 3, Section H – Watershed and Wetlands. Even with continuation of the environmental baseline, Alternative 2 would continue to provide aquatic macroinvertebrate habitat in all Analysis Area streams and would not measurably contribute to any negative trend in the Forest-wide population or habitat trend of aquatic macroinvertebrates that would affect achieving Forest Plan MIS objectives.

With respect to water quantity and hydrology, there would be 51 acres of additional temporary and permanently disturbed areas associated with proposed projects included in Alternative 2. The average yield increase for the Analysis Area watersheds would range from 0.20 to 0.63 percent. The maximum yield increase in wet years would range from 0.26 to 0.83 percent. The maximum yield increase in dry years would range from 0.26 to 0.09 percent, which would be less than 0.4 cfs. This modeled increase would be too small to be measurable and result in no negative effects.

With respect to channel stability, by employing a mix of the site-specific and general PDFs identified in Table 2-1, any Alternative 2 increases in CDA related to projects would be mitigated and stream health throughout the Analysis Area would be maintained.

A recent analysis of the Gore Creek watershed, prepared for The Eagle River Watershed Urban Runoff Group compiled data collected by USFS, USGS, and local municipalities. The compiled data set from 2000 to 2011 points to multiple sources and stressors associated with urbanization including petroleum products, nutrients, insecticides/herbicides, and other pollutants associated with urban runoff and storm water, which are leading to depressed macroinvertebrate communities in Gore Creek. At this time, fine sediment does not appear to be a major limiting factor of aquatic macroinvertebrates in this segment of Gore Creek. Project related development would adhere to a strict set of BMPs and PDFs (refer to Table 2-

1) that would minimize sediment input into Project Area and larger receiving streams such as Gore Creek. It is possible that incremental amounts of sediment generated from Alternative 2 could reach Gore Creek; however, they are not expected to have a long-term negative effect on macroinvertebrate communities. With respect to water quality, the only water quality impacts associated with proposed projects and activities are those associated with potential increases in erosion and sedimentation associated with temporary ground disturbance during construction and permanent disturbance from additional hiking, mountain bike, and horse trails. Erosion from disturbed areas would be minimized through implementation of PDFs (refer to Table 2-1).

With the implementation of PDFs (refer to Table 2-1), Alternative 2 would be consistent with all applicable water quality-related standards and guidelines and Forest direction applicable to aquatic macroinvertebrates. With the implementation of any of the action alternatives, no change in macroinvertebrate community metrics is expected. Therefore, these activities would neither contribute towards nor negatively affect meeting Forest-wide aquatic MIS objectives of improving habitat quality within 15 years.

All Trout (Brook, Brown, Rainbow, and Colorado River Cutthroat)

Alternative 2 includes a number of required, site-specific, watershed and aquatic resources PDF (refer to Table 2-1) that would be implemented to avoid, minimize, and mitigate negative project component effects to aquatic habitat within and below the Project Area that could alter aquatic faunal communities. Nevertheless, Alternative 2 would cause short-term and permanent, localized, ground disturbing activities and increased runoff with potential to increase erosion, sedimentation, and local slope failures that could extend to local creeks and cause changes to the hydrology, aquatic habitat, and all trout communities within Project Area streams. Even with continuation of the environmental baseline (including the recent MPB epidemic), Alternative 2 would continue to maintain all trout habitat in all currently inhabited Analysis Area streams and would not measurably contribute to any negative trend in the Forest-wide population or habitat trend of all trout that would affect achieving Forest Plan MIS objectives. Alternative 2 effects on water quantity and hydrology, channel stability, disturbed areas and connected disturbed areas, and water quality are provided in Chapter 3, Section H – Watershed and Wetlands.

With the implementation of PDFs (refer to Table 2-1), Alternative 2 would be consistent with all applicable water quality-related standards and guidelines and Forest direction applicable to all trout. With the implementation of any of the action alternatives, no change in trout populations or composition is expected. Therefore, these activities would neither contribute towards, nor negatively affect meeting, Forest-wide aquatic MIS objectives of improving habitat quality within 15 years.

Migratory Birds

No bird nests were detected in proposed impact areas during field surveys, although suitable nesting habitat is present in some areas for some migratory birds known to inhabit the Project Area. The project

has been designed, to the extent practicable, to minimize incidental take through the implementation of PDF (refer to Table 2-1). Specifically, in the event that nests of the four R2 bird species known or suspected of occurring in the Project Area are detected within impact areas, direct mortality of eggs and/or nestlings could be avoided by conducting tree removal in potential nesting habitat outside of the collective March 1 to July 31 nesting period(s). Such a construction closure would also avoid incidental take for all migratory birds possibly nesting in and adjacent to project disturbance areas during that time interval. However, it is possible that undetected active nests of the three R2 bird species and/or other migratory bird species could occur in impact areas during tree removal, possibly resulting in the incidental take of eggs and altricial young. Under such circumstances, Alternative 2 would not be entirely consistent with the Forest Service/USFWS MOU.

Alternative 3

Threatened, Endangered, and Proposed Species

Canada Lynx

Alternative 3 would be consistent with all applicable SRLA management direction. Up to 46 acres of habitat would have the majority of their current values permanently converted, largely into facilities and disturbed areas. Most of this habitat conversion would occur on NFS lands (approximately 98 percent). As with Alternative 2, because most of the disturbance acreage (36 acres) is associated with hiking/biking trails that have only been conceptually located within disturbance polygons, it is unknown precisely what habitat types, structural stages, and lynx habitat types would be affected by those trails. Known Alternative 3 habitat type, structural stage, and lynx habitat type disturbance acreage would total 10.2 acres. Assuming the proposed trails are located proportionally to the distribution of lynx habitat types in the Project Area, approximately 45 percent of the 36 acres of trail disturbances would affect non-habitat, while up to 7.5 acres of forest habitat modifications would affect an unknown amount of currently unsuitable, winter foraging, and “other” lynx habitat.

As with Alternative 2, modifications to lynx habitat types would have barely discernable changes on lynx habitat statistics in the Eagle Valley and Camp Hale LAUs. With Alternative 3, modifications to currently unsuitable habitat would remain unchanged at approximately 57 percent and 56 percent for the Eagle Valley and Camp Hale LAUs. This would be consistent with Southern Rockies Lynx Management Direction applicable to ski areas.

Alternative 3 would result in incremental traffic increases on I-70 through the Vail Pass and Dowds Junction lynx linkages, however considering baseline traffic volumes, the effects of those traffic increases on lynx would be insignificant and discountable. Proposed Alternative 3 project components are not expected to result in any increased skier use of undeveloped habitat blocks outside of the currently dissected portion of the ski area that could have further adverse effects on the lynx prey base, lynx DSH, habitat connectivity, or lynx home range efficacy.

Even considering the collective habitat losses, land use, and human activity within the Eagle Valley and Camp Hale LAUs, including considerable recent losses associated with the MPB epidemic, the additive loss of lynx habitat and disturbances associated with Alternative 3 are not considered to be adverse. Alternative 3's collective effects on lynx foraging, sheltering, and breeding would not exceed the definitions of insignificant and discountable. Therefore, Alternative 3 warrants a "**may affect, not likely to adversely affect**" determination for Canada lynx.

Region 2 Sensitive Species

The effects of Alternative 3 on R2 sensitive species would be identical to those previously discussed for Alternative 2, with differences noted below.

Colorado River Cutthroat Trout

The effects to Colorado River cutthroat trout would be similar to those described above under Alternative 2. However, with respect to water quantity and hydrology, there would be approximately 46.1 acres of additional temporary and permanently disturbed areas associated with proposed projects included in Alternative 3. The average yield increase for the Analysis Area watersheds would range from 0.20 to 0.57 percent under Alternative 3.

Alternative 3 "**may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**" for Colorado River cutthroat trout and their habitat.

Boreal Western Toad

Alternative 3 "**may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**" for boreal western toads.

Northern Goshawk

Alternative 3 "**may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**" for northern goshawks.

American Peregrine Falcon

Alternative 3 "**may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**" for American peregrine falcons.

Flammulated Owl

Alternative 3 "**may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**" for flammulated owls.

Boreal Owl

Alternative 3 "**may impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend toward federal listing**" for boreal owls.

Olive-Sided Flycatcher

Alternative 3 "**may impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend toward federal listing**" for olive-sided flycatchers.

Pygmy Shrew

Alternative 3 "**may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**" for pygmy shrews.

Hoary Bat

The effects to hoary bats would be slightly less than those associated with Alternative 2 in regards to the modification of roosting and foraging habitat.

Alternative 3 "**may impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend toward federal listing**" for hoary bats.

American Marten

Alternative 3 "**may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**" for American martens.

Management Indicator Species

American Elk

The effects to American elk would be similar to those described above under Alternative 2. However, there would be no effects associated with mountain coasters.

Aquatic Macroinvertebrates

The effects to aquatic macroinvertebrates would be similar to those described above under Alternative 2. Refer to the above discussion. With respect to water quantity and hydrology, there would be approximately 46.1 acres of additional temporary and permanently disturbed areas associated with proposed projects. The average yield increase for the Analysis Area watersheds would range from 0.20 to 0.57 percent. The maximum yield increase in wet years would range from 0.26 to 0.73 percent. The maximum yield increase in dry years would range from 0.23 to 0.08 percent, which would be less than 0.4 cfs. This modeled increase would be too small to be measurable and result in no negative effects.

With the implementation of PDFs (refer to Table 2-1), Alternative 3 would be consistent with all applicable water quality-related standards and guidelines and Forest direction applicable to aquatic macroinvertebrates. With the implementation of any of the action alternatives, no change in macroinvertebrate community metrics is expected. Therefore, these activities would neither contribute towards, nor negatively affect meeting, Forest-wide aquatic MIS objectives of improving habitat quality within 15 years.

All Trout (Brook, Brown, Rainbow, and Colorado River Cutthroat)

The effects to all trout would be identical to those described above under Alternative 2. Refer to the above discussion. With the implementation of PDFs (refer to Table 2-1), Alternative 3 would be consistent with all applicable water quality-related standards and guidelines and Forest direction applicable to all trout. With the implementation of any of the action alternatives, no change in trout populations or composition is expected. Therefore, these activities would neither contribute towards nor negatively affect meeting Forest-wide aquatic MIS objectives of improving habitat quality within 15 years.

Migratory Birds

The effects to migratory birds would be identical to those described above under Alternative 2.

CUMULATIVE EFFECTS

For a detailed description of past, present, and reasonably foreseeable future projects within the cumulative effects Analysis Area referred to Appendix A. Most of these projects have been approved and are part of the environmental baseline considered and described above under individual species accounts. Approved, but unimplemented components of those projects are considered to have been implemented and part of the environmental baseline that may be further affected by alternatives 1, 2 and 3.

In general, the MPB epidemic will continue to alter habitat characteristics throughout the WRNF, potentially affecting species discussed in this section. Within forests dominated by lodgepole pine, MPB-induced lodgepole pine mortality can alter wildlife abundance and habitat use. Through time, a patchy distribution of large amounts of deadfall, dead standing, and newly regenerating trees and shrubs will occur across the landscape. This will benefit some species and negatively affect others as more coarse woody debris becomes available for denning, nesting, and foraging and as forest canopies open and the understory vegetation is released. Anecdotal evidence indicates that most wildlife species continue to be present and use infected stands. With moderate levels of natural lodgepole germination, lodgepole stands can develop high live conifer understory values from approximately 10 to 40 years after treatment. After 40 to 60 years, the live lodgepole canopy tends to lift and the relative stand values shift to those species benefiting from mature lodgepole stands. Mountain pine beetle effects in mixed conifer (spruce-fir dominated with a subdominant lodgepole pine component) stands would be more subtle compared their effects in pure lodgepole stands.

Threatened and Endangered Species

A potential year-round road to access a 680-acre private inholding surrounded by NFS lands north of Edwards (referred to as “Berlaimont Estates”) has been discussed for years. Although the Eagle County Board of County Commissioners recently (December 2013) approved an application for a variance from County road construction standards by the landowner, at this time, the WRNF is not analyzing a formal proposal to cross NFS lands with a road to access the inholding. This would require a site-specific NEPA analysis.

Road construction would result in a net loss of "other" habitat on NFS and private lands. Access road use on NFS and private lands would have insignificant and discountable effects on road-kill probabilities because of the relative quality of habitats bisected, the topographic location of habitats bisected (i.e., below higher elevation, primary lynx habitats), and the relatively low speeds (20 mph) of a maximum of 192 VPD. Other proposed road design variances would have no effect on lynx. Potential negative effects would also result from residential development on private land, including, but not limited to, the conversion of "other" habitat to "non-habitat," locally reduced habitat effectiveness, and the introduction of risk factors into the lower fringe of aspen forest that is part of a broad band of continuous forest surrounding the Gore Range. Road-kill probabilities would theoretically increase along regional highways used to access the residential development, including those bisecting designated, lynx linkage areas, would be insignificant and discountable.

R2 Sensitive Species

For all R2 Sensitive species, except the northern goshawk, reasonably foreseeable projects considered in this analysis would contribute no additional cumulative effects to these species because impact zones associated with those projects would not extend to potential habitat for this species that could be directly and indirectly affected by alternatives 2 and 3 on NFS land. A discussion of specific effects of past, present, and reasonable foreseeable future actions is presented for each species below.

Colorado River Cutthroat Trout

There are no anticipated long-term negative affects expected as a result of the action alternatives and stream health, both physical and biological, is expected to be maintained. Since there are no significant negative direct or indirect effects expected to aquatic resources as a result of any of the alternatives analyzed in this document, there are no expected cumulative effects, above the baseline condition, associated with any of the alternatives.

Boreal Western Toad

Past and present actions in the vicinity of the Project Area, including ski area and secondary base area developments, mining, logging, and road building, water diversions, summer recreational trails and use, and the continuing chytrid fungus trends have negatively affected habitat that falls within the broad continuum used elsewhere by boreal toads. While it is likely that historic boreal toad habitat overlapped the Vail Ski Area, there is limited potential breeding habitat and no evidence that boreal toads are now present.

There are no additional reasonably foreseeable actions considered herein that could affect boreal toads that could also be affected by alternatives 2 and 3. There are no negative effects expected as a result of the Proposed Action and wetland and riparian habitat is expected to be maintained. Since there are no significant negative direct or indirect effects expected to aquatic resources as a result of the Proposed

Action, there are no expected cumulative effects, above the baseline condition, associated with any of the alternatives.

Northern Goshawk

For the northern goshawk, impact zones associated with reasonably foreseeable projects considered in this analysis would contribute additional effects to foraging and potential nesting habitat associated with any pair of goshawks whose territory may overlap the Project Area. However, goshawks would persist in this Analysis Area.

American Peregrine Falcon, Flammulated Owl, Boreal Owl, and Olive-Sided Flycatcher

Past and present actions including, but not limited to, ski area development, secondary residential development, and historic mining and logging activities have cumulatively affected the habitat of these bird species both positively and negatively. PDF identified in Table 2-1 have been included to avoid/minimize effects to these four bird species, all of which have MAII determinations related to alternatives 2 and 3.

Pygmy Shrew

Past and present actions, largely associated with ski area development in the Project Area, may have negatively affected potential habitat of this species. However, large areas of potential pygmy shrew habitat persist beyond and within the Vail Ski Area SUP area, including developed and undeveloped ski terrain within the Project Area.

Hoary Bat

Past and present actions that resulted in habitat conversion, fragmentation, loss, and incomplete successional recovery (largely associated with historic mining and logging and more recent ski area development in the Project Area) may have affected potential habitat of this species both positively and negatively. While the development of ski terrain may have theoretically benefitted this species by providing the clearings they are associated with, while maintaining adequate roosting habitat in intertrail islands, the effects of the current MPB epidemic on hoary bats are largely negative because of the loss and removal of roosting habitat, and uncertain because of unknown effects to their insect prey base. Substantial numbers of large snags may be removed with high levels of beetle-induced lodgepole mortality. It is likely that adequate snag density would remain in the Project Area's lodgepole zone and would not limit potential hoary bat use. Large areas of potential hoary bat habitat persist in the surrounding landscape, including developed and undeveloped ski terrain within the Vail Ski Area SUP area.

American Marten

Past and present actions, largely associated with ski area development in the Project Area, have negatively affected marten habitat through habitat conversion, fragmentation, loss, and incomplete

successional recovery. Virtually all of the Project Area currently receives skiing and other human activities at least during the ski season. However, martens persist at Vail Ski Area. The ebbing MPB epidemic will likely reduce short- and moderate-term foraging and possibly denning opportunities along mid- and lower-elevation lodgepole pine and mixed conifer habitats, including the Project Area and other portions of the Vail Ski Area SUP area. The local, mature, closed canopy lodgepole stands that dominate much of the north side of Vail Mountain do not represent primary marten habitat. Pure spruce-fir stands, representing the primary habitat of this species, should be largely unaffected by the MPB epidemic.

Management Indicator Species

Full development of the "Berlaimont Estates" project in the future could have substantive impacts on local elk values. Direct effects of constructing the access road and building residences would result in a moderate loss of elk winter range, winter concentration area, severe winter range, transitional range, and calving habitat. Indirect year-round motorized use of the access road and residential habitation of the private parcel (the use of roads, driveways, home sites, caretaker units, etc.) would result in the vast majority of impacts to elk associated with this overall project. Impacts would include reduced habitat effectiveness affecting a much larger acreage of the above habitats, restricted migratory and local movements, and increased injury and road-kill probabilities on access roads and regional highways.

Past and present actions that have affected aquatic macroinvertebrates and their habitat in the aquatic macroinvertebrate Analysis Area are dominated by ski area development, road and dispersed recreational trail developments, and secondary resort development. These actions have affected some stream channels and aquatic habitat to some extent and resulted in short-term to long-term perturbations to water quality, quality, and aquatic faunal communities compared with control streams.

Reasonably foreseeable actions considered herein that could affect aquatic macroinvertebrates and all trout that could also be affected by the action alternatives would include continued Eagle County residential build-out and dispersed recreational activity in the Project Area. The impact zones of other reasonably foreseeable projects considered in this analysis would contribute no additional cumulative effects to Project Area streams because impact zones associated with those projects would not extend to the flowing waters that could be directly and indirectly affected by alternatives 2 and 3 on NFS land.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The amount of habitat modifications, as well as disturbances during the summer, would irretrievably affect some individual members of various wildlife species, but are not considered irreversible.

G. SOILS

SCOPE OF THE ANALYSIS

The Analysis Area for soil resources includes areas proposed for direct ground disturbance in the East Vail, Game Creek, Mill Creek, Two Elk Creek, and West Vail Watersheds within Vail Ski Area's SUP area. This analysis is based on review of the Holy Cross Area Soil Survey. No site-specific soil surveys were completed for this analysis, but would be required prior to implementation of any approved projects.

FOREST PLAN DIRECTION

Both the 2002 Forest Plan and the WCPH provide soil management measures to guide land treatments within the WRNF. The following direction applies to the proposed projects analyzed in this DEIS.

WRNF 2002 Forest Plan

8.25 Ski Areas – Existing and Potential

Soils Standard 1. Effective ground cover (mulch) upon completion of ground disturbing activities will meet minimum levels of pre-treatment habitat type (Aspen 95 percent, Lodgepole Pine 90 percent, Spruce-Fir 95 percent).

Soils Guideline 1. Ground cover as a combination of revegetation and mulch applications, should meet the requirements in Table 3G-1, one and two years following completion of ground disturbing activities.

Table 3G-1:
Soils Guideline 1: Ground Cover Requirements

Erosion Hazard Class	Year 1 Minimum Effective Ground Cover (%)	Year 2 Minimum Effective Ground Cover (%)
Low	20–30	30–40
Moderate	30–45	40–60
High	45–60	60–75
Very High/Severe	60–90	75–90

Soils

Guideline 1. Conduct an onsite slope stability exam in areas identified as potentially unstable. Potentially unstable land is described as having a "high" or "very high" instability ranking. Limit intensive ground-disturbing activities on unstable slopes identified during examinations.

Forest Service Watershed Conservation Practices Handbook (WCPH)

Hydrologic Function

11.2 Manage land treatments to maintain enough organic ground cover in each activity area to prevent harmful increased runoff.

Riparian Areas and Wetlands

12.4 Maintain long-term ground cover, soil structure, water budgets, and flow patterns of wetlands to sustain their ecological function.

Sediment Control

13.3 Stabilize and maintain roads and other disturbed sites during and after construction to control erosion.

13.4 Reclaim roads and other disturbed sites when use ends, as needed, to prevent resource damage.

Soil Quality

14.2 Maintain or improve long-term levels of organic matter and nutrients on all lands.

AFFECTED ENVIRONMENT

The Analysis Area is between the elevation of 8,350 and 11,250 feet above mean sea level (amsl). Much of the precipitation at Vail Ski Area falls in the form of snow. Winter precipitation (October through April) makes up more than half of annual precipitation, with approximately 120 inches of total snowfall. The climate and elevation of the Analysis Area limit the rate of soil formation.

Geology of Vail Ski Area

The front side of Vail Ski Area is underlain by sedimentary limestone, sandstone, siltstone and shale of the Minturn Formation. These four types of rock differ in resistance to erosion, resulting in varying slope characteristics between the summit (sandstone, siltstone and shale) and the lower (limestone) portions of the proposed trails. Sandstone, siltstone, and shale are less resistant to erosion and consequently, the upper portion of the mountain is smooth and less steep then the lower portion. As a result, the soft, micaceous siltstone/clay is more susceptible to erosion, and subsequent gullying, from concentrated overland water flow.

In most places near the Golden Peak access road, slopes are covered with colluvium no more than 2 to 3 feet thick; in other places (such as directly upslope of the turn station of the Riva Bahn Express) the colluvium is thin to non-existent and bedrock lies at the surface. On the steepest slopes above the existing access road, there is some evidence of soil creep on both natural and disturbed slopes, and of very small-scale soil slumping on disturbed (cleared) slopes where they exceed roughly a 30 degree slope angle (a very small percentage of the Project Area).

The topography of the lower portion of the mountain is steeper, as exhibited by the cliffs and ledges that formed in the hard limestone of the Minturn Formation. The entire slope is mantled with glacial till, but the layer is thin with the steep cliff band clearly reflecting the underlying bedrock control.

Downslope of the access road, near the existing half-pipe, the northern edge of the slope is again mantled with a thin layer of glacial till deposited as lateral moraine by the latest Pleistocene Vail Valley glacier. The glacial till matrix is sandy and well-drained, making it a permeable layer (of unknown thickness) that sits atop the less permeable Minturn Formation. In many areas of Colorado this geology of permeable till overlying impermeable fine-grained bedrock gives rise to landslides. Ridges bisect the area resulting in differing slopes and slope angles.

Soil Map Units and Distribution at Vail Ski Area

Twenty-five soil units were mapped within the East Vail, Game Creek, Mill Creek, Two Elk Creek, and West Vail Watersheds within the Vail Ski Area SUP boundary. These soils can be grouped into Cryoborolls, Cryaquolls, Scout, Leadville, Quander, Gateview, Handran, Eyre, Cryoboralfs, Seitz, Hechtman, Tellura, Anvik, Skylick, Handran, Ansel and Slingting. Mapped miscellaneous land types include rock outcrops, mire land, and standing water. Table 3G-2 summarizes the general soil characteristics. Refer to the Forest Service Stability Model and Soil Map Units figure in this section for more information.

Table 3G-2:
General Characteristics of Mapped Soil Units

Map Unit/ Name	Area in SUP (acres)	Drainage Class	Available Water Capacity[a]	Runoff[b]	Effective Rooting Depth
104A	160.5				
Cryoborolls		well	moderate	moderate	> 60”
Cryaquolls		very poorly	moderate	moderate	> 60”
212 B	96.5				
Scout		somewhat exc.	low	moderate	> 60”
220 B	760.4				
Leadville		well	moderate	moderate	> 60”
220 C	353.9				
Leadville		well	moderate	moderate	> 60”
226 B	132.3				
Leadville		well	moderate	moderate	> 60”
Cryaquolls		very poorly	moderate	moderate	> 60”
281 B	61.7				
Quander Family		well	moderate	moderate-slow	> 60”
346C	2,551.4				
Gateview		well	moderate	moderate	> 60”
Handran		somewhat exc.	low	moderate	> 60”
Eyre		well	low	rapid	< 40”
349 C	84.4				
Eyre		well	low	rapid	< 20”
Quander		well	low	moderate	> 20”

Table 3G-2:
General Characteristics of Mapped Soil Units

Map Unit/ Name	Area in SUP (acres)	Drainage Class	Available Water Capacity[a]	Runoff[b]	Effective Rooting Depth
351 C	4,805.2				
Scout		somewhat exc.	low	moderate	> 20”
352 C	143.2				
Scout		Somewhat exc.	low	moderate	> 20”
353 C	369.6				
Scout		somewhat exc.	low	moderate	> 20”
354 B	13.7				
Argic Cryoborolls		well	moderate	moderate	> 40”
Typic Cryoboralfs		well	moderate	moderate	> 40”
367 B	2,140.3				
Scout		somewhat exc.	low	moderate	> 20”
Leadville		well	moderate	moderate	> 20”
381 B	2,776.2				
Seitz		well	high	moderate	> 60”
Scout		somewhat exc.	low	moderate	> 60”
385D	735.2				
Scout		somewhat exc.	low	moderate	> 20”
Hechtman		somewhat exc.	low	moderate	< 20”
Rock outcrop					
386C	250.9				
Seitz-Tellura		Well	high	rapid	> 40”
Cryaquolls		Well	high	rapid	> 40”
393 B	911.9				
Gateview		well	moderate	moderate	> 60”
Handran		somewhat exc.	low	moderate	> 60”
395 D	72.4				
Scout		somewhat exc.	low	moderate	> 60”
Rock Outcrop					
Cryoborolls		well	moderate	rapid	> 60”
446 B, C	654.0, 2399.3				
Handran		somewhat exc.	low	moderate	> 20”
Eyre		well	low	moderate	< 20”
452 B	34.0				
Anvik		well	moderate	moderate	> 40”
Skylick		well	moderate	moderate	> 60”
Handran		somewhat exc.	low	moderate	> 40”
932 B	35.0				
Handran		somewhat exc.	low	moderate	> 20”
Eyre		well	low	rapid	< 20”
Rubble Land					

Table 3G-2:
General Characteristics of Mapped Soil Units

Map Unit/ Name	Area in SUP (acres)	Drainage Class	Available Water Capacity[a]	Runoff[b]	Effective Rooting Depth
AG 9	226.9				
Ansel		well drained	high		
Anvik		well drained	very high		
AG 11	223.4				
Anvik		well drained	very high		
Skylick		well drained	high		
Slingting		well drained	low		
ML	167.7				
Mire Land		N/A	N/A	N/A	N/A
RO/RL	0.4				
Rock Outcrop		hydro group D	N/A	high	N/A
Rubble Land		hydro group A	low	low	N/A
W	9.6				
Water		N/A	N/A	N/A	N/A
UNCL	1,748.3				
Unclassified		N/A	N/A	N/A	N/A

[a] Available Water Capacity refers to the volume of water that should be available to plants if the soil, inclusive of rock fragments, were at field capacity.
[b] Runoff refers to the degree to/rate at which precipitation, once interfaced with the soil, flows as a result of gravitational forces. Greater rates of runoff are generally consistent with greater erosion risk.
exc. = excessively; N/A = not applicable
Source: USDA Forest Service, 1998

Drainage class ratings for these soils range from very poorly to somewhat excessively drained, and have variable runoff potential (low to high) and available water capacity (low to very high). Generally, revegetation limitations are slight to moderate within the Analysis Area due to low available water capacity and erosion hazard. Cut/fill slope stability potential varies widely from slight to severe due to saturated soil, fine grained materials and slope. In their native condition, mass movement potentials of soils within the Analysis Area are generally low; however, excess site moisture associated with snowmaking and ski area drainage, coupled with the loss of soil organic matter from previous grading activities can exacerbate this risk.

Surface and subsurface soil erodibility is generally low within the Analysis Area with some adjacent moderate areas, with K-factor (K_w) values of surface soil horizons up to 0.24. Higher erosion risk ratings result from coarse textures, high infiltration rates, and significant runoff potential.[80] The whole soil K-

[80] The K-factor represents the soil's susceptibility to erosion in their plot condition based on soil texture. Soils that are resistant to erosion have low K values (0.02 to 0.15); soils that display moderate erosion potential are in the middle of the range (0.16 to 0.27); and highly erodible soils tend to have values greater than 0.28.
National Resource Conservation Service, 2008

factor (with the *w* subscript) best reflects natural soil conditions in the field because the whole soil factor considers rock fragments which serve to "armor" soil and make them less erodible overall.[81] Soil organic matter can also be related to soil erodibility as organic horizons allow infiltration and provide productive soils for stabilizing vegetation.[82] Maintenance of soil organic matter and surface O and A horizon integrity minimizes erosion, compaction, and hydrology problems within the ski area.

The front side of Vail Mountain, which encompasses most of the Analysis Area, covers approximately 3,700 acres of terrain. Tree removal and grading has occurred across the front side of Vail Mountain associated with ski trails, as well as hiking/biking trails, lift installation, mountain access roads and guest service facilities. In total, approximately 1,700 acres of the front side of Vail Mountain do not have overstory vegetation. The lack of overstory is primarily from tree removal and/or grading, however there are some areas where grass cover is naturally occurring. In general clearing and grading that has occurred throughout Vail Ski Area's SUP area since its inception has resulted in a loss of, and degradation to, soil organic matter throughout the Analysis Area.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

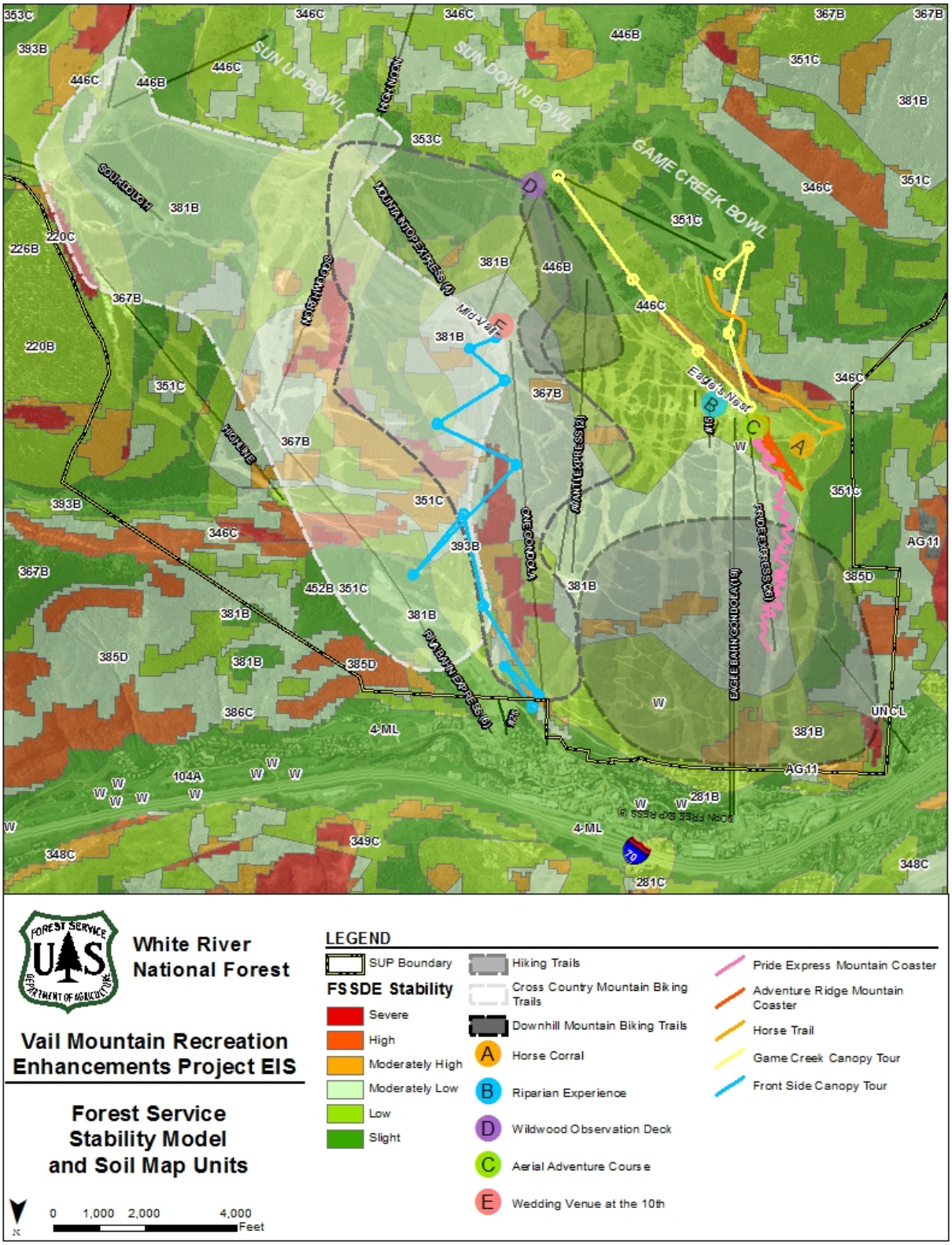
No new grading is included in Alternative 1. However, on-going ski area operations and maintenance would continue to require management to reduce erosion and loss of soil organic material within Vail Ski Area's SUP area.

Alternative 2 – Proposed Action

Geology

Projects included in the Proposed Action were compared with the White River National Forest Stability Model (refer to the Forest Service Stability Model and Soil Map Units figure in this section). Slope stability ratings were developed through an evaluation of area geology, slopes and landslide risk (based on past landslide mapping). The susceptibility of these indicators to causing irreversible resource damage to soil productivity and watershed condition from timber harvest ranges from "slight" to "severe". The proposed projects would have similar impacts from tree clearing and soil disturbance. Projects were found to overlap areas with a range of mass movement potential, from "slight" to "severe." Generally proposed project locations overlap areas of "slight" to "moderately low" mass movement potential and projects could be implemented without special design considerations in these areas.

[81] McCormick et al., 1982
[82] Franzluebbers, 2002; McMullen, 2011


SUN UP BOWL
SUN DOWN BOWL
GAME CREEK BOWL
Eagle's Nest
White River National Forest
Vail Mountain Recreation Enhancements Project EIS
Forest Service Stability Model and Soil Map Units
LEGEND
SUP Boundary
FS SDE Stability
Severe
High
Moderately High
Moderately Low
Low
Slight
Hiking Trails
Cross Country Mountain Biking Trails
Downhill Mountain Biking Trails
Horse Corral
Riparian Experience
Wildwood Observation Deck
Aerial Adventure Course
Wedding Venue at the 10th
Pride Express Mountain Coaster
Adventure Ridge Mountain Coaster
Horse Trail
Game Creek Canopy Tour
Front Side Canopy Tour
0 1,000 2,000 4,000 Feet

Proposed projects that would be constructed within or near areas that have been identified as having "moderately high" and "severe" stability risk include both canopy tours, the horse trail, and potentially the hiking, cross-country and downhill mountain biking trails. However, portions of the Analysis Area that are mapped as having severe stability risk are limited and could be avoided during construction of the canopy tours. The proposed trails would entail minimal ground disturbance in areas that are identified as having "moderately high" and "severe" mass movement potential. During trail layout, the length of the trail would be reviewed for indications of landscape instability and built to minimize that risk.

The risk to stability has potential to impact project design; therefore, Project Design Features (refer to the Forest Service Stability Model and Soil Map Units figure in this section) may be required to ensure drainage is properly managed to minimize potential impacts from the projects to soils, and from stability issues on the project elements. These stability rankings are not limiting to the proposed projects, as these rankings are derived from a model rather than strictly empirical data. Field surveys and project implementation would watch for and consider visible indicators of landscape instability such as tension cracks and rill/gully erosion and appropriate erosion control and drainage management would be employed to maintain soil productivity and watershed condition.

Soils

Approximately 15 acres of disturbance would occur in the soil map units identified in Table 3G-3 for the canopy tours, mountain coasters, horse trail and corral, observation deck, and wedding venue. No ground disturbance is anticipated in relation to the proposed Interpretive and Education Programs, Riparian Experience or the Aerial Adventure Course.

The Proposed Action entails approximately 4.9 acres of tree removal, 7.4 acres of grading and 2.7 acres of tree removal and grading. Generally, the approximate 10.1 acres of grading would represent a permanent loss of soils within those management units due to trail and access route construction and installation of infrastructure. The remaining 5 acres of tree removal is generally associated with clearing corridors for the canopy tours and mountain coaster and soil disturbance could be minimized by maintaining vegetative cover as well as levels of soil organic matter (soil O and/or A horizons). If and when loss of soil organic matter is documented, these losses will be mitigated by amending soils with carbonaceous soil amendments in coordination with the White River National Forest Soil Scientist.

Table 3G-3:
Project Disturbance by Soil Map Unit

Soil Map Unit Project Component	Disturbance Type by Acre	Total Acres	K_W
346C		**0.91**	**0.15**
Game Creek Canopy Tour Access Route	Grading: 0.10 Clearing and Grading: 0.02	0.12	
Game Creek Canopy Tour Corridor	Clearing: 0.08	0.08	
Game Creek Canopy Tour Tower	Grading: 0.03 Clearing and Grading: 0.33	0.36	
Horse Trail	Grading: 0.36	0.36	
351C		**5.57**	**0.08**
Adventure Ridge Mountain Coaster Corridor	Clearing: 0.69	0.69	
Front Side Canopy Tour Access Route	Grading: 2.27 Clearing and Grading: 0.05	2.32	
Front Side Canopy Tour Corridor	Clearing: 0.18	0.18	
Front Side Canopy Tour Tower	Grading: 0.06 Clearing and Grading: 0.48	0.54	
Game Creek Canopy Tour Access Route	Grading: 0.30	0.30	
Game Creek Canopy Tour Corridor	Clearing: 0.06	0.06	
Game Creek Canopy Tour Tower	Grading: 0.12 Clearing and Grading: 0.14	0.26	
Horse Corral	Grading: 0.48	0.48	
Pride Express Mountain Coaster Corridor	Clearing: 0.73	0.73	
367B		**1.44**	**0.08**
Adventure Ridge Mountain Coaster Corridor	Clearing: 0.11	0.11	
Front Side Canopy Tour Access Route	Grading: 0.30 Clearing and Grading: 0.09	0.39	
Front Side Canopy Tour Corridor	Clearing: 0.11	0.11	
Front Side Canopy Tour Tower	Grading: 0.17 Clearing and Grading: 0.37	0.54	
Pride Express Mountain Coaster Corridor	Clearing: 0.06	0.06	
Pride Express Mountain Coaster Top Terminal	Grading: 0.24	0.24	
381B		**4.36**	**0.08**
Adventure Ridge Mountain Coaster Bottom Terminal	Grading: 0.33	0.33	
Adventure Ridge Mountain Coaster Corridor	Clearing: 0.24	0.24	
Front Side Canopy Tour Access Route	Grading: 0.39 Clearing and Grading: 0.05	0.44	
Front Side Canopy Tour Corridor	Clearing: 0.41	0.41	
Front Side Canopy Tour Tower	Grading: 0.18 Clearing and Grading: 0.72	0.90	
Pride Express Mountain Coaster Bottom Terminal	Grading: 0.29 Clearing and Grading: 0.04	0.33	
Pride Express Mountain Coaster Corridor	Clearing: 1.68	1.68	
Wedding Venue	Grading: 0.01	0.01	

Table 3G-3:
Project Disturbance by Soil Map Unit

Soil Map Unit Project Component	Disturbance Type by Acre	Total Acres	K_W
446B		**0.18**	**0.10**
Game Creek Canopy Tour Access Route	Grading: 0.07	0.07	
Game Creek Canopy Tour Tower	Grading: 0.05 Clearing and Grading: 0.05	0.10	
Wildwood Observation Deck	Grading: 0.01	0.01	
446C		**2.54**	**0.10**
Adventure Ridge Mountain Coaster Top Terminal	Grading: 0.33	0.33	
Game Creek Canopy Tour Access Route	Grading: 0.68 Clearing and Grading: 0.17	0.86	
Game Creek Canopy Tour Corridor	Clearing: 0.37	0.37	
Game Creek Canopy Tour Tower	Grading: 0.18 Clearing and Grading: 0.15 Clearing: 0.21	0.54	
Game Creek Canopy Tour Tower 1/9	Grading: 0.18	0.18	
Horse Corral	Grading: 0.01	0.01	
Horse Trail	Grading: 0.14	0.14	
Pride Express Mountain Coaster Top Terminal	Grading: 0.10	0.10	
Wildwood Observation Deck	Grading: 0.01	0.01	
Total		**15.00**	**--**

Soils within these project areas are mapped as having low surface and subsurface soil erodibility potential ($K_w \leq 0.22$), and with implementation of appropriate features for drainage management, erosion within the Analysis Area could be minimized. For all of the proposed projects under Alternative 2, implementation of the following soil management requirements and Project Design Features (PDF) would minimize erosion and impacts to soil organic material in the Analysis Area:

1. Prior to construction, soil surveys will be completed within the disturbance footprint to ensure no net loss of soil organic matter. Vail Associates will work with the Forest Service soil scientist to ensure proposed alignments are identified in the field and adequate time for surveys is allotted.
2. Prior to construction, a detailed site erosion control plan will be prepared. This plan shall include the following components:
   - Silt fences, straw bales, straw wattles, and other standard erosion control BMPs shall be employed to contain sediment onsite.
   - Jute-netting or appropriate erosion-control matting on steep fill slopes (i.e., land with a slope angle of 35 percent or greater) will be utilized to protect soils and enhance conditions for vegetation re-establishment.

- Revegetate disturbed areas following direction by the Forest Service botanist to complement soil erosion control efforts.

3. Existing roads will be used for construction and routine maintenance of the proposed project components where possible.
4. Vegetative buffers will be maintained adjacent to intermittent or perennial drainages and wetlands, to the extent possible. Where avoidance of the vegetative buffer is not possible, disturbance will be minimized.
5. In all areas where grading or soil disturbance will occur, a reassessment of the quantity (depths) of soil A and/or organic ground cover would be made to ensure no net loss of this material. Re-spreading of stockpiled topsoil/A horizon material and/or the duff layer (O horizon) or where necessary applying an organic amendment would promote the successful rehabilitation of these areas in addition to promoting compliance with USFS policy direction towards soil productivity. Soil amendments to maintain or improve levels of soil organic matter could include, but are not limited to, compost, compost/biochar mixtures, topsoil importation, and Class A biosolids.
6. Soil-disturbing activities will be avoided during periods of heavy rain or excessively wet soils.
7. Areas determined to have been compacted by construction activities may require mechanical subsoiling or scarification to the compacted depth to reduce bulk density and restore porosity.
8. Ground cover, as a combination of revegetation, organic amendments and mulch applications, should restore depths of soil A and/or organic ground cover.

In addition to the projects described above, areas have been identified as appropriate for developing hiking, cross-country mountain biking and downhill mountain biking trails.

Approximately 11 miles of hiking trails are included in Alternative 2 within an approximate 1,000-acre area on the front side of Vail Mountain (refer to Figure 2). Specific trail locations have not been identified at this time. Soils within the area proposed for development of hiking trails are mapped as having generally low surface and subsurface soil erodibility potential ($K_w \leq 0.22$). Soil organic matter can also be related to soil erodibility as organic horizons allow infiltration and provide productive soils for stabilizing vegetation.[83] Maintenance of soil organic matter and surface O and A horizon integrity adjacent to trails minimizes erosion, compaction, and hydrology problems within the Analysis Area. Trails would be constructed with appropriate drainage features including water bars, swales and ditches, rolling dips, in-sloping and installation of a roadside ditch, check dams and sediment traps. In addition, the PDFs identified above would be implemented to minimize erosion and impacts to soil organic material.

[83] Franzluebbers, 2002; McMullen, 2011

Table 3G-4 identifies acreage of each soil map unit within the area identified as potentially appropriate for developing hiking trails.

Table 3G-4:
Soil Map Units within the Area Identified for Hiking

Soil Map Unit	Acres	K_W
351C	239.16	0.08
353C	9.09	0.08
367B	442.42	0.08
381B	246.29	0.08
393B	4.42	0.15
446B	60.92	0.1
446C	0.51	0.1
Total	**1002.81**	**--**

Approximately 25 miles of cross-country mountain biking trails are included in Alternative 2 within an approximate 1,500-acre portion of Vail Mountain. As with the hiking trails, specific trail alignments have not been identified. Again, soils within the area are broadly mapped as having low surface and subsurface soil erodibility potential ($K_w \leq 0.22$), however, there is one portion that has moderate surface and subsurface erodibility (220C with a K_w of 0.24, refer to the Forest Service Stability Model and Soil Map Units figure in this section). To the extent possible, these areas may be avoided, or trail segments would be designed to minimize impacts. In soil map unit 220C, where soil stabilization is identified to be particularly critical, on less stable, disturbed slopes, tackifying, erosion control matting, jute netting (or coconut netting, not plastic) and hydroseeding will be used to stabilize the area adjacent trails. Throughout the area, trails would be constructed with appropriate drainage features including water bars, swales and ditches, rolling dips, in-sloping and installation of a roadside ditch, check dams and sediment traps. In addition, the PDFs identified above would be implemented to minimize erosion and impacts to soil organic material.

Table 3G-5 identifies acreage of each soil map unit within the area identified as potentially appropriate for developing cross-country mountain biking trails.

Table 3G-5:
Soil Map Units within the Area
Identified for Cross-Country Mountain Biking

Soil Map Unit	Acres	K_W
220C	16.13	0.24
346C	59.77	0.15
351C	475.75	0.08
353C	3.19	0.08
367B	289.75	0.08
381B	457.60	0.08
385D	1.97	0.08
393B	7.50	0.15
446B	95.97	0.1
446C	56.20	0.1
452B	9.54	0.1
Total	**1473.37**	**--**

Approximately 19 miles of cross-country mountain biking trails are included in Alternative 2 in two areas encompassing approximately 690 and 130 acres. As with the hiking and cross-country mountain biking trails, specific trail alignments have not been identified. Most of the areas have low surface and subsurface erodibility potential ($K_w \leq 0.22$), however, one area was identified as having moderate potential (AG11, refer to the Forest Service Stability Model and Soil Map Units figure in this section). As discussed for cross-country mountain biking trails, this area would be avoided where possible, or trail design and stabilization measures would be identified to minimize erosion potential and impacts to soils. In addition, the PDFs identified above would be implemented to minimize erosion and impacts to soil organic material.

Table 3G-6 identifies acreage of each soil map unit within the area identified as potentially appropriate for developing downhill mountain biking trails.

Table 3G-6:
Soil Map Units within the Area
Identified for Downhill Mountain Biking

Soil Map Unit	Acres	K_W
351C	239.27	0.08
367B	46.76	0.08
381B	367.67	0.08
385D	0.28	0.08
446B	79.20	0.1
446C	1.52	0.1
AG11	11.11	0.24
UNCL	71.64	--
W	2.13	--
Total	**819.59**	**--**

Alternative 3

Projects included in Alternative 3 are identical to Alternative 2, except that both mountain coasters, the Riparian Experience, and the wedding venue have been removed. Therefore impacts from the canopy tours, horse trail and corral, and the observation and wedding decks would be the same as those discussed above under Alternative 2. Total disturbance under Alternative 3 would be approximately 10.2 acres. Approximately 1.4 acres of tree removal, 6.1 acres of grading and 2.7 acres of tree removal and grading would occur under this alternative. Generally, the 8.8 acres of tree removal and grading would represent a permanent loss of soils within those management units due to trail and access route construction and installation of infrastructure. The remaining 1.4 acres of tree removal is generally associated with clearing corridors for the canopy tours and soil disturbance could be minimized by leaving grasses and the O and A horizon.

Soils within these project areas have low surface and subsurface soil erodibility potential ($K_w \leq 0.22$), and with implementation of management requirements for drainage management, erosion within the Analysis Area could be minimized.

The discussion for the hiking, cross-country mountain biking and downhill mountain biking trails is identical to that discussed under Alternative 2. With the PDFs identified above, Alternative 3 project impacts to the soil resource could be minimized.

CUMULATIVE EFFECTS

Development within Vail Ski Area's SUP boundary, including vegetation removal, grading and installation of facilities has affected soil resources, particularly the depth of organic-rich soil horizons, across the SUP area. Vail Ski Area implements drainage management and erosion control such as water

bars and revegetation (as required by the Forest Service). The effectiveness of these management activities at stabilizing soils within the Analysis Area would be assessed during the site-specific field surveys. Cumulatively, if the disturbance required by the Proposed Action or Alternative 3 is carefully managed with effective erosion control, the movement potential of the soil management units can be minimized. PDFs would include stockpiling topsoil and applying organic soil amendments to areas where soils disturbance occurs, where practical.

Other regional projects have had a range of impacts on soils resources in the Analysis Area. Forest Health projects are generally designed to reduce overland flow and erosion and minimize removal or disturbance of the organic layer, so often they have minimal impacts to soils resources. However, community and residential development have resulted in a loss of soils in the area due to increases in roads, buildings and increase soil compaction and impermeable surfaces. Generally, on-going developments would continue these impacts into the future.

When considered cumulatively with the proposed projects, other past, present and future projects affect soils by reducing soil organic matter and increase exposure and compaction resulting in increased erosion within the Analysis Area. However, with implementation of project PDFs, cumulative effects of these issues when considered with Alternative 2 or 3 within the Analysis Area could be minimized. Current and future conditions of soils within the Analysis Area are anticipated to maintain compliance with the 2002 Forest Plan and the WCHP. Innovative uses of newly available soil amendments that increase soil moisture, nutrient, and carbon storage could serve to not only offset impacts to soil resources from the Proposed Action, but also to improve baseline soil conditions at Vail Ski Area.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Under Alternative 2, approximately 10.1 acres of soils would be lost due to trail installation, access route construction and installation of infrastructure. Under Alternative 3, approximately 8.8 acres of soils would be lost due to trail installation, access route construction and installation of infrastructure. Although these losses would represent a minimal acreage within the soil map unit as a whole, soil is a very slowly renewable resource, as estimates for rates of soil formation range from 0.0056 cm to 0.00078 cm per year.[84] Globally, rates of soil formation are not keeping pace with erosion, leading to widespread soil loss that in part owes to grading activities such as those associated with ski area development.[85] In this sense, soil loss from development for summer projects at Vail Ski Area is an irreversible and irretrievable commitment of resources.

[84] Alexander, 2006
[85] Wakatsuki and Rasyidin, 1992

H. WATERSHED AND WETLANDS

SCOPE OF THE ANALYSIS

The Vail Ski Area is located within the upper Eagle River watershed in Eagle County, Colorado. The SUP for the ski area covers 12,590 acres within the Gore Creek, Game Creek and Two Elk Creek watersheds at elevations ranging from 8,200 to 11,816 feet.

The Analysis Area addressed in this report focuses on approximately 5,153 acres of NFS land within SUP area in the Gore Creek and Game Creek watersheds, which encompass total drainages areas of approximately 7,260 acres. For purposes of this analysis the Gore Creek and Game Creek watersheds were divided into five primary watersheds: Game Creek, Cascade Village, Golden Peak, Mountain Front, and Mill Creek. These watersheds all drain to Gore Creek, with the exception of Game Creek, which drains directly to the Eagle River. Each of the primary watersheds was further divided into sub-basin drainage areas based on watershed characteristics and their proximity to the proposed projects.

The information provided here represents a summary of a comprehensive hydrologic analysis that was completed to support this EIS.[86] The hydrologic analysis, in its entirety, is available for review in the project file.

FOREST PLAN DIRECTION

Pursuant to the 2002 Forest Plan, as amended, stream health standards and design criteria are mandated by the Region 2 *Watershed Conservation Practices Handbook* (WCPH).[87] The WCPH contains several Management Measures of relevance regarding stream health and water resources effects:

Applicable WCPH Management Measures

1. Manage land treatments to conserve site moisture and to protect long-term stream health from damage by increased runoff.
3. In the Water Influence Zone (WIZ) next to perennial and intermittent streams, lakes, and wetlands, allow only those actions that maintain or improve long-term stream health and riparian ecosystem condition.
5. Conduct actions so that stream pattern, geometry, and habitats maintain or improve long-term stream health.
6. Maintain long-term ground cover, soil structure, water budgets, and flow patterns of wetlands to sustain their ecological function.

[86] Leonard Rice Engineers, Inc., 2014
[87] USDA Forest Service, 2002 and 2006

8. Manage water use facilities to prevent gully erosion of slopes and to prevent sediment and bank damage to streams.

The Forest Plan also outlines specific Forest-wide and Management Area 8.25 watershed standards, outlined as follows.

Forest-Wide Standards

1. In each stream currently supporting a self-sustaining fish population, ensure that projects maintain sufficient habitat, including flow, for all life history stages of native and desired non-native species.

AFFECTED ENVIRONMENT

The Vail Ski Area is located within the upper Eagle River watershed (HUC 14010003). The primary drainage areas within the Analysis Area (Cascade Village, Mountain Front, Golden Peak, Mill Creek, and Game Creek) cover a total 7,260 acres and are predominately forested areas and open meadows, including ski trails. Disturbed areas include roads, hiking and biking trails, buildings, lift towers and various facilities associated with the ski area. Table 3H-1 provides a summary of the vegetative cover, forested areas, and snowmaking acreage within each of the five primary Analysis Area watersheds.

Table 3H-1:
Drainage Basin Land Use and Snowmaking – Existing Conditions

Watershed	Total Area (acres)	Existing and Alternative 1 Land Use			Existing Snowmaking	
		Ski Trails Area[a] (acres)	Tree Area (acres)	Disturbed Area (acres)	Snowmaking (acres)	Water usage (acre feet)
Cascade Village	444.7	26.3	351.8	66.6	3.3	4.6
Mountain Front	932.4	311.7	513.5	107.2	176.3	213.3
Golden Peak	597.2	191.5	332.8	72.9	140.4	310.7
Mill Creek	4,306.6	972.9	3,257.8	75.9	64.2	60.0
Game Creek	979.0	311.3	638.1	29.6	11.1	11.0
Total	**7,260.0**	**1,813.7**	**5,094.1**	**352.2**	**395.4**	**599.6**

[a] Ski trail area includes natural meadows.
Source: Leonard Rice Engineers, Inc., 2014

The primary drainage areas within the Analysis Area (Cascade Village, Mountain Front, Golden Peak, Mill Creek, and Game Creek) were divided into sub-basin drainage areas to provide more detailed information on stream and drainage channel conditions. The drainage network throughout most of the Analysis Area is comprised of first order perennial streams and intermittent drainages that drain directly to Gore Creek or to Gore Creek via Mill Creek. Refer to Table 3H-2 and Figure 4 for sub-basin identification and characteristics.

Table 3H-2:
Total Existing Disturbed Area and CDA by Watershed

Watershed	Map Reference	Watershed Area (acres)	Total WIZ (acres)	Total Existing Disturbed Area (acres)	Total Existing CDA (acres)
Cascade Village	CV-1	444.66	42.50	66.59	6.53
Mountain Front	MF-1	242.41	9.14	28.27	1.06
	MF-2	178.60	33.44	10.06	2.44
	MF-3	150.99	50.93	42.71	14.34
	MF-4	320.26	29.80	25.18	3.17
	MF-5	40.17	5.97	0.99	0.45
Golden Peak	GP-1	91.07	10.07	50.73	6.00
	GP-2	210.49	17.59	4.45	0.14
	GP-3	190.18	23.16	11.91	1.40
	GP-4	105.51	8.05	5.81	0.81
Mill Creek	MC-1	461.05	47.50	21.55	1.38
	MC-2	310.64	30.09	13.26	2.45
	MC-3	308.61	28.47	9.68	0.91
	MC-4	673.85	77.31	16.24	3.38
	MC-5	174.33	21.66	0.01	0.01
	MC-6	270.37	19.59	2.13	0.32
	MC-7	2,107.81	47.55	13.04	0.02
Game Creek	GC-1	549.16	59.15	9.99	0.00
	GC-2	429.88	21.96	19.65	0.69
Totals		**7,260.03**	**583.94**	**352.24**	**45.50**

Source: Leonard Rice Engineers, Inc., 2014

Stream Health

Stream Health Evaluation

Drainage channel and stream channel characterization was based upon Rosgen Level 2 Stream Classification protocols and the Forest Service Stream Reach Inventory and Channel Stability. The Rosgen Classification protocols were used to understand the general classification of each channel, and the channel's sensitivity to disturbance, while the Forest Service Stream Reach Inventory and Channel Stability Evaluation protocols were used to support the identification of potential problem areas.

Problem areas and sensitive areas associated with existing conditions (e.g., stream channel stability and erosion problems within sensitive riparian areas) were identified during the field reconnaissance work (refer to Figure 5). The Stream Reach Inventory and Channel Stability Evaluation protocols were used to supplement the Rosgen Classifications for evaluation of intermittent drainage channels not previously surveyed by the WRNF. These survey methods are intended for evaluation of perennial streams but also provide an index for comparison of information for determining the resistive capacity of small

intermittent stream channels to the detachment of bed and bank materials and the capacity of streams to adjust and recover from potential changes in flow and/or increases in sediment production.

Each channel was judged qualitatively based on a classification system for the following criteria: entrenchment, gradient, width/depth ratio, sinuosity in various landforms, mass wasting, debris jams potential, vegetative bank protection, channel capacity, bank rock content and angularity, obstructions, undercutting, deposition, streambed sediment size distribution and stability. Data collected focused on four stream health metrics: fine sediment, residual pool depth, wood frequency, and bank stability. Each of these criteria was given a rating and a total score to indicate stream health. Field investigations focused on areas that would be potentially affected by proposed activities. The stream health evaluation and characterization was also based on geospatial data and other calculated data such as slope, sinuosity, connected disturbed areas, channel length, etc.

The purpose of the hydrology analysis is to characterize the surface water hydrology of the Analysis Area, and quantify changes in the amount of runoff from the areas potentially affected by proposed activities. The Colorado Ski Country (CSC) methodology was used to characterize Analysis Area hydrology. Using this methodology, the modeled results represent the most conservative runoff scenario for evaluating impacts during the summer season because 70 percent to 80 percent of the runoff in the Gore Creek watershed occurs during spring snowmelt and peak flows are typically associated with peak snowmelt runoff in the late spring.

Using the CSC methodology water yields were characterized for existing conditions for each of the primary drainage areas. The CSC Model uses a variety of data sources to calculate changes in runoff associated with ski trail clearing and snowmaking.

Water Quantity and Hydrology

Vail Ski Area receives most of its annual precipitation as snow during the winter months. Over the decades, the natural drainage network of the ski area has been changed with the addition of ski trails, water bars, culverts, and roadside ditches to redirect snowmelt and reduce erosion. In general, the hydrograph pattern typically shows a significant increase in discharge beginning toward the end of March or early April, with the peak discharge normally occurring late May or early June, and steadily declining in June and July. Peak flows associated with summer rainstorm events may equal or occasionally exceed peak flows that occur during spring runoff.

Table 3H-3 summarizes the average water yields/hydrology for wet, average, and dry years for each of the watersheds in the Analysis Area.

Table 3H-3:
Existing Water Yield/Hydrology

Watershed	Year Type	Annual Runoff (acre feet)	Peak Flow (cfs)[a]
Cascade Village	Wet	1,328	14.6
	Average	1,174	12.7
	Dry	712	4.7
Mountain Front	Wet	3,067	29.5
	Average	2,714	30.1
	Dry	1,718	11.6
Golden Peak	Wet	2,100	19.8
	Average	1,880	21.0
	Dry	1,226	8.3
Mill Creek	Wet	11,744	129.2
	Average	10,136	109.2
	Dry	5,935	43.0
Game Creek	Wet	2,781	28.3
	Average	2,386	26.2
	Dry	1,443	9.8

[a] Peak flow index based on average annual peak flows observed at Gore Creek above Red Sandstone streamflow gage.
Source: Leonard Rice Engineers, Inc., 2014

Channel Stability

The primary drainage areas within the Analysis Area (Cascade Village, Mountain Front, Golden Peak, Mill Creek, and Game Creek) were divided into sub-basin drainage areas to provide more detailed information on stream and drainage channel conditions. The drainage network throughout most of the Analysis Area is comprised of first order perennial streams and intermittent drainages that drain directly to Gore Creek or to Gore Creek via Mill Creek.

The WRNF has previously completed stream health surveys for some stream reaches within the Analysis Area. Surveys were completed during the 2002–2004 field seasons, utilizing survey methodologies for measuring and quantifying specific stream health metrics. The WRNF survey methodology for quantifying specific stream health metrics includes fine sediment, large woody debris frequency, residual pool depth, undercut banks, and unstable banks as indicators of habitat conditions. The evaluation of stream health is defined by classifications based on the observed habitat condition as a percentage of reference, or expected condition. Three classes of stream health are recognized in the Rocky Mountain Region: *robust*, *at-risk*, and *diminished*. It should be noted that the formal stream health evaluation process is only applied to third-order and larger watersheds; small drainage basins are evaluated with a

mixture of qualitative and quantitative methods. Several reaches located within Golden Peak, Mill Creek, and Game Creek drainages have been evaluated using the formal stream health method and the results are summarized below.

Golden Peak Watershed

In the Golden Peak watershed data results from the WRNF surveys indicate many effects of bank instability are evident higher up in the watershed. As a result, fine sediments are flushed downstream, some of which are deposited in slower water zones of Gore Creek.[88]

Mill Creek Watershed

In the Mill Creek watershed, data results from formal WRNF stream surveys indicate *robust* stream health with respect to fine sediment and unstable banks in Mill Creek. The lower channel, below the culverts, is well-armored and has been heavily modified with rip-rap. The residual pool depth variable is *at-risk* for the lower reach and *diminished* for the upper reach due to ski trail clearing. The double culverts near the lower area of Golden Peak contribute to the lack of wood recruitment. In 2002–2003, the Vail Valley Forest Health Project surveys found that Ptarmigan Creek exhibited *diminished* stream health conditions and Mill Creek exhibited *at-risk* and *diminished* stream due to unstable banks and deposition of fine sediment. Mill Creek has a high density of connected roads in the upper watershed that is a source for fine sediment.[89]

Upper Game Creek Watershed

In the Upper Game Creek watershed, WRNF survey results indicate *robust* stream health with respect to fine sediment, residual pool depth, and woody frequency; however, Upper Game Creek exhibited *diminished* stream health due to unstable banks.[90]

Natural Perennial and Small Intermittent Streams

The evaluation of stream channels in the Analysis Area is divided into two categories based upon the field assessment methods used to characterize existing stream health and channel types. The two categories are: 1) natural perennial stream channels; and 2) small intermittent streams and other drainages. The evaluation of stream health metrics using the Rosgen classification method applies to natural, well-defined channels that are generally first order or higher streams. The evaluation of intermittent small tributaries and other drainage pathways is also important to understanding drainage conditions, Connected Disturbed Areas (CDA), and overall stream health of each watershed.

[88] USDA Forest Service, 2009
[89] Ibid.
[90] Weinhold, 2013

The first and second order drainages within the Analysis Area were evaluated using the Rosgen classification system.[91] This was paired with the Pfankuch Reach Inventory and Channel Stability Evaluation rating procedure to evaluate the upper and lower banks of the streambed for evidence of degradation or erosion/deposition.[92] Using the Pfankuch method, a score is assigned to each reach based upon the viability of bed materials, channel geometries, and channel slopes to determine channel stability conditions; low numbers suggest a higher stability. Each reach was assessed using the Rosgen Classification and Pfankuch rating, and assigned a Channel Stability rating. Table 3H-4 summarizes the results of the survey.

The stream channels in the Analysis Area largely fall into the Rosgen "Aa+" and "A" stream types. These channels tend to be steep gradient (> 10 percent slopes) systems that are often entrenched and in some cases can be characterized as step-pool systems. These systems also have high sediment transport capacities due to their steep gradients and high confinement. Rosgen "B" classification exhibits a moderately steep gradient (2 to 4 percent slopes). The number designation associated with each Rosgen Class refers to the median size of the stream channel bed material (i.e., 1 indicates bedrock, 6 indicates silt/clay).[93]

Perennial stream channels within the Analysis Area are identified in Table 3H-4; in general, they were rated stable, with the exception of sub-basin MC-1, MC-4 and GC-2. Sub-basin MC-1 is classified as "Moderately Unstable"; however, with no indication of channel erosion of unstable banks. Sub-basin MC-4 is classified as "Stable"; however, the drainage is moderately stable to unstable, with no indication of channel erosion of unstable banks, and has a high Pfankuch score. Sub-basin GC-2 is classed as "Stable"; however, the drainage is moderately stable to unstable, with no indication of channel erosion of unstable banks, and a culvert is located on the downstream portion of the basin.

[91] Rosgen, n.d.
[92] Pfankuch, 1975
[93] Rosgen and Silvey, 1998

Table 3H-4:
Natural Perennial Stream Channel Surveys

Watershed	Map Reference/ Sub-basin	Stream Name	Channel Stability Conditions		
			Pfankuch Score	Rosgen Classification	Channel Stability Rating
Golden Peak	GP-2	Mill Creek	46.5	B2	Stable
Mill Creek	MC-1	W. Fork Mill Creek	79	A2a+	Moderately Unstable
	MC-2	W. Fork Mill Creek	68	A3a+	Stable
	MC-4	E. Fork Mill Creek	50	A3a+	Stable
	MC-4	E. Fork Mill Creek	74	A3a+	Stable
	MC-4	E. Fork Mill Creek	72.5	A4a+	Stable
	MC-4	E. Fork Mill Creek	87.5	A4a+	Stable
	MC-6	Mill Creek	66.5	A3	Stable
Game Creek	GC-2	Game Creek	56	A2a+	Stable
	GC-2	Game Creek	49	A3a+	Stable

Source: Leonard Rice Engineers, Inc., 2014

Most of the proposed activities would occur near small drainage swales and pathways to perennial streams, Gore Creek and the Eagle River, which are not large enough to warrant a formal stream health evaluation. Supplemental channel stability surveys were completed to assess stream health for these drainages using the Pfankuch's method, a qualitative approach based upon the viability of bed materials, channel geometries, and channel slopes to determine channel stability conditions.[94] A score is assigned to each sub-basin; low numbers suggest a higher stability. Table 3H-5 summarizes the results for these channels.

As indicated in Table 3H-5, one small intermittent stream, sub-basin GP-3 or the lower portion of the Golden Peak watershed, is classified as "Unstable." The upslope portion of the channel flows into a man-made channel and then flows into a culvert to an area with significant erosion. Some evidence of deposition was present at this location; however, the drainage is stable, with no indication of channel erosion of unstable banks.

[94] Pfankuch, 1975

Table 3H-5:
Small Intermittent Streams and Other Drainages Surveys

Watershed	Map Reference/ Sub-basin	Channel Stability Conditions		
		Pfankuch Score	Pfankuch Rating	Channel Stability Rating
Cascade Village	CV-1	36	High Good	Stable
	CV-1	49.5	Med Good	Stable
Mountain Front	MF-1	61	Low Good	Stable
	MF-2	53	Med Good	Stable
	MF-2	69	Low Good	Stable
	MF-2	68	Low Good	Stable
	MF-2	79	High Fair	Stable
	MF-3	48	Med Good	Stable
	MF-3	58	Med Good	Stable
	MF-3	71	Low Good	Stable
	MF-3	84	High Fair	Stable
	MF-4	68	Low Good	Stable
Golden Peak	GP-3	52	Med Good	Stable2
	GP-3	133	Med Poor	Unstable
Mill Creek	MC-1	67	Low Good	Stable
	MC-1	77	High Fair	Stable
	MC-2	62	Low Good	Stable
	MC-4	64	Low Good	Stable
	MC-4	70.5	Low Good	Stable

Disturbed Areas and Connected Disturbed Areas

Snowmelt and rain event runoff from graded and disturbed areas, such as roads, trails and other facilities that are hydrologically connected to the drainage network have the ability to quickly route water to the streams and contribute to increased peak flows. Removal of vegetative cover reduces soil permeability, allows water to runoff much more quickly and exposes soil to erosion which increases sediment loading to streams. Direct hydrologic connection between disturbed areas and streams occurs when waterbars, ditches, culverts and other drainage features convey runoff to the streams. When disturbed areas are disconnected from the streams by routing runoff to areas where water can infiltrate to soils, the impacts on peak flow and water quality are substantially attenuated.

Under existing conditions, there is an estimated 45.5 acres of CDA within in the Analysis Area for the proposed projects. Most of the existing CDA is associated with roads and some constructed drainages and water bars that discharge directly to streams. CDA under the existing conditions (Alternative 1) is displayed in Table 3H-10.

Perennial streams in the Analysis Area include Mill Creek, East Fork and West Fork Mill Creek, and Game Creek. The WIZ is the land next to water bodies where vegetation plays a major role in sustaining

long-term integrity of aquatic systems. The WIZ includes the geomorphic floodplain (valley bottom), riparian ecosystem, and inner gorge. Its minimal horizontal width (from top of each bank) is 100 feet or the mean height of mature dominant late-seral vegetation, whichever is most. The WIZ protects interacting aquatic, riparian, and upland functions by maintaining natural processes and resilience of soil, water, and vegetation systems.[95]

Tree removal and ground disturbance in the WIZ can impact bank stability by creating hydrologic connections between high-runoff areas and the channel network, known as CDAs. CDAs include roads, trails, ditches, compacted soils, bare soils, and other high runoff areas that are directly connected to the channel system. All existing disturbed areas within the WIZ were considered to be CDA. Table 3H-2 shows the total existing disturbed areas for each drainage and total CDA currently located within the WIZ.

Roads and trails that intersect the WIZ were assumed to be connected to the stream channel network because roadside drainage ditches frequently discharge directly to the stream. Because culverts that divert water out of roadside ditches are generally spaced approximately 300 feet apart, it was assumed that a maximum of 300 feet of roadside ditches would drain directly to the stream channel. The connection of roadside drainage ditches increases direct routing of runoff flow within the watershed, increasing peak flows and subsequent erosion and sediment transport.

Sensitive Areas

Field reconnaissance conducted between September 24 and 26, 2013 included identification of sensitive areas throughout the Analysis Area that could potentially be affected by soil disturbance, drainage modifications, and hydrology changes associated with the proposed projects and activities. Previously identified sensitive areas and sensitive areas identified during field reconnaissance include areas of channel instability, mass wasting and slope failure, erosion, and wetlands and are evaluated below by watershed (refer to Figure 5).

Sensitive areas identified within each watershed are described in detail below, and are identified on Figure 5. The identification of sensitive areas is intended to assist in the final location/design of any approved projects activities, as the need to avoid these areas altogether or minimize/mitigate potential impacts is an important consideration in resource management and complying with Forest Plan standards.

Cascade Village

In the Cascade Village watershed, there is no evidence or identified areas of channel instability, mass wasting, slope failure or erosion.

[95] USDA Forest Service, 2006

Mountain Front

In the Mountain Front watershed, five areas of bank instability, two areas of slope failure, and nine areas of erosion w identified. The bank instability areas are associated with a culvert outlet and drainage construction. The two slopes failures are located on the west side of *Giant Steps* trail (sub-basin MF-1) and on *Simba* trail (sub-basin MF-3). The areas of erosion are located in sub-basins MF-1, MF-2, and MF-3. Two significant erosion areas associated with tree clearing are located in the upper sub-basin MF-3 to the east of Eagle's Nest. Erosion control BMPs are being implemented to stabilize erosion areas and restore ground cover. This area should be considered sensitive until reclamation has been completed.

Golden Peak

In the Golden Peak watershed, one area of degraded stream, six areas of slope failure, one area of erosion are present. The degraded stream is located in sub-basin GP-3 due to road maintenance. The six areas of slope failures are located in GP-2, GP-3, and GP-4. One significant erosion area associated with tree clearing is located in the lower GP-3 drainage between the upper end of *Giant Steps* and Gondola One. Erosion control BMPs are being implemented to stabilize erosion areas and restore ground cover. This area should be considered sensitive until reclamation has been completed.

Mill Creek

In the Mill Creek watershed, one area of moderate instability, one slope failure, and four areas of erosion are present. The one segment of moderate stream instability is located in sub-basin MC-1. The one slope failure is located in sub-basin MC-1. The four areas of erosion are located in sub-basins MC-1 and MC-2.

Game Creek

In the Game Creek watershed, there is no evidence or identified areas of channel instability, mass wasting, slope failure or erosion.

Wetlands

Wetlands in the Analysis Area are predominantly associated with streams, intermittent drainages and springs (refer to Figure 5). The wetlands identified in the Analysis Area occur in narrow bands immediately adjacent to the streams. There are also isolated pockets of wetlands within the Analysis Area that are associated with springs and drainage collection areas. The WIZ protects interacting aquatic, riparian, and upland functions by maintaining natural processes and resilience of soil, water, and vegetation systems.

Water Quality

In December 2012, Gore Creek (Segment 8) was added to Colorado's 303(d) List of impaired water bodies for aquatic life use impairment, with a provisional qualifier indicating that the cause of impairment is unknown. The listing will remain provisional until a pollutant—one that is either the cause of the

impairment, or one that fails to meet a water quality standard—is identified. Several stream reaches in the Eagle River, Segment 9a (from Gore Creek to Rube Creek) are also listed as impaired and identified for Monitoring and Evaluation (M&E). Table 3H-6 shows the impaired or threatened waterbody segments located downstream from the Analysis Area. Currently available data indicates that stream reaches on the 303(d) List are not meeting an applicable water quality standard. For stream reaches on the M&E List, additional data are needed to determine whether or not standards are being met.

Table 3H-6:
Gore Creek Segment 8 and Eagle River Segment 9a 303(d) List
Impaired and Monitoring & Evaluation Waters

Reach Start	Reach End	Parameter	Type
GORE CREEK – SEGMENT 8			
Black Gore Creek	Confluence with the Eagle River	Aquatic Life (provisional)	Impaired (Low Priority)
EAGLE RIVER – SEGMENT 9A			
Berry Creek	Ute Creek	Temperature	M&E
Ute Creek	Rube Creek	Temperature	Impaired (High Priority)
Berry Creek	Squaw Creek	Aquatic Life	M&E
Berry Creek	Squaw Creek	Sediment	Impaired (High Priority)
Gore Creek	Berry Creek	Sediment	M&E
Squaw Creek	Rube Creek	Sediment	M&E

Segment 8 includes the main stem of Gore Creek from Black Gore Creek to the confluence of the Eagle River. Several key stressors have been identified as the cause of impairment and biological degradation in Gore Creek. Recent studies have documented the primary stressors in Gore Creek, which include: urban runoff containing pollutants such as petroleum products, nutrients, fertilizers, and other lawn care products, and other pollutants. These studies found stressed conditions throughout the urbanized areas of the Town of Vail. The areas that showed the most biological degradation were in East Vail and upstream from Mill Creek and the Vail Golf Course. Biological conditions observed in the East Vail reach of Gore Creek are consistent with impacts from insecticides and herbicides, road deicers, and petroleum products. Observations of stream substrate conditions in Gore Creek, above and below the confluence of Mill Creek, during the collection of biological samples have not indicated embedded conditions or significant accumulation of fine sediment that would cause or contribute to the impairment of aquatic life.

Eagle River Basin Segment 9a includes the main stem of the Eagle River from the confluence with Gore Creek to the confluence with Rube Creek. The portion of Eagle River from Berry Creek to Squaw Creek was placed on the 303(d) List for sediment based on data collected in a very broad, low gradient stream reach that includes an evaporite sinkhole that functions as a large sediment trap. A major stream restoration project was completed in 2011 by the Eagle River Watershed Council to improve stream habitat and restore riparian conditions through much of this stream reach. The portions of Eagle River

Segment 9a above Berry Creek and below Squaw Creek were placed on the M&E List for sediment only because no data were available.

The 6-mile long portion of Segment 9a from Berry Creek to Ute Creek has been added to the State's M&E List for temperature and the portion from Ute Creek to Rube Creek has been added to the 303(d) List for temperature. The Eagle River Water and Sanitation District, in consultation with the Colorado Water Quality Control Division and Colorado Parks and Wildlife, is collecting and evaluating temperature data to determine the potential causes (natural and anthropogenic) of elevated temperatures during the late summer and fall, the potential biological impacts, and the appropriateness of the currently applicable standards. It is important to note that this area is located 9 to 11 miles downstream from the confluences of Gore Creek and Game Creek with the Eagle River.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

The No Action Alternative would result in a continuation of existing operations and management practices at the Vail Ski Area because no other summer recreation facilities and improvements would be developed under this alternative. Stream health conditions, water yield and hydrology would continue to resemble existing conditions. Under this alternative, the existing 352.2 acres of disturbed areas and 45.5 acres of connected disturbed areas would not increase (refer to tables 3H-7 and 3H-8).

Alternative 2 – The Proposed Action

Table 3H-7 identifies project design features, best management practices, and mitigation measures (collectively referred to as Management Requirements) that are designed to minimize, avoid or mitigate for impacts to watershed resources throughout the Analysis Area. It is important to note that this is an exhaustive list that many not apply to each and every proposed project or activity. Because the proposed mountain biking and hiking trails have not been site-specifically designed or located, an on-going/evolving follow-up assessment will need to be prepared to ensure that any increases in CDA related to approved projects are mitigated and that stream health throughout the Analysis Area is maintained. On a project-by-project basis, a mix of general and site-specific Management Requirements may be employed. The follow-up assessment will need to be a collaborative effort between Forest Service hydrologists, consulting hydrologists, and Vail Associates representatives. Proposed Management Requirements are included in Table 3H-7.

Table 3H-7:
Management Requirements

USFS Applicable Standards, Design Features, and Project-Specific Required Mitigation
In order to ensure that stream health in the Analysis Area is maintained or improved with implementation of proposed activities, a follow-up assessment would be required once site-specific locations of activities, particularly trails, are known. The follow-up assessment would include a site-specific delineation of the effective WIZ and other identified Sensitive Areas, as well as quantification of connected disturbed areas and WIZ disturbance, including proposals for mitigation and treatment of such. This assessment would be updated on a project-by-project basis and would require collaboration between the Forest hydrologist, consulting hydrologists, and Vail Associates.
Vail Ski Area is required to have a Stormwater Management Plan (SWMP) to operate under a State approved Permit for Stormwater Discharges Associated with Construction Activity (CDPS Permit No. COR-030541). The SWMP describes practices (BMPs) to be used to reduce the pollutants in stormwater discharges associated with construction activities and is updated annually to incorporate appropriate BMPs for specific projects.
In the water influence zone next to perennial and intermittent streams, lakes and wetlands, allow only those land treatments that maintain or improve long-term stream health and riparian ecosystem condition.
Keep heavy equipment out of streams, swales, and lakes, except to cross at designated points, build crossings, or do restoration work, or if protected by at least 1 foot of packed snow or 2 inches of frozen soil. Keep heavy equipment out of streams during fish spawning, incubation and emergence periods.
Locate new concentrated-use sites outside of the WIZ if feasible and outside riparian areas and wetlands always. Harden or reclaim existing sites in the WIZ to prevent detrimental soil and bank erosion. (WIZ boundaries adjacent to project areas should be clearly demarcated on the ground to prevent infringement during construction and operation.)
Do not excavate earth material from, or store excavated earth material in, any stream, swale, lake, wetland, or WIZ. (WIZ boundaries adjacent to project areas should be clearly demarcated on the ground to prevent infringement during construction and operation.)
Do not excavate earth material from, or store excavated earth material in, any stream, swale, lake, wetland, or WIZ.
Keep ground vehicles out of wetlands unless protected by at least 1 foot of packed snow or 2 inches of frozen soil. Do not disrupt water supply or drainage patterns into wetlands.
If trails must enter wetlands, use bridges or raised prisms with diffuse drainage to sustain flow patterns. Set crossing bottoms at natural levels of channel beds and wet meadow surfaces. Avoid actions that may dewater or reduce water budgets in wetlands.
Final locations of any approved mountain biking and hiking trails will avoid all wetlands (including through the use of bridges and/or other structures). If any wetland impacts are determined to be absolutely necessary, additional NEPA analysis and U.S. Army Corps of Engineers permitting will be required prior to construction.
Avoid long-term reduction in organic ground cover and organic soil layers in any wetland (including peat in fens).
Limit disturbed sites to the minimum feasible number, width, and total length consistent with the purpose of specific operations, local topography, and climate. (No new roads are proposed, but temporary construction access routes are required for installation and maintenance of canopy tour towers and coasters.)
Stabilize soils onsite. Endhaul soil if full-bench construction is used. Avoid slopes steeper than 70%.
Avoid soil-disturbing actions during periods of heavy rain or wet soils. Apply travel restrictions to protect soil and water.
Install cross drains to disperse runoff into filter strips and minimize connected disturbed areas. Make cuts, fills, and road surfaces strongly resistant to erosion between each stream crossing and at least the nearest cross drain. Revegetate using certified local native plants as feasible; avoid persistent or invasive exotic plants.
Retain stabilizing vegetation on unstable soils. Avoid new roads or heavy equipment use on unstable or highly-erodible soils.

Table 3H-7:
Management Requirements

USFS Applicable Standards, Design Features, and Project-Specific Required Mitigation
Use existing roads unless other options will produce less long-term sediment. Reconstruct for long-term soil and drainage stability.
Avoid ground skidding with blades lowered or on highly erodible slopes steeper than 40%. Conduct logging to disperse runoff as feasible.
Designate, construct, and maintain recreational travelways for proper drainage and harden their stream crossings as needed to control sediment. (Applies primarily to biking, hiking, and horse trails.)
Any construction-related disturbance will minimize sediment discharge into streams, lakes and wetlands.
Design trails and other soil disturbing activities to the minimum standard for their use and to "roll" with the terrain as feasible.
Use filter strips, and sediment traps if needed, to keep all sand sized sediment on the land and disconnect disturbed soil from streams, lakes and wetlands. Disperse runoff into filter strips.
Key sediment traps into the ground. Clean them out when 80% full. Remove sediment to a stable gentle upland site and revegetate.
Stabilize disturbed sites during and after construction to control erosion.
Do not encroach fills or introduce soil into streams, swales, lakes, or wetlands.
Properly compact fills and keep woody debris out of them. Revegetate cuts and fills upon final shaping to restore ground cover, using certified local native plants as feasible; avoid persistent or invasive exotic plants. Provide sediment control until erosion control is permanent.
Do not disturb ditches during maintenance unless needed to restore drainage capacity or repair damage. Do not undercut the cut slope.
PLANNING CONSIDERATION BMPS (CDPHE, WQCC, REGULATION 82)
CDPHE, Construction Stormwater Discharge Permit – Colorado stormwater regulations (5 CCR 1002-61) require a permit for construction activity that disturbs 1 acre or more during the life of the project. Prior to commencement of construction, a stormwater management plan (SWMP) with appropriate erosion and sediment control BMPs must be developed and implemented. A comprehensive list of potentially appropriate BMPs is included in the CDPHE 401Certification Regulation (5 CCR 1002-82).
An erosion and sediment control plan should be developed and is comprised of three major elements. The erosion control measures used to limit erosion of soil from disturbed areas at a construction site; the sediment control measures that will be used to limit transport of sediment to off-site properties and downstream receiving waters; and the drainageway protection and runoff management measures that will be used to protect streams and other drainageways located on the construction site from erosion and sediment damages.
Some of the site constraints that should be considered planning/designing/locating approved projects and activities include slope stability, drainage aspect and constructability, along with the general stream hydrology, stream morphology, water quality and aquatic ecology. (Site constraints, such as avoidance of wetlands, are address above under the USFS Design Standards)
Seasonality should be considered, particularly when construction must take place within streams and other waterways. (For example, construction during periods of high stream should be avoided.)
Surface roughening provides temporary stabilization of disturbed areas from wind and water erosion; surface roughening should be performed after final grading to create depressions 2 to 4 inches deep and 4 to 6 inches apart. It is particularly useful where temporary revegetation cannot be immediately established due to seasonal planting limitations. Surface roughening only provides temporary protection and must be used in combination with other BMPs, such as mulching and temporary cover.
Mulching of all disturbed areas should occur within 14 days after final is reached on all portions of site not permanently stabilized.
A viable vegetative cover should be established within one year on all disturbed areas and soil stockpiles not otherwise permanently stabilized. Vegetation is not considered established until a ground cover is achieved, which is sufficiently mature to control soil erosion and can survive severe weather conditions.

Table 3H-7:
Management Requirements

USFS Applicable Standards, Design Features, and Project-Specific Required Mitigation
The seed mix for erosion control and stabilization during construction should be compatible with the final seeding needs and will be approved by the WRNF.
As a minimum, topsoil preservation and reuse involves the removal, stockpiling, and re-spreading of the surface 6 to 8 inches of natural soil.
Erosion control blankets are used in place of mulch on areas of high velocity runoff and/or steep grade, to aid in controlling erosion on critical areas by protected young vegetation.
To provide vegetative cover on disturbed areas not paved or built upon for a period of two years or longer, or for an indeterminate length of time, a perennial grass should be planted.
Cut-and-fill slopes must be designed and constructed to minimize erosion. This requires consideration of the length and steepness of the slope, the soil type, up-slope drainage area, groundwater conditions and other applicable factors. Slopes that are found to be eroding excessively will require additional slope stabilization until the problem is corrected.
Sediment entrapment facilities include terracing, slope drains, straw bale barriers, silt fences, filter strips, sediment traps and sediment basins; at least one entrapment facility should capture runoff leaving a disturbed area.
A silt fence is made of a woven synthetic material and acts to filter runoff. Silt fence can be placed as a temporary barrier at the base of a disturbed area but is not recommended for use in a channel or swale.
A sediment trap is a temporary structure that is designed to fill with sediment. A sediment trap can be constructed by either excavating below grade or building an embankment across a swale. Excavated traps are less prone to failure than embankments. No pipe is used at the outlet, as in a sediment basin, and an open-channel spillway must be included in the design. A minimum of 900 cubic feet of storage volume must be provided for each tributary acre.
All BMPs shall be maintained and repaired as needed to assure continued performance. Straw bale barriers or silt fences may require periodic replacement and all sediment accumulated behind them must be removed and disposed of properly. Sediment traps and basins will require periodic sediment removal when the design storage level is one-half full. All facilities must be inspected following each heavy precipitation or snowmelt event that results in runoff.
All temporary erosion and sediment control measures must be removed within 30 days after final stabilization.
Good housekeeping requires keeping potential areas where pollutants and pollution exist clean and orderly. Use of common sense to improve and maintain basic housekeeping methods: accidental spill response, well-maintained machinery and processes, improved operations, material storage practices, material inventory controls, routine or regular clean-up schedules, well-organized work areas, educational programs and method to prevent mixing of runoff into environment from stormwater runoff. Preventative maintenance involves regular inspection and testing of equipment and operational systems to prevent break downs and failures that cause potential runoff contamination.

Sources: USDA Forest Service, 2006 and CDPHE, 2003

Stream Health

Water Quantity and Hydrology

There would be 51 acres of additional temporary and permanently disturbed areas associated with the proposed projects included in Alternative 2. The average yield increase for the Analysis Area watersheds would range from 0.20 to 0.63 percent and the maximum increase, which would occur in wet years, would range from 0.26 to 0.83 percent. The maximum increase in peak flows would range from 0.23 to 0.91 percent in dry years, which would be less than 0.2 cfs. This modeled increase would be too small to

be measurable and result in no adverse impact. Table 3H-8 shows the water yield and peak flow changes for each watershed under alternatives 1, 2 and 3.

Table 3H-8:
Water Yield and Peak Flow Changes

Watershed	Alternative	Year Type	Annual Runoff (acre feet)	Annual Runoff % Change	Peak Flow (cfs)	Peak Flow % Change
Cascade Village	Alternative 1	Wet	1,328	0.00	14.6	0.00
		Average	1,174	0.00	12.7	0.00
		Dry	712	0.00	4.7	0.00
	Alternative 2	Wet	1,335	0.48	14.6	0.09
		Average	1,180	0.54	12.7	0.63
		Dry	718	0.74	4.7	0.78
	Alternative 3	Wet	1,333	0.32	14.6	0.11
		Average	1,178	0.37	12.7	0.42
		Dry	716	0.50	4.7	0.49
Mountain Front	Alternative 1	Wet	3,067	0.00	29.5	0.00
		Average	2,714	0.00	30.1	0.00
		Dry	1,718	0.00	11.6	0.00
	Alternative 2	Wet	3,084	0.56	29.5	0.12
		Average	2,731	0.63	30.3	0.72
		Dry	1,732	0.83	11.7	0.91
	Alternative 3	Wet	3,081	0.47	29.5	0.14
		Average	2,729	0.53	30.3	0.60
		Dry	1,730	0.70	11.7	0.76
Golden Peak	Alternative 1	Wet	2,100	0.00	19.8	0.00
		Average	1,880	0.00	21.0	0.00
		Dry	1,226	0.00	8.3	0.00
	Alternative 2	Wet	2,110	0.50	19.8	0.20
		Average	1,891	0.57	21.1	0.63
		Dry	1,235	0.73	8.4	0.78
	Alternative 3	Wet	2,110	0.50	19.8	0.20
		Average	1,891	0.57	21.1	0.63
		Dry	1,235	0.73	8.4	0.78
Mill Creek	Alternative 1	Wet	11,744	0.00	129.2	0.00
		Average	10,136	0.00	109.2	0.00
		Dry	5,935	0.00	43.0	0.00
	Alternative 2	Wet	11,768	0.21	129.3	0.01
		Average	10,160	0.24	109.5	0.28
		Dry	5,955	0.34	43.1	0.36
	Alternative 3	Wet	11,768	0.21	129.3	0.01
		Average	10,160	0.24	109.5	0.28
		Dry	5,955	0.34	43.1	0.36

Table 3H-8:
Water Yield and Peak Flow Changes

Watershed	Alternative	Year Type	Annual Runoff (acre feet)	Annual Runoff % Change	Peak Flow (cfs)	Peak Flow % Change
Game Creek	Alternative 1	Wet	2,781	0.00	28.3	0.00
		Average	2,386	0.00	26.2	0.00
		Dry	1,443	0.00	9.8	0.00
	Alternative 2	Wet	2,786	0.16	28.4	0.05
		Average	2,391	0.20	26.2	0.22
		Dry	1,446	0.26	9.9	0.23
	Alternative 3	Wet	2,786	0.16	28.4	0.05
		Average	2,391	0.20	26.2	0.22
		Dry	1,446	0.26	9.9	0.23

Channel Stability

The channel survey results described previously found that in most of the Analysis Area watersheds stream channel conditions are stable. Several isolated stream reaches were identified that are unstable under existing conditions and disturbance associated with construction activities in the WIZ could further destabilize these stream reaches. By employing a mix of the site-specific and general Management Requirements identified in Table 3H-7, any increases in CDA related to approved projects will be mitigated and stream health throughout the Analysis Area will be maintained or improved. As indicated, an on-going/evolving follow-up assessment will need to be prepared in collaboration with the Forest hydrologist, consulting hydrologists and Vail Associates to ensure proper location and design of approved projects.[96] Potential impacts to stream channel stability for each alternative are addressed under the discussion of Disturbed Areas and Connected Disturbed Areas.

Disturbed Areas and Connected Disturbed Areas

Construction of the proposed activities and facilities would result in a substantial amount of temporary ground disturbance and potential increases in the amount of CDA throughout the Analysis Area. However, the proposed facilities would be spread over a large area during multiple construction seasons, and projects can be configured/located to minimize the amount of direct drainage connections between disturbed areas and streams by employing appropriate erosion/drainage BMPs and project design features (refer to Table 3H-7), coupled with wide vegetative buffers. Disturbed areas located outside of the WIZ would be effectively disconnected from streams, or existing CDA throughout the watersheds would be disconnected. Conversely, disturbed areas within the WIZ are assumed to be connected.

[96] In the technical report (Leonard Rice Engineers, Inc., 2014) figures B-1 through B-13 provide locations and descriptions of channel conditions, including stream reaches where channel stability concerns were observed, and their proximity to proposed recreation facilities.

Existing sensitive areas, including areas of unstable stream channels, mass wasting and slope failure, and active erosion, have been identified and discussed above. These areas should be avoided, or impacts should be minimized or mitigated. Currently there are an estimated 45.5 acres of CDA within in the Analysis Area (refer to Table 3H-10). Most of the existing CDA is associated with roads and some constructed drainages and water bars that discharge directly to streams. Permanent increases in ground disturbance related to the Proposed Action would result in an increase to CDA of 3.5 acres, approximately 7 percent, which would result in some increase in sediment loading to Gore Creek and the Eagle River. Management Requirements and a follow-up assessment to mitigate for impacts to CDA will be required to avoid/minimize/offset the 3.5-acre increase to CDA under Alternative 2 (refer to Table 3H-7).

Total disturbed areas, including WIZ areas, were estimated for each watershed for existing conditions and the action alternatives are shown in Table 3H-9. Connected disturbed areas within the WIZ of each watershed are shown in Table 3H-10 for each alternative. Because the actual locations and layouts of the proposed mountain biking trails and hiking trails are unknown at this time, impacts within the WIZ were estimated based on the proportion of the total WIZ acres within each watershed. For example, if 9 percent of the watershed area was within the WIZ, then 9 percent of the proposed disturbed area resulting from trails was assumed to impact the WIZ and was therefore included in the estimated CDA. Impacts to the WIZ were only estimated for watersheds with proposed trails intersecting the WIZ. It is important to note that trails would be located to avoid and minimize impacts in the WIZ.

Table 3H-9:
Total Disturbed Area by Watershed (including areas within the WIZ)

Watershed	Watershed Area (acres)	Alternative 1 and Existing Disturbed Area (acres)	Alternative 2 Disturbed Area (acres)		Alternative 3 Disturbed Area (acres)	
			Temporary Disturbance	Permanent Disturbance	Temporary Disturbance	Permanent Disturbance
Cascade Village-1	444.66	66.59	0.00	70.67	0.00	68.91
Mountain Front-1	242.41	28.27	0.00	30.19	0.00	30.19
Mountain Front-2	178.60	10.06	0.00	12.71	0.00	12.71
Mountain Front-3	150.99	42.71	0.00	43.56	0.00	42.98
Mountain Front-4	320.26	25.18	0.00	32.02	0.00	29.65
Mountain Front-5	40.17	0.99	0.00	1.35	0.00	1.35
Golden Peak-1	91.07	50.73	0.00	51.29	0.00	51.29
Golden Peak-2	210.49	4.45	0.24	6.58	0.24	6.58
Golden Peak-3	190.18	11.91	0.00	12.33	0.00	12.33
Golden Peak-4	105.51	5.81	0.09	7.31	0.09	7.31
Mill Creek-1	461.05	21.55	0.90	27.84	0.90	27.84
Mill Creek-2	310.64	13.26	0.00	16.33	0.00	16.33
Mill Creek-3	308.61	9.68	1.73	13.64	1.73	13.64
Mill Creek-4	673.85	16.24	0.00	24.80	0.00	24.80

Table 3H-9:
Total Disturbed Area by Watershed (including areas within the WIZ)

Watershed	Watershed Area (acres)	Alternative 1 and Existing Disturbed Area (acres)	Alternative 2 Disturbed Area (acres)		Alternative 3 Disturbed Area (acres)	
			Temporary Disturbance	Permanent Disturbance	Temporary Disturbance	Permanent Disturbance
Mill Creek-5	174.33	0.01	0.00	0.10	0.00	0.10
Mill Creek-6	270.37	2.13	0.00	2.13	0.00	2.13
Mill Creek-7	2,107.81	13.04	0.00	13.60	0.00	13.60
Game Creek-1	549.16	9.99	0.18	11.13	0.18	10.99
Game Creek-2	429.88	19.65	0.96	21.52	0.96	21.52
Total	**7,260.03**	**352.24**	**4.10**	**399.12**	**4.10**	**394.28**

Under Alternative 2, approximately 51 acres of additional temporary and permanent disturbed areas are associated with the proposed projects. Trail and facility designs would be modified to reduce impacts to the WIZ to the extent possible; however, some impacts to the WIZ or perennial and/or intermittent streams may be unavoidable. Additional ground disturbance within the WIZ may not result in adverse impacts to stream health, or stream health would be maintained or improved with implementation of Management Requirements to minimize or prevent increases in CDA. Below each watershed disturbed areas is described in detail.

Table 3H-10:
Total Connected Disturbed Area by Watershed

Watershed	Total WIZ Area (acres)	Alternative 1 and Existing CDA (acres)	Alternative 2 Increase in CDA (acres)		Alternative 3 Increase in CDA (acres)	
			Temporary Disturbance	Permanent Disturbance	Temporary Disturbance	Permanent Disturbance
Cascade Village-1	42.50	6.53	0.30	0.00	0.00	0.00
Mountain Front-1	9.14	1.06	0.00	0.07	0.00	0.07
Mountain Front-2	33.44	2.44	0.00	0.50	0.00	0.50
Mountain Front-3	50.93	14.34	0.00	0.04	0.00	0.04
Mountain Front-4	29.80	3.17	0.00	0.42	0.00	0.42
Mountain Front-5	5.97	0.45	0.00	0.05	0.00	0.05
Golden Peak-1	10.07	6.00	0.00	0.00	0.00	0.00
Golden Peak-2	17.59	0.14	0.14	0.15	0.14	0.15
Golden Peak-3	23.16	1.40	0.00	0.02	0.00	0.02
Golden Peak-4	8.05	0.81	0.00	0.07	0.00	0.07
Mill Creek-1	47.50	1.38	0.00	0.39	0.00	0.39
Mill Creek-2	30.09	2.45	0.05	0.22	0.05	0.22
Mill Creek-3	28.47	0.91	0.00	0.34	0.00	0.34
Mill Creek-4	77.31	3.38	0.00	0.98	0.00	0.98

Table 3H-10:
Total Connected Disturbed Area by Watershed

Watershed	Total WIZ Area (acres)	Alternative 1 and Existing CDA (acres)	Alternative 2 Increase in CDA (acres)		Alternative 3 Increase in CDA (acres)	
			Temporary Disturbance	Permanent Disturbance	Temporary Disturbance	Permanent Disturbance
Mill Creek-5	21.66	0.01	0.00	0.00	0.00	0.00
Mill Creek-6	19.59	0.32	0.00	0.00	0.00	0.00
Mill Creek-7	47.55	0.02	0.00	0.00	0.00	0.00
Game Creek-1	59.15	0.00	0.00	0.00	0.00	0.00
Game Creek-2	21.96	0.69	0.00	0.00	0.00	0.00
Total	**583.94**	**45.50**	**0.49**	**3.25**	**0.19**	**3.25**

Cascade Village

Proposed facilities located in the Cascade Village watershed include the horse corral, the Adventure Ridge Mountain Coaster, the Pride Express Mountain Coaster, and downhill mountain biking trails. Construction of these projects would increase the total amount of disturbed area within the watershed by up to 4.1 acres. Channel conditions could degrade from stable to unstable due to temporary ground disturbance for construction of the proposed Adventure Ridge Mountain Coaster and Pride Express Mountain Coaster within the WIZ. No mass wasting or significant erosion areas were identified. The facilities that would intersect the WIZ are the Adventure Ridge and Pride Express mountain coasters. It also should be noted that the potential WIZ impacts are located in the upper most reach of the CV-1 intermittent sub-drainage area.

Mountain Front

Proposed facilities located in the Mountain Front watershed include the Aerial Adventure Course, the Riparian Experience, the Adventure Ridge Mountain Coaster, the Pride Express Mountain Coaster, and downhill mountain biking trails. Construction of these projects would increase the total amount of disturbed area within the watershed by up to 12.6 acres. Channel conditions could degrade from stable to unstable due to ground disturbance for construction of the proposed downhill mountain biking trails within the WIZ, and final layout of any approved mountain biking/hiking trails has potential to increase CDA. This would be addressed through the implementation of Management Requirements identified in Table 3H-7.

Two slope failure areas were found in the Mountain Front watershed, but the layout of proposed facilities would avoid impacts to these areas. Several erosion areas were identified in the Mountain Front watershed, the most significant of which was associated with recent tree clearing. The preliminary layout of facilities for Alternative 2 does not show any direct conflicts, and mountain biking trails can/should be routed to avoid these areas. Ongoing operations and maintenance activities at the ski area include drainage improvements and reclamation of disturbed areas, which would result in restoration of these

areas. The facilities that would intersect the WIZ are the proposed Riparian Experience, hiking and biking trails. The Riparian Experience is located in a current CDA and the project would include drainage improvements that would reduce the CDA in sub-drainage basin MF-3.

Mill Creek

Mill Creek is the largest watershed in the Analysis Area. Proposed facilities located in the Mill Creek watershed include the Front Side Canopy Tour, hiking trails, downhill and cross-county mountain biking trails, and the wedding venue at The 10th. These facilities would increase the total amount of disturbed area within the watershed by up to 25.2 acres.

Channel conditions could degrade from stable to unstable due to ground disturbance for construction of the proposed mountain biking trails. A slope failure and mass wasting areas adjacent to the West Fork of Mill Creek were identified. These areas potentially conflict with the preliminary location of towers for the proposed Font Site Canopy Tour and cross-country bike trails. Impacts to these slope failure and mass wasting areas can be avoided with proper location of these trails and activities, as based on the identification of sensitive areas throughout the watershed.

Several isolated erosion areas were found in the Mill Creek watershed, all of which were associated with roads and recent maintenance activities. The preliminary layout of facilities for Alternative 2 does not show any direct conflicts with these areas with the exception of a tower for the Front Side Canopy Tour. This erosion site is associated with a culvert outlet and road runoff. Ongoing operations and maintenance activities at the ski area include drainage improvements and reclamation of disturbed areas, which would result in restoration of this area.

The facilities that would intersect the WIZ are towers for the Front Side Canopy Tour, hiking trails and downhill and cross-country mountain biking trails.

Game Creek

Proposed facilities located in the Game Creek watershed include the Game Creek Canopy Tour, a horse trail, and downhill mountain biking trails. These facilities would increase the total amount of disturbed area within the watershed by up to 4.2 acres. Channel stability conditions in the Game Creek watershed would not be impacted by any of the proposed projects. The Game Creek Canopy Tour would span Game Creek and the WIZ and towers would be located well outside of the WIZ. No mass wasting or significant erosion areas were identified.

As proposed, there would be no increase in connected disturbed areas associated with facilities that would be located in the WIZ. The Game Creek Canopy Tour would cross the WIZ, but all of the towers for the canopy tour and all of the trails would be located outside of the WIZ. There would be no tree clearing or ground disturbance within the WIZ in the Game Creek watershed and existing stream health conditions would be maintained.

Golden Peak

Proposed facilities located in the Golden Peak watershed include the Front Side Canopy Tour and downhill and cross-country mountain biking trails. These facilities would increase the total amount of disturbed area within the watershed by up to 4.9 acres. Channel conditions could degrade from stable to unstable due to ground disturbance for construction of the proposed mountain biking trails. The preliminary layout of the mountain biking trails could increase CDA, but the layout of these trails can be modified to avoid impacts that could cause channel stability problems.

Five slope failure areas were identified in the Golden Peak watershed, all of which can be avoided to prevent further impacts. Three slope failures, two located adjacent to Mill Creek and one adjacent to a proposed downhill mountain biking trail, are located under the proposed Front Side Canopy Tour but would not be affected by any ground disturbance. A ski area maintenance road and ski trail are located immediately above these slope failures and drainage improvements have recently been completed to convey runoff around these areas. Proposed mountain biking trails could utilize this road without adverse impacts to these slope failures. Two slope failure areas are in locations that would not be affected by any of the proposed summer recreation facilities. The slope failure located to the east of Mill Creek would be spanned by the proposed Front Side Canopy Tour. Drainage improvements associated with the tower proposed to be located uphill from the slope failure would be implemented to route runoff away from the slope failure area.

The only significant erosion area found in the Golden Peak watershed is associated with recent tree clearing. The preliminary layout of facilities for Alternative 2 does not show any direct conflicts with this area. Ongoing operations and maintenance activities at the ski area include drainage improvements and reclamation of disturbed areas, would result in restoration of this area.

The facilities that would intersect the WIZ are downhill and cross-country mountain biking trails.

Wetlands

The projects included in Alternative 2 would not impact any known and previously identified wetlands. Detailed design and layout for implementation of the proposed hiking and biking trails would require surveys to assure the wetlands are avoided. It is likely that some stream crossings for proposed mountain biking, horse, and hiking trails would be required, in which case, project design features (e.g., bridges) and applicable BMPs would be implemented to avoid impacts to riparian wetlands and to minimize increases in CDA. If any wetland impacts are determined to be unavoidable, additional NEPA analysis and U.S. Army Corps of Engineers permitting would be required prior to construction.

Water Quality

The only water quality impacts associated with proposed projects and activities are those associated with potential increases in erosion and sedimentation associated with temporary ground disturbance during

construction and permanent disturbance from additional hiking, mountain biking and horse trails. Erosion from disturbed areas will be minimized through implementation of Management Requirements (refer to Table 3H-7).

Vail Ski Area is required to have a Stormwater Management Plan (SWMP) to operate under a State approved Permit for Stormwater Discharges Associated with Construction Activity (CDPS Permit No. COR-030541).

Alternative 3

Stream Health

Water Quantity and Hydrology

There would be 46.1 acres of additional temporary and permanent disturbed areas associated with the proposed projects included in Alternative 3. The average yield increase for the Analysis Area watersheds would range from 0.20 to 0.57 percent and the maximum increase, which would occur in wet years, would range from 0.26 to 0.73 percent (refer to Table 3H-8). The maximum increase in peak flows would range from 0.23 to 0.078 percent in dry years, which would be less than 0.2 cfs. This modeled increase would be too small to be measurable and would result in no adverse impact.

Channel Stability

Potential impacts to stream channel stability for each alternative are addressed under the discussion of Disturbed Areas and Connected Disturbed Areas.

Disturbed Areas and Connected Disturbed Areas

Total disturbed areas, including WIZ areas, were estimated for each watershed for existing conditions and the action alternatives and are shown in Table 3H-9. CDA within the WIZ of each watershed is shown in Table 3H-10 for each alternative.

Currently there are an estimated 45.5 acres of CDA within in the Analysis Area (refer to Table 3H-10). Most of the existing CDA is associated with roads and some constructed drainages and water bars that discharge directly to streams. Permanent increases in ground disturbance would result in an increase to CDA of 3.5 acres, approximately 7 percent, which would result in some increase in sediment loading to Gore Creek and the Eagle River. The 3.5-acre increase to CDA under Alternative 3 could therefore be fully offset by reductions to existing CDAs or through implementation of BMPs and project design features (e.g., drainage improvements to route runoff from disturbed areas to sediment basins or areas that are not directly connected to streams).

Cascade Village

Under Alternative 3, proposed facilities located in the Cascade Village watershed include the horse corral and downhill mountain biking trails. These proposed facilities would increase the total amount of

disturbed area within the watershed by up to 2.3 acres. Channel conditions would not be affected under Alternative 3. No mass wasting or significant erosion areas were identified.

As proposed, there would be no increase in CDA because the proposed mountain biking trails could be located outside the WIZ (refer to Table 3H-7 for more information). There would therefore be no change in stream health conditions.

Mountain Front

Proposed facilities located in the Mountain Front watershed would include the Aerial Adventure Course, hiking trails, and downhill mountain biking trails. These facilities would increase the total amount of disturbed area within the watershed by up to 9.7 acres. Channel conditions could degrade from stable to unstable due to ground disturbance for construction of the proposed downhill mountain biking trails within the WIZ. With implementation of BMPs and project design features, there would be no impacts to channel stability.

Potential impacts in the Mountain Front watershed for mass wasting and erosion areas would be the same as Alternative 2, in which the two slope failure and several erosion areas should be avoided. The facilities that would intersect the WIZ are the proposed the hiking and mountain biking trails.

Mill Creek

Under Alternative 3, proposed facilities located in the Mill Creek are the same as for Alternative 2 (i.e., facilities would increase the total amount of disturbed area within the watershed by up to 25.2 acres).

Potential impacts in the Mill Creek watershed for channel stability, mass wasting and erosion areas would be the same as Alternative 2.

Game Creek

Under Alternative 3, proposed facilities located in the Game Creek are the same as for Alternative 2 (i.e., facilities would increase the total amount of disturbed area within the watershed by up to 4.2 acres). Potential impacts in the Game Creek watershed for channel stability, mass wasting and erosion areas would be the same as Alternative 2.

Golden Peak

Under Alternative 3, proposed facilities located in the Golden Peak watershed are the same as for Alternative 2 (i.e., facilities would increase the total amount of disturbed area within the watershed by up to 4.9 acres). Potential impacts in the Golden Peak watershed for channel stability, mass wasting and erosion areas would be the same as Alternative 2.

Wetlands

The projects included in Alternative 3 would not impact any known and previously identified wetlands. Detailed design and layout for implementation of the proposed hiking and biking trails would require

surveys to assure the wetlands are avoided. It is likely that some stream crossings for proposed mountain biking, horse, and hiking trails would be required, in which case, project design features (e.g., bridges) and applicable BMPs would be implemented to avoid impacts to riparian wetlands and to minimize increases in CDA. If any wetland impacts are determined to be unavoidable, additional NEPA analysis and U.S. Army Corps of Engineers permitting would be required prior to construction.

Water Quality

The only water quality impacts associated with proposed projects and activities are those associated with potential increases in erosion and sedimentation associated with temporary ground disturbance during construction and permanent disturbance from additional hiking, mountain biking and horse trails. Erosion from disturbed areas will be minimized through implementation of BMPs and project design features and a surface water management plan (refer to Table 3H-7).

CUMULATIVE EFFECTS

The geographical area for this cumulative effects analysis therefore includes the Analysis Area for the Vail Ski Area summer recreation facilities: Gore Creek and Eagle River above Gore Creek watersheds. The cumulative influence of the Alternative 2 – Proposed Action and Alternative 3 considered in this study is generally very small within the scale of the Upper Eagle Watershed, which encompasses roughly 636,000 acres above the confluence with Gore Creek near Dowd Junction. The Gore Creek watershed has an area of approximately 100,000 acres, which by itself is an order-of-magnitude greater than the scale of the project-area drainages.

The past, present, and reasonably foreseeable future actions that affect hydrology, water quality and stream health within the Vail Ski Area SUP were most recently described in the *Final Environmental Impact Statement for the 2007 Vail Ski Area Improvement Project*.[97] Other activities that have affected watershed conditions include the 2009 Vail Beetle Tree Salvage Project, the 2009 Golden Peak Snowmaking and Race Course Improvements, the 2010, 2012, and 2013 Vail Mountain Summer Improvements, and the 2011 Vail Ski Area Forest Health Project. In addition, substantial drainage and revegetation work has been completed in the Golden Peak area in conjunction with ongoing ski area maintenance and improvement projects including relocation of the halfpipe to the lower Golden Peak area and installation of the Dragon's Breath stormwater pipeline. These efforts have significantly reduced erosion and sedimentation, which has been beneficial to stream health conditions in Mill Creek and Gore Creek.

The total water annual yield and peak flows from the Analysis Area watersheds would increase by a maximum of about 0.5 percent in dry years under Alternative 2. These changes would be too small to measure even within the individual watersheds of the Analysis Area and would be even more

[97] USDA Forest Service, 2009

insignificant in the context the of the much larger Eagle River and/or Gore Creek watershed scale. It is important to note that increase in water yield would be offset by growing water demands for municipal uses in the Eagle River Basin. However, runoff from larger impermeable areas associated with urban development would likely result in higher peak flows unless BMPs are implemented to attenuate runoff from snowmelt and rain events.

In addition to the ongoing stream health and water quality related activities described in the *2007 Vail Ski Area Improvements Project EIS*, a major effort has been underway to improve stream health conditions in Gore Creek in response to the addition of Gore Creek to the Colorado 303(d) List for aquatic life impairment. This effort is being coordinated by the Eagle River Watershed Council and has resulted in the recent completion of the "Gore Creek Water Quality Improvement Plan." Coordinated efforts are currently underway by the Town of Vail, the Eagle River Water & Sanitation District, Vail Associates, CDOT and other interested stakeholders to implement water quality protection and improvement programs and projects identified in the Plan.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

No irreversible and/or irretrievable commitment of resources have been identified that may impact the water resources in association with the alternatives analyzed in this document.

H. WATERSHED AND WETLANDS

SCOPE OF THE ANALYSIS

The Vail Ski Area is located within the upper Eagle River watershed in Eagle County, Colorado. The SUP for the ski area covers 12,590 acres within the Gore Creek, Game Creek and Two Elk Creek watersheds at elevations ranging from 8,200 to 11,816 feet.

The Analysis Area addressed in this report focuses on approximately 5,153 acres of NFS land within SUP area in the Gore Creek and Game Creek watersheds, which encompass total drainages areas of approximately 7,260 acres. For purposes of this analysis the Gore Creek and Game Creek watersheds were divided into five primary watersheds: Game Creek, Cascade Village, Golden Peak, Mountain Front, and Mill Creek. These watersheds all drain to Gore Creek, with the exception of Game Creek, which drains directly to the Eagle River. Each of the primary watersheds was further divided into sub-basin drainage areas based on watershed characteristics and their proximity to the proposed projects.

The information provided here represents a summary of a comprehensive hydrologic analysis that was completed to support this EIS.[86] The hydrologic analysis, in its entirety, is available for review in the project file.

FOREST PLAN DIRECTION

Pursuant to the 2002 Forest Plan, as amended, stream health standards and design criteria are mandated by the Region 2 *Watershed Conservation Practices Handbook* (WCPH).[87] The WCPH contains several Management Measures of relevance regarding stream health and water resources effects:

Applicable WCPH Management Measures

1. Manage land treatments to conserve site moisture and to protect long-term stream health from damage by increased runoff.
3. In the Water Influence Zone (WIZ) next to perennial and intermittent streams, lakes, and wetlands, allow only those actions that maintain or improve long-term stream health and riparian ecosystem condition.
5. Conduct actions so that stream pattern, geometry, and habitats maintain or improve long-term stream health.
6. Maintain long-term ground cover, soil structure, water budgets, and flow patterns of wetlands to sustain their ecological function.

[86] Leonard Rice Engineers, Inc., 2014
[87] USDA Forest Service, 2002 and 2006

8. Manage water use facilities to prevent gully erosion of slopes and to prevent sediment and bank damage to streams.

The Forest Plan also outlines specific Forest-wide and Management Area 8.25 watershed standards, outlined as follows.

Forest-Wide Standards

1. In each stream currently supporting a self-sustaining fish population, ensure that projects maintain sufficient habitat, including flow, for all life history stages of native and desired non-native species.

AFFECTED ENVIRONMENT

The Vail Ski Area is located within the upper Eagle River watershed (HUC 14010003). The primary drainage areas within the Analysis Area (Cascade Village, Mountain Front, Golden Peak, Mill Creek, and Game Creek) cover a total 7,260 acres and are predominately forested areas and open meadows, including ski trails. Disturbed areas include roads, hiking and biking trails, buildings, lift towers and various facilities associated with the ski area. Table 3H-1 provides a summary of the vegetative cover, forested areas, and snowmaking acreage within each of the five primary Analysis Area watersheds.

Table 3H-1:
Drainage Basin Land Use and Snowmaking – Existing Conditions

Watershed	Total Area (acres)	Existing and Alternative 1 Land Use			Existing Snowmaking	
		Ski Trails Area[a] (acres)	Tree Area (acres)	Disturbed Area (acres)	Snowmaking (acres)	Water usage (acre feet)
Cascade Village	444.7	26.3	351.8	66.6	3.3	4.6
Mountain Front	932.4	311.7	513.5	107.2	176.3	213.3
Golden Peak	597.2	191.5	332.8	72.9	140.4	310.7
Mill Creek	4,306.6	972.9	3,257.8	75.9	64.2	60.0
Game Creek	979.0	311.3	638.1	29.6	11.1	11.0
Total	**7,260.0**	**1,813.7**	**5,094.1**	**352.2**	**395.4**	**599.6**

[a] Ski trail area includes natural meadows.
Source: Leonard Rice Engineers, Inc., 2014

The primary drainage areas within the Analysis Area (Cascade Village, Mountain Front, Golden Peak, Mill Creek, and Game Creek) were divided into sub-basin drainage areas to provide more detailed information on stream and drainage channel conditions. The drainage network throughout most of the Analysis Area is comprised of first order perennial streams and intermittent drainages that drain directly to Gore Creek or to Gore Creek via Mill Creek. Refer to Table 3H-2 and Figure 4 for sub-basin identification and characteristics.

Table 3H-2:
Total Existing Disturbed Area and CDA by Watershed

Watershed	Map Reference	Watershed Area (acres)	Total WIZ (acres)	Total Existing Disturbed Area (acres)	Total Existing CDA (acres)
Cascade Village	CV-1	444.66	42.50	66.59	6.53
Mountain Front	MF-1	242.41	9.14	28.27	1.06
	MF-2	178.60	33.44	10.06	2.44
	MF-3	150.99	50.93	42.71	14.34
	MF-4	320.26	29.80	25.18	3.17
	MF-5	40.17	5.97	0.99	0.45
Golden Peak	GP-1	91.07	10.07	50.73	6.00
	GP-2	210.49	17.59	4.45	0.14
	GP-3	190.18	23.16	11.91	1.40
	GP-4	105.51	8.05	5.81	0.81
Mill Creek	MC-1	461.05	47.50	21.55	1.38
	MC-2	310.64	30.09	13.26	2.45
	MC-3	308.61	28.47	9.68	0.91
	MC-4	673.85	77.31	16.24	3.38
	MC-5	174.33	21.66	0.01	0.01
	MC-6	270.37	19.59	2.13	0.32
	MC-7	2,107.81	47.55	13.04	0.02
Game Creek	GC-1	549.16	59.15	9.99	0.00
	GC-2	429.88	21.96	19.65	0.69
Totals		**7,260.03**	**583.94**	**352.24**	**45.50**

Source: Leonard Rice Engineers, Inc., 2014

Stream Health

Stream Health Evaluation

Drainage channel and stream channel characterization was based upon Rosgen Level 2 Stream Classification protocols and the Forest Service Stream Reach Inventory and Channel Stability. The Rosgen Classification protocols were used to understand the general classification of each channel, and the channel's sensitivity to disturbance, while the Forest Service Stream Reach Inventory and Channel Stability Evaluation protocols were used to support the identification of potential problem areas.

Problem areas and sensitive areas associated with existing conditions (e.g., stream channel stability and erosion problems within sensitive riparian areas) were identified during the field reconnaissance work (refer to Figure 5). The Stream Reach Inventory and Channel Stability Evaluation protocols were used to supplement the Rosgen Classifications for evaluation of intermittent drainage channels not previously surveyed by the WRNF. These survey methods are intended for evaluation of perennial streams but also provide an index for comparison of information for determining the resistive capacity of small

intermittent stream channels to the detachment of bed and bank materials and the capacity of streams to adjust and recover from potential changes in flow and/or increases in sediment production.

Each channel was judged qualitatively based on a classification system for the following criteria: entrenchment, gradient, width/depth ratio, sinuosity in various landforms, mass wasting, debris jams potential, vegetative bank protection, channel capacity, bank rock content and angularity, obstructions, undercutting, deposition, streambed sediment size distribution and stability. Data collected focused on four stream health metrics: fine sediment, residual pool depth, wood frequency, and bank stability. Each of these criteria was given a rating and a total score to indicate stream health. Field investigations focused on areas that would be potentially affected by proposed activities. The stream health evaluation and characterization was also based on geospatial data and other calculated data such as slope, sinuosity, connected disturbed areas, channel length, etc.

The purpose of the hydrology analysis is to characterize the surface water hydrology of the Analysis Area, and quantify changes in the amount of runoff from the areas potentially affected by proposed activities. The Colorado Ski Country (CSC) methodology was used to characterize Analysis Area hydrology. Using this methodology, the modeled results represent the most conservative runoff scenario for evaluating impacts during the summer season because 70 percent to 80 percent of the runoff in the Gore Creek watershed occurs during spring snowmelt and peak flows are typically associated with peak snowmelt runoff in the late spring.

Using the CSC methodology water yields were characterized for existing conditions for each of the primary drainage areas. The CSC Model uses a variety of data sources to calculate changes in runoff associated with ski trail clearing and snowmaking.

Water Quantity and Hydrology

Vail Ski Area receives most of its annual precipitation as snow during the winter months. Over the decades, the natural drainage network of the ski area has been changed with the addition of ski trails, water bars, culverts, and roadside ditches to redirect snowmelt and reduce erosion. In general, the hydrograph pattern typically shows a significant increase in discharge beginning toward the end of March or early April, with the peak discharge normally occurring late May or early June, and steadily declining in June and July. Peak flows associated with summer rainstorm events may equal or occasionally exceed peak flows that occur during spring runoff.

Table 3H-3 summarizes the average water yields/hydrology for wet, average, and dry years for each of the watersheds in the Analysis Area.

Table 3H-3:
Existing Water Yield/Hydrology

Watershed	Year Type	Annual Runoff (acre feet)	Peak Flow (cfs)[a]
Cascade Village	Wet	1,328	14.6
	Average	1,174	12.7
	Dry	712	4.7
Mountain Front	Wet	3,067	29.5
	Average	2,714	30.1
	Dry	1,718	11.6
Golden Peak	Wet	2,100	19.8
	Average	1,880	21.0
	Dry	1,226	8.3
Mill Creek	Wet	11,744	129.2
	Average	10,136	109.2
	Dry	5,935	43.0
Game Creek	Wet	2,781	28.3
	Average	2,386	26.2
	Dry	1,443	9.8

[a] Peak flow index based on average annual peak flows observed at Gore Creek above Red Sandstone streamflow gage.
Source: Leonard Rice Engineers, Inc., 2014

Channel Stability

The primary drainage areas within the Analysis Area (Cascade Village, Mountain Front, Golden Peak, Mill Creek, and Game Creek) were divided into sub-basin drainage areas to provide more detailed information on stream and drainage channel conditions. The drainage network throughout most of the Analysis Area is comprised of first order perennial streams and intermittent drainages that drain directly to Gore Creek or to Gore Creek via Mill Creek.

The WRNF has previously completed stream health surveys for some stream reaches within the Analysis Area. Surveys were completed during the 2002–2004 field seasons, utilizing survey methodologies for measuring and quantifying specific stream health metrics. The WRNF survey methodology for quantifying specific stream health metrics includes fine sediment, large woody debris frequency, residual pool depth, undercut banks, and unstable banks as indicators of habitat conditions. The evaluation of stream health is defined by classifications based on the observed habitat condition as a percentage of reference, or expected condition. Three classes of stream health are recognized in the Rocky Mountain Region: *robust*, *at-risk*, and *diminished*. It should be noted that the formal stream health evaluation process is only applied to third-order and larger watersheds; small drainage basins are evaluated with a

mixture of qualitative and quantitative methods. Several reaches located within Golden Peak, Mill Creek, and Game Creek drainages have been evaluated using the formal stream health method and the results are summarized below.

Golden Peak Watershed

In the Golden Peak watershed data results from the WRNF surveys indicate many effects of bank instability are evident higher up in the watershed. As a result, fine sediments are flushed downstream, some of which are deposited in slower water zones of Gore Creek.[88]

Mill Creek Watershed

In the Mill Creek watershed, data results from formal WRNF stream surveys indicate *robust* stream health with respect to fine sediment and unstable banks in Mill Creek. The lower channel, below the culverts, is well-armored and has been heavily modified with rip-rap. The residual pool depth variable is *at-risk* for the lower reach and *diminished* for the upper reach due to ski trail clearing. The double culverts near the lower area of Golden Peak contribute to the lack of wood recruitment. In 2002–2003, the Vail Valley Forest Health Project surveys found that Ptarmigan Creek exhibited *diminished* stream health conditions and Mill Creek exhibited *at-risk* and *diminished* stream due to unstable banks and deposition of fine sediment. Mill Creek has a high density of connected roads in the upper watershed that is a source for fine sediment.[89]

Upper Game Creek Watershed

In the Upper Game Creek watershed, WRNF survey results indicate *robust* stream health with respect to fine sediment, residual pool depth, and woody frequency; however, Upper Game Creek exhibited *diminished* stream health due to unstable banks.[90]

Natural Perennial and Small Intermittent Streams

The evaluation of stream channels in the Analysis Area is divided into two categories based upon the field assessment methods used to characterize existing stream health and channel types. The two categories are: 1) natural perennial stream channels; and 2) small intermittent streams and other drainages. The evaluation of stream health metrics using the Rosgen classification method applies to natural, well-defined channels that are generally first order or higher streams. The evaluation of intermittent small tributaries and other drainage pathways is also important to understanding drainage conditions, Connected Disturbed Areas (CDA), and overall stream health of each watershed.

[88] USDA Forest Service, 2009
[89] Ibid.
[90] Weinhold, 2013

The first and second order drainages within the Analysis Area were evaluated using the Rosgen classification system.[91] This was paired with the Pfankuch Reach Inventory and Channel Stability Evaluation rating procedure to evaluate the upper and lower banks of the streambed for evidence of degradation or erosion/deposition.[92] Using the Pfankuch method, a score is assigned to each reach based upon the viability of bed materials, channel geometries, and channel slopes to determine channel stability conditions; low numbers suggest a higher stability. Each reach was assessed using the Rosgen Classification and Pfankuch rating, and assigned a Channel Stability rating. Table 3H-4 summarizes the results of the survey.

The stream channels in the Analysis Area largely fall into the Rosgen "Aa+" and "A" stream types. These channels tend to be steep gradient (> 10 percent slopes) systems that are often entrenched and in some cases can be characterized as step-pool systems. These systems also have high sediment transport capacities due to their steep gradients and high confinement. Rosgen "B" classification exhibits a moderately steep gradient (2 to 4 percent slopes). The number designation associated with each Rosgen Class refers to the median size of the stream channel bed material (i.e., 1 indicates bedrock, 6 indicates silt/clay).[93]

Perennial stream channels within the Analysis Area are identified in Table 3H-4; in general, they were rated stable, with the exception of sub-basin MC-1, MC-4 and GC-2. Sub-basin MC-1 is classified as "Moderately Unstable"; however, with no indication of channel erosion of unstable banks. Sub-basin MC-4 is classified as "Stable"; however, the drainage is moderately stable to unstable, with no indication of channel erosion of unstable banks, and has a high Pfankuch score. Sub-basin GC-2 is classed as "Stable"; however, the drainage is moderately stable to unstable, with no indication of channel erosion of unstable banks, and a culvert is located on the downstream portion of the basin.

[91] Rosgen, n.d.
[92] Pfankuch, 1975
[93] Rosgen and Silvey, 1998

Table 3H-4:
Natural Perennial Stream Channel Surveys

Watershed	Map Reference/ Sub-basin	Stream Name	Channel Stability Conditions		
			Pfankuch Score	Rosgen Classification	Channel Stability Rating
Golden Peak	GP-2	Mill Creek	46.5	B2	Stable
Mill Creek	MC-1	W. Fork Mill Creek	79	A2a+	Moderately Unstable
	MC-2	W. Fork Mill Creek	68	A3a+	Stable
	MC-4	E. Fork Mill Creek	50	A3a+	Stable
	MC-4	E. Fork Mill Creek	74	A3a+	Stable
	MC-4	E. Fork Mill Creek	72.5	A4a+	Stable
	MC-4	E. Fork Mill Creek	87.5	A4a+	Stable
	MC-6	Mill Creek	66.5	A3	Stable
Game Creek	GC-2	Game Creek	56	A2a+	Stable
	GC-2	Game Creek	49	A3a+	Stable

Source: Leonard Rice Engineers, Inc., 2014

Most of the proposed activities would occur near small drainage swales and pathways to perennial streams, Gore Creek and the Eagle River, which are not large enough to warrant a formal stream health evaluation. Supplemental channel stability surveys were completed to assess stream health for these drainages using the Pfankuch's method, a qualitative approach based upon the viability of bed materials, channel geometries, and channel slopes to determine channel stability conditions.[94] A score is assigned to each sub-basin; low numbers suggest a higher stability. Table 3H-5 summarizes the results for these channels.

As indicated in Table 3H-5, one small intermittent stream, sub-basin GP-3 or the lower portion of the Golden Peak watershed, is classified as "Unstable." The upslope portion of the channel flows into a man-made channel and then flows into a culvert to an area with significant erosion. Some evidence of deposition was present at this location; however, the drainage is stable, with no indication of channel erosion of unstable banks.

[94] Pfankuch, 1975

Table 3H-5:
Small Intermittent Streams and Other Drainages Surveys

Watershed	Map Reference/ Sub-basin	Channel Stability Conditions		
		Pfankuch Score	Pfankuch Rating	Channel Stability Rating
Cascade Village	CV-1	36	High Good	Stable
	CV-1	49.5	Med Good	Stable
Mountain Front	MF-1	61	Low Good	Stable
	MF-2	53	Med Good	Stable
	MF-2	69	Low Good	Stable
	MF-2	68	Low Good	Stable
	MF-2	79	High Fair	Stable
	MF-3	48	Med Good	Stable
	MF-3	58	Med Good	Stable
	MF-3	71	Low Good	Stable
	MF-3	84	High Fair	Stable
	MF-4	68	Low Good	Stable
Golden Peak	GP-3	52	Med Good	Stable2
	GP-3	133	Med Poor	Unstable
Mill Creek	MC-1	67	Low Good	Stable
	MC-1	77	High Fair	Stable
	MC-2	62	Low Good	Stable
	MC-4	64	Low Good	Stable
	MC-4	70.5	Low Good	Stable

Disturbed Areas and Connected Disturbed Areas

Snowmelt and rain event runoff from graded and disturbed areas, such as roads, trails and other facilities that are hydrologically connected to the drainage network have the ability to quickly route water to the streams and contribute to increased peak flows. Removal of vegetative cover reduces soil permeability, allows water to runoff much more quickly and exposes soil to erosion which increases sediment loading to streams. Direct hydrologic connection between disturbed areas and streams occurs when waterbars, ditches, culverts and other drainage features convey runoff to the streams. When disturbed areas are disconnected from the streams by routing runoff to areas where water can infiltrate to soils, the impacts on peak flow and water quality are substantially attenuated.

Under existing conditions, there is an estimated 45.5 acres of CDA within in the Analysis Area for the proposed projects. Most of the existing CDA is associated with roads and some constructed drainages and water bars that discharge directly to streams. CDA under the existing conditions (Alternative 1) is displayed in Table 3H-10.

Perennial streams in the Analysis Area include Mill Creek, East Fork and West Fork Mill Creek, and Game Creek. The WIZ is the land next to water bodies where vegetation plays a major role in sustaining

long-term integrity of aquatic systems. The WIZ includes the geomorphic floodplain (valley bottom), riparian ecosystem, and inner gorge. Its minimal horizontal width (from top of each bank) is 100 feet or the mean height of mature dominant late-seral vegetation, whichever is most. The WIZ protects interacting aquatic, riparian, and upland functions by maintaining natural processes and resilience of soil, water, and vegetation systems.[95]

Tree removal and ground disturbance in the WIZ can impact bank stability by creating hydrologic connections between high-runoff areas and the channel network, known as CDAs. CDAs include roads, trails, ditches, compacted soils, bare soils, and other high runoff areas that are directly connected to the channel system. All existing disturbed areas within the WIZ were considered to be CDA. Table 3H-2 shows the total existing disturbed areas for each drainage and total CDA currently located within the WIZ.

Roads and trails that intersect the WIZ were assumed to be connected to the stream channel network because roadside drainage ditches frequently discharge directly to the stream. Because culverts that divert water out of roadside ditches are generally spaced approximately 300 feet apart, it was assumed that a maximum of 300 feet of roadside ditches would drain directly to the stream channel. The connection of roadside drainage ditches increases direct routing of runoff flow within the watershed, increasing peak flows and subsequent erosion and sediment transport.

Sensitive Areas

Field reconnaissance conducted between September 24 and 26, 2013 included identification of sensitive areas throughout the Analysis Area that could potentially be affected by soil disturbance, drainage modifications, and hydrology changes associated with the proposed projects and activities. Previously identified sensitive areas and sensitive areas identified during field reconnaissance include areas of channel instability, mass wasting and slope failure, erosion, and wetlands and are evaluated below by watershed (refer to Figure 5).

Sensitive areas identified within each watershed are described in detail below, and are identified on Figure 5. The identification of sensitive areas is intended to assist in the final location/design of any approved projects activities, as the need to avoid these areas altogether or minimize/mitigate potential impacts is an important consideration in resource management and complying with Forest Plan standards.

Cascade Village

In the Cascade Village watershed, there is no evidence or identified areas of channel instability, mass wasting, slope failure or erosion.

[95] USDA Forest Service, 2006

Mountain Front

In the Mountain Front watershed, five areas of bank instability, two areas of slope failure, and nine areas of erosion w identified. The bank instability areas are associated with a culvert outlet and drainage construction. The two slopes failures are located on the west side of *Giant Steps* trail (sub-basin MF-1) and on *Simba* trail (sub-basin MF-3). The areas of erosion are located in sub-basins MF-1, MF-2, and MF-3. Two significant erosion areas associated with tree clearing are located in the upper sub-basin MF-3 to the east of Eagle's Nest. Erosion control BMPs are being implemented to stabilize erosion areas and restore ground cover. This area should be considered sensitive until reclamation has been completed.

Golden Peak

In the Golden Peak watershed, one area of degraded stream, six areas of slope failure, one area of erosion are present. The degraded stream is located in sub-basin GP-3 due to road maintenance. The six areas of slope failures are located in GP-2, GP-3, and GP-4. One significant erosion area associated with tree clearing is located in the lower GP-3 drainage between the upper end of *Giant Steps* and Gondola One. Erosion control BMPs are being implemented to stabilize erosion areas and restore ground cover. This area should be considered sensitive until reclamation has been completed.

Mill Creek

In the Mill Creek watershed, one area of moderate instability, one slope failure, and four areas of erosion are present. The one segment of moderate stream instability is located in sub-basin MC-1. The one slope failure is located in sub-basin MC-1. The four areas of erosion are located in sub-basins MC-1 and MC-2.

Game Creek

In the Game Creek watershed, there is no evidence or identified areas of channel instability, mass wasting, slope failure or erosion.

Wetlands

Wetlands in the Analysis Area are predominantly associated with streams, intermittent drainages and springs (refer to Figure 5). The wetlands identified in the Analysis Area occur in narrow bands immediately adjacent to the streams. There are also isolated pockets of wetlands within the Analysis Area that are associated with springs and drainage collection areas. The WIZ protects interacting aquatic, riparian, and upland functions by maintaining natural processes and resilience of soil, water, and vegetation systems.

Water Quality

In December 2012, Gore Creek (Segment 8) was added to Colorado's 303(d) List of impaired water bodies for aquatic life use impairment, with a provisional qualifier indicating that the cause of impairment is unknown. The listing will remain provisional until a pollutant—one that is either the cause of the

impairment, or one that fails to meet a water quality standard—is identified. Several stream reaches in the Eagle River, Segment 9a (from Gore Creek to Rube Creek) are also listed as impaired and identified for Monitoring and Evaluation (M&E). Table 3H-6 shows the impaired or threatened waterbody segments located downstream from the Analysis Area. Currently available data indicates that stream reaches on the 303(d) List are not meeting an applicable water quality standard. For stream reaches on the M&E List, additional data are needed to determine whether or not standards are being met.

Table 3H-6:
Gore Creek Segment 8 and Eagle River Segment 9a 303(d) List
Impaired and Monitoring & Evaluation Waters

Reach Start	Reach End	Parameter	Type
GORE CREEK – SEGMENT 8			
Black Gore Creek	Confluence with the Eagle River	Aquatic Life (provisional)	Impaired (Low Priority)
EAGLE RIVER – SEGMENT 9A			
Berry Creek	Ute Creek	Temperature	M&E
Ute Creek	Rube Creek	Temperature	Impaired (High Priority)
Berry Creek	Squaw Creek	Aquatic Life	M&E
Berry Creek	Squaw Creek	Sediment	Impaired (High Priority)
Gore Creek	Berry Creek	Sediment	M&E
Squaw Creek	Rube Creek	Sediment	M&E

Segment 8 includes the main stem of Gore Creek from Black Gore Creek to the confluence of the Eagle River. Several key stressors have been identified as the cause of impairment and biological degradation in Gore Creek. Recent studies have documented the primary stressors in Gore Creek, which include: urban runoff containing pollutants such as petroleum products, nutrients, fertilizers, and other lawn care products, and other pollutants. These studies found stressed conditions throughout the urbanized areas of the Town of Vail. The areas that showed the most biological degradation were in East Vail and upstream from Mill Creek and the Vail Golf Course. Biological conditions observed in the East Vail reach of Gore Creek are consistent with impacts from insecticides and herbicides, road deicers, and petroleum products. Observations of stream substrate conditions in Gore Creek, above and below the confluence of Mill Creek, during the collection of biological samples have not indicated embedded conditions or significant accumulation of fine sediment that would cause or contribute to the impairment of aquatic life.

Eagle River Basin Segment 9a includes the main stem of the Eagle River from the confluence with Gore Creek to the confluence with Rube Creek. The portion of Eagle River from Berry Creek to Squaw Creek was placed on the 303(d) List for sediment based on data collected in a very broad, low gradient stream reach that includes an evaporite sinkhole that functions as a large sediment trap. A major stream restoration project was completed in 2011 by the Eagle River Watershed Council to improve stream habitat and restore riparian conditions through much of this stream reach. The portions of Eagle River

Segment 9a above Berry Creek and below Squaw Creek were placed on the M&E List for sediment only because no data were available.

The 6-mile long portion of Segment 9a from Berry Creek to Ute Creek has been added to the State's M&E List for temperature and the portion from Ute Creek to Rube Creek has been added to the 303(d) List for temperature. The Eagle River Water and Sanitation District, in consultation with the Colorado Water Quality Control Division and Colorado Parks and Wildlife, is collecting and evaluating temperature data to determine the potential causes (natural and anthropogenic) of elevated temperatures during the late summer and fall, the potential biological impacts, and the appropriateness of the currently applicable standards. It is important to note that this area is located 9 to 11 miles downstream from the confluences of Gore Creek and Game Creek with the Eagle River.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

The No Action Alternative would result in a continuation of existing operations and management practices at the Vail Ski Area because no other summer recreation facilities and improvements would be developed under this alternative. Stream health conditions, water yield and hydrology would continue to resemble existing conditions. Under this alternative, the existing 352.2 acres of disturbed areas and 45.5 acres of connected disturbed areas would not increase (refer to tables 3H-7 and 3H-8).

Alternative 2 – The Proposed Action

Table 3H-7 identifies project design features, best management practices, and mitigation measures (collectively referred to as Management Requirements) that are designed to minimize, avoid or mitigate for impacts to watershed resources throughout the Analysis Area. It is important to note that this is an exhaustive list that many not apply to each and every proposed project or activity. Because the proposed mountain biking and hiking trails have not been site-specifically designed or located, an on-going/evolving follow-up assessment will need to be prepared to ensure that any increases in CDA related to approved projects are mitigated and that stream health throughout the Analysis Area is maintained. On a project-by-project basis, a mix of general and site-specific Management Requirements may be employed. The follow-up assessment will need to be a collaborative effort between Forest Service hydrologists, consulting hydrologists, and Vail Associates representatives. Proposed Management Requirements are included in Table 3H-7.

Table 3H-7:
Management Requirements

USFS Applicable Standards, Design Features, and Project-Specific Required Mitigation
In order to ensure that stream health in the Analysis Area is maintained or improved with implementation of proposed activities, a follow-up assessment would be required once site-specific locations of activities, particularly trails, are known. The follow-up assessment would include a site-specific delineation of the effective WIZ and other identified Sensitive Areas, as well as quantification of connected disturbed areas and WIZ disturbance, including proposals for mitigation and treatment of such. This assessment would be updated on a project-by-project basis and would require collaboration between the Forest hydrologist, consulting hydrologists, and Vail Associates.
Vail Ski Area is required to have a Stormwater Management Plan (SWMP) to operate under a State approved Permit for Stormwater Discharges Associated with Construction Activity (CDPS Permit No. COR-030541). The SWMP describes practices (BMPs) to be used to reduce the pollutants in stormwater discharges associated with construction activities and is updated annually to incorporate appropriate BMPs for specific projects.
In the water influence zone next to perennial and intermittent streams, lakes and wetlands, allow only those land treatments that maintain or improve long-term stream health and riparian ecosystem condition.
Keep heavy equipment out of streams, swales, and lakes, except to cross at designated points, build crossings, or do restoration work, or if protected by at least 1 foot of packed snow or 2 inches of frozen soil. Keep heavy equipment out of streams during fish spawning, incubation and emergence periods.
Locate new concentrated-use sites outside of the WIZ if feasible and outside riparian areas and wetlands always. Harden or reclaim existing sites in the WIZ to prevent detrimental soil and bank erosion. (WIZ boundaries adjacent to project areas should be clearly demarcated on the ground to prevent infringement during construction and operation.)
Do not excavate earth material from, or store excavated earth material in, any stream, swale, lake, wetland, or WIZ. (WIZ boundaries adjacent to project areas should be clearly demarcated on the ground to prevent infringement during construction and operation.)
Do not excavate earth material from, or store excavated earth material in, any stream, swale, lake, wetland, or WIZ.
Keep ground vehicles out of wetlands unless protected by at least 1 foot of packed snow or 2 inches of frozen soil. Do not disrupt water supply or drainage patterns into wetlands.
If trails must enter wetlands, use bridges or raised prisms with diffuse drainage to sustain flow patterns. Set crossing bottoms at natural levels of channel beds and wet meadow surfaces. Avoid actions that may dewater or reduce water budgets in wetlands.
Final locations of any approved mountain biking and hiking trails will avoid all wetlands (including through the use of bridges and/or other structures). If any wetland impacts are determined to be absolutely necessary, additional NEPA analysis and U.S. Army Corps of Engineers permitting will be required prior to construction.
Avoid long-term reduction in organic ground cover and organic soil layers in any wetland (including peat in fens).
Limit disturbed sites to the minimum feasible number, width, and total length consistent with the purpose of specific operations, local topography, and climate. (No new roads are proposed, but temporary construction access routes are required for installation and maintenance of canopy tour towers and coasters.)
Stabilize soils onsite. Endhaul soil if full-bench construction is used. Avoid slopes steeper than 70%.
Avoid soil-disturbing actions during periods of heavy rain or wet soils. Apply travel restrictions to protect soil and water.
Install cross drains to disperse runoff into filter strips and minimize connected disturbed areas. Make cuts, fills, and road surfaces strongly resistant to erosion between each stream crossing and at least the nearest cross drain. Revegetate using certified local native plants as feasible; avoid persistent or invasive exotic plants.
Retain stabilizing vegetation on unstable soils. Avoid new roads or heavy equipment use on unstable or highly-erodible soils.

Table 3H-7:
Management Requirements

USFS Applicable Standards, Design Features, and Project-Specific Required Mitigation
Use existing roads unless other options will produce less long-term sediment. Reconstruct for long-term soil and drainage stability.
Avoid ground skidding with blades lowered or on highly erodible slopes steeper than 40%. Conduct logging to disperse runoff as feasible.
Designate, construct, and maintain recreational travelways for proper drainage and harden their stream crossings as needed to control sediment. (Applies primarily to biking, hiking, and horse trails.)
Any construction-related disturbance will minimize sediment discharge into streams, lakes and wetlands.
Design trails and other soil disturbing activities to the minimum standard for their use and to "roll" with the terrain as feasible.
Use filter strips, and sediment traps if needed, to keep all sand sized sediment on the land and disconnect disturbed soil from streams, lakes and wetlands. Disperse runoff into filter strips.
Key sediment traps into the ground. Clean them out when 80% full. Remove sediment to a stable gentle upland site and revegetate.
Stabilize disturbed sites during and after construction to control erosion.
Do not encroach fills or introduce soil into streams, swales, lakes, or wetlands.
Properly compact fills and keep woody debris out of them. Revegetate cuts and fills upon final shaping to restore ground cover, using certified local native plants as feasible; avoid persistent or invasive exotic plants. Provide sediment control until erosion control is permanent.
Do not disturb ditches during maintenance unless needed to restore drainage capacity or repair damage. Do not undercut the cut slope.
PLANNING CONSIDERATION BMPS (CDPHE, WQCC, REGULATION 82)
CDPHE, Construction Stormwater Discharge Permit – Colorado stormwater regulations (5 CCR 1002-61) require a permit for construction activity that disturbs 1 acre or more during the life of the project. Prior to commencement of construction, a stormwater management plan (SWMP) with appropriate erosion and sediment control BMPs must be developed and implemented. A comprehensive list of potentially appropriate BMPs is included in the CDPHE 401Certification Regulation (5 CCR 1002-82).
An erosion and sediment control plan should be developed and is comprised of three major elements. The erosion control measures used to limit erosion of soil from disturbed areas at a construction site; the sediment control measures that will be used to limit transport of sediment to off-site properties and downstream receiving waters; and the drainageway protection and runoff management measures that will be used to protect streams and other drainageways located on the construction site from erosion and sediment damages.
Some of the site constraints that should be considered planning/designing/locating approved projects and activities include slope stability, drainage aspect and constructability, along with the general stream hydrology, stream morphology, water quality and aquatic ecology. (Site constraints, such as avoidance of wetlands, are address above under the USFS Design Standards)
Seasonality should be considered, particularly when construction must take place within streams and other waterways. (For example, construction during periods of high stream should be avoided.)
Surface roughening provides temporary stabilization of disturbed areas from wind and water erosion; surface roughening should be performed after final grading to create depressions 2 to 4 inches deep and 4 to 6 inches apart. It is particularly useful where temporary revegetation cannot be immediately established due to seasonal planting limitations. Surface roughening only provides temporary protection and must be used in combination with other BMPs, such as mulching and temporary cover.
Mulching of all disturbed areas should occur within 14 days after final is reached on all portions of site not permanently stabilized.
A viable vegetative cover should be established within one year on all disturbed areas and soil stockpiles not otherwise permanently stabilized. Vegetation is not considered established until a ground cover is achieved, which is sufficiently mature to control soil erosion and can survive severe weather conditions.

Table 3H-7:
Management Requirements

USFS Applicable Standards, Design Features, and Project-Specific Required Mitigation
The seed mix for erosion control and stabilization during construction should be compatible with the final seeding needs and will be approved by the WRNF.
As a minimum, topsoil preservation and reuse involves the removal, stockpiling, and re-spreading of the surface 6 to 8 inches of natural soil.
Erosion control blankets are used in place of mulch on areas of high velocity runoff and/or steep grade, to aid in controlling erosion on critical areas by protected young vegetation.
To provide vegetative cover on disturbed areas not paved or built upon for a period of two years or longer, or for an indeterminate length of time, a perennial grass should be planted.
Cut-and-fill slopes must be designed and constructed to minimize erosion. This requires consideration of the length and steepness of the slope, the soil type, up-slope drainage area, groundwater conditions and other applicable factors. Slopes that are found to be eroding excessively will require additional slope stabilization until the problem is corrected.
Sediment entrapment facilities include terracing, slope drains, straw bale barriers, silt fences, filter strips, sediment traps and sediment basins; at least one entrapment facility should capture runoff leaving a disturbed area.
A silt fence is made of a woven synthetic material and acts to filter runoff. Silt fence can be placed as a temporary barrier at the base of a disturbed area but is not recommended for use in a channel or swale.
A sediment trap is a temporary structure that is designed to fill with sediment. A sediment trap can be constructed by either excavating below grade or building an embankment across a swale. Excavated traps are less prone to failure than embankments. No pipe is used at the outlet, as in a sediment basin, and an open-channel spillway must be included in the design. A minimum of 900 cubic feet of storage volume must be provided for each tributary acre.
All BMPs shall be maintained and repaired as needed to assure continued performance. Straw bale barriers or silt fences may require periodic replacement and all sediment accumulated behind them must be removed and disposed of properly. Sediment traps and basins will require periodic sediment removal when the design storage level is one-half full. All facilities must be inspected following each heavy precipitation or snowmelt event that results in runoff.
All temporary erosion and sediment control measures must be removed within 30 days after final stabilization.
Good housekeeping requires keeping potential areas where pollutants and pollution exist clean and orderly. Use of common sense to improve and maintain basic housekeeping methods: accidental spill response, well-maintained machinery and processes, improved operations, material storage practices, material inventory controls, routine or regular clean-up schedules, well-organized work areas, educational programs and method to prevent mixing of runoff into environment from stormwater runoff. Preventative maintenance involves regular inspection and testing of equipment and operational systems to prevent break downs and failures that cause potential runoff contamination.

Sources: USDA Forest Service, 2006 and CDPHE, 2003

Stream Health

Water Quantity and Hydrology

There would be 51 acres of additional temporary and permanently disturbed areas associated with the proposed projects included in Alternative 2. The average yield increase for the Analysis Area watersheds would range from 0.20 to 0.63 percent and the maximum increase, which would occur in wet years, would range from 0.26 to 0.83 percent. The maximum increase in peak flows would range from 0.23 to 0.91 percent in dry years, which would be less than 0.2 cfs. This modeled increase would be too small to

be measurable and result in no adverse impact. Table 3H-8 shows the water yield and peak flow changes for each watershed under alternatives 1, 2 and 3.

Table 3H-8:
Water Yield and Peak Flow Changes

Watershed	Alternative	Year Type	Annual Runoff (acre feet)	Annual Runoff % Change	Peak Flow (cfs)	Peak Flow % Change
Cascade Village	Alternative 1	Wet	1,328	0.00	14.6	0.00
		Average	1,174	0.00	12.7	0.00
		Dry	712	0.00	4.7	0.00
	Alternative 2	Wet	1,335	0.48	14.6	0.09
		Average	1,180	0.54	12.7	0.63
		Dry	718	0.74	4.7	0.78
	Alternative 3	Wet	1,333	0.32	14.6	0.11
		Average	1,178	0.37	12.7	0.42
		Dry	716	0.50	4.7	0.49
Mountain Front	Alternative 1	Wet	3,067	0.00	29.5	0.00
		Average	2,714	0.00	30.1	0.00
		Dry	1,718	0.00	11.6	0.00
	Alternative 2	Wet	3,084	0.56	29.5	0.12
		Average	2,731	0.63	30.3	0.72
		Dry	1,732	0.83	11.7	0.91
	Alternative 3	Wet	3,081	0.47	29.5	0.14
		Average	2,729	0.53	30.3	0.60
		Dry	1,730	0.70	11.7	0.76
Golden Peak	Alternative 1	Wet	2,100	0.00	19.8	0.00
		Average	1,880	0.00	21.0	0.00
		Dry	1,226	0.00	8.3	0.00
	Alternative 2	Wet	2,110	0.50	19.8	0.20
		Average	1,891	0.57	21.1	0.63
		Dry	1,235	0.73	8.4	0.78
	Alternative 3	Wet	2,110	0.50	19.8	0.20
		Average	1,891	0.57	21.1	0.63
		Dry	1,235	0.73	8.4	0.78
Mill Creek	Alternative 1	Wet	11,744	0.00	129.2	0.00
		Average	10,136	0.00	109.2	0.00
		Dry	5,935	0.00	43.0	0.00
	Alternative 2	Wet	11,768	0.21	129.3	0.01
		Average	10,160	0.24	109.5	0.28
		Dry	5,955	0.34	43.1	0.36
	Alternative 3	Wet	11,768	0.21	129.3	0.01
		Average	10,160	0.24	109.5	0.28
		Dry	5,955	0.34	43.1	0.36

Table 3H-8:
Water Yield and Peak Flow Changes

Watershed	Alternative	Year Type	Annual Runoff (acre feet)	Annual Runoff % Change	Peak Flow (cfs)	Peak Flow % Change
Game Creek	Alternative 1	Wet	2,781	0.00	28.3	0.00
		Average	2,386	0.00	26.2	0.00
		Dry	1,443	0.00	9.8	0.00
	Alternative 2	Wet	2,786	0.16	28.4	0.05
		Average	2,391	0.20	26.2	0.22
		Dry	1,446	0.26	9.9	0.23
	Alternative 3	Wet	2,786	0.16	28.4	0.05
		Average	2,391	0.20	26.2	0.22
		Dry	1,446	0.26	9.9	0.23

Channel Stability

The channel survey results described previously found that in most of the Analysis Area watersheds stream channel conditions are stable. Several isolated stream reaches were identified that are unstable under existing conditions and disturbance associated with construction activities in the WIZ could further destabilize these stream reaches. By employing a mix of the site-specific and general Management Requirements identified in Table 3H-7, any increases in CDA related to approved projects will be mitigated and stream health throughout the Analysis Area will be maintained or improved. As indicated, an on-going/evolving follow-up assessment will need to be prepared in collaboration with the Forest hydrologist, consulting hydrologists and Vail Associates to ensure proper location and design of approved projects.[96] Potential impacts to stream channel stability for each alternative are addressed under the discussion of Disturbed Areas and Connected Disturbed Areas.

Disturbed Areas and Connected Disturbed Areas

Construction of the proposed activities and facilities would result in a substantial amount of temporary ground disturbance and potential increases in the amount of CDA throughout the Analysis Area. However, the proposed facilities would be spread over a large area during multiple construction seasons, and projects can be configured/located to minimize the amount of direct drainage connections between disturbed areas and streams by employing appropriate erosion/drainage BMPs and project design features (refer to Table 3H-7), coupled with wide vegetative buffers. Disturbed areas located outside of the WIZ would be effectively disconnected from streams, or existing CDA throughout the watersheds would be disconnected. Conversely, disturbed areas within the WIZ are assumed to be connected.

[96] In the technical report (Leonard Rice Engineers, Inc., 2014) figures B-1 through B-13 provide locations and descriptions of channel conditions, including stream reaches where channel stability concerns were observed, and their proximity to proposed recreation facilities.

Existing sensitive areas, including areas of unstable stream channels, mass wasting and slope failure, and active erosion, have been identified and discussed above. These areas should be avoided, or impacts should be minimized or mitigated. Currently there are an estimated 45.5 acres of CDA within in the Analysis Area (refer to Table 3H-10). Most of the existing CDA is associated with roads and some constructed drainages and water bars that discharge directly to streams. Permanent increases in ground disturbance related to the Proposed Action would result in an increase to CDA of 3.5 acres, approximately 7 percent, which would result in some increase in sediment loading to Gore Creek and the Eagle River. Management Requirements and a follow-up assessment to mitigate for impacts to CDA will be required to avoid/minimize/offset the 3.5-acre increase to CDA under Alternative 2 (refer to Table 3H-7).

Total disturbed areas, including WIZ areas, were estimated for each watershed for existing conditions and the action alternatives are shown in Table 3H-9. Connected disturbed areas within the WIZ of each watershed are shown in Table 3H-10 for each alternative. Because the actual locations and layouts of the proposed mountain biking trails and hiking trails are unknown at this time, impacts within the WIZ were estimated based on the proportion of the total WIZ acres within each watershed. For example, if 9 percent of the watershed area was within the WIZ, then 9 percent of the proposed disturbed area resulting from trails was assumed to impact the WIZ and was therefore included in the estimated CDA. Impacts to the WIZ were only estimated for watersheds with proposed trails intersecting the WIZ. It is important to note that trails would be located to avoid and minimize impacts in the WIZ.

Table 3H-9:
Total Disturbed Area by Watershed (including areas within the WIZ)

Watershed	Watershed Area (acres)	Alternative 1 and Existing Disturbed Area (acres)	Alternative 2 Disturbed Area (acres)		Alternative 3 Disturbed Area (acres)	
			Temporary Disturbance	Permanent Disturbance	Temporary Disturbance	Permanent Disturbance
Cascade Village-1	444.66	66.59	0.00	70.67	0.00	68.91
Mountain Front-1	242.41	28.27	0.00	30.19	0.00	30.19
Mountain Front-2	178.60	10.06	0.00	12.71	0.00	12.71
Mountain Front-3	150.99	42.71	0.00	43.56	0.00	42.98
Mountain Front-4	320.26	25.18	0.00	32.02	0.00	29.65
Mountain Front-5	40.17	0.99	0.00	1.35	0.00	1.35
Golden Peak-1	91.07	50.73	0.00	51.29	0.00	51.29
Golden Peak-2	210.49	4.45	0.24	6.58	0.24	6.58
Golden Peak-3	190.18	11.91	0.00	12.33	0.00	12.33
Golden Peak-4	105.51	5.81	0.09	7.31	0.09	7.31
Mill Creek-1	461.05	21.55	0.90	27.84	0.90	27.84
Mill Creek-2	310.64	13.26	0.00	16.33	0.00	16.33
Mill Creek-3	308.61	9.68	1.73	13.64	1.73	13.64
Mill Creek-4	673.85	16.24	0.00	24.80	0.00	24.80

Table 3H-9:
Total Disturbed Area by Watershed (including areas within the WIZ)

Watershed	Watershed Area (acres)	Alternative 1 and Existing Disturbed Area (acres)	Alternative 2 Disturbed Area (acres)		Alternative 3 Disturbed Area (acres)	
			Temporary Disturbance	Permanent Disturbance	Temporary Disturbance	Permanent Disturbance
Mill Creek-5	174.33	0.01	0.00	0.10	0.00	0.10
Mill Creek-6	270.37	2.13	0.00	2.13	0.00	2.13
Mill Creek-7	2,107.81	13.04	0.00	13.60	0.00	13.60
Game Creek-1	549.16	9.99	0.18	11.13	0.18	10.99
Game Creek-2	429.88	19.65	0.96	21.52	0.96	21.52
Total	**7,260.03**	**352.24**	**4.10**	**399.12**	**4.10**	**394.28**

Under Alternative 2, approximately 51 acres of additional temporary and permanent disturbed areas are associated with the proposed projects. Trail and facility designs would be modified to reduce impacts to the WIZ to the extent possible; however, some impacts to the WIZ or perennial and/or intermittent streams may be unavoidable. Additional ground disturbance within the WIZ may not result in adverse impacts to stream health, or stream health would be maintained or improved with implementation of Management Requirements to minimize or prevent increases in CDA. Below each watershed disturbed areas is described in detail.

Table 3H-10:
Total Connected Disturbed Area by Watershed

Watershed	Total WIZ Area (acres)	Alternative 1 and Existing CDA (acres)	Alternative 2 Increase in CDA (acres)		Alternative 3 Increase in CDA (acres)	
			Temporary Disturbance	Permanent Disturbance	Temporary Disturbance	Permanent Disturbance
Cascade Village-1	42.50	6.53	0.30	0.00	0.00	0.00
Mountain Front-1	9.14	1.06	0.00	0.07	0.00	0.07
Mountain Front-2	33.44	2.44	0.00	0.50	0.00	0.50
Mountain Front-3	50.93	14.34	0.00	0.04	0.00	0.04
Mountain Front-4	29.80	3.17	0.00	0.42	0.00	0.42
Mountain Front-5	5.97	0.45	0.00	0.05	0.00	0.05
Golden Peak-1	10.07	6.00	0.00	0.00	0.00	0.00
Golden Peak-2	17.59	0.14	0.14	0.15	0.14	0.15
Golden Peak-3	23.16	1.40	0.00	0.02	0.00	0.02
Golden Peak-4	8.05	0.81	0.00	0.07	0.00	0.07
Mill Creek-1	47.50	1.38	0.00	0.39	0.00	0.39
Mill Creek-2	30.09	2.45	0.05	0.22	0.05	0.22
Mill Creek-3	28.47	0.91	0.00	0.34	0.00	0.34
Mill Creek-4	77.31	3.38	0.00	0.98	0.00	0.98

Table 3H-10:
Total Connected Disturbed Area by Watershed

Watershed	Total WIZ Area (acres)	Alternative 1 and Existing CDA (acres)	Alternative 2 Increase in CDA (acres)		Alternative 3 Increase in CDA (acres)	
			Temporary Disturbance	Permanent Disturbance	Temporary Disturbance	Permanent Disturbance
Mill Creek-5	21.66	0.01	0.00	0.00	0.00	0.00
Mill Creek-6	19.59	0.32	0.00	0.00	0.00	0.00
Mill Creek-7	47.55	0.02	0.00	0.00	0.00	0.00
Game Creek-1	59.15	0.00	0.00	0.00	0.00	0.00
Game Creek-2	21.96	0.69	0.00	0.00	0.00	0.00
Total	**583.94**	**45.50**	**0.49**	**3.25**	**0.19**	**3.25**

Cascade Village

Proposed facilities located in the Cascade Village watershed include the horse corral, the Adventure Ridge Mountain Coaster, the Pride Express Mountain Coaster, and downhill mountain biking trails. Construction of these projects would increase the total amount of disturbed area within the watershed by up to 4.1 acres. Channel conditions could degrade from stable to unstable due to temporary ground disturbance for construction of the proposed Adventure Ridge Mountain Coaster and Pride Express Mountain Coaster within the WIZ. No mass wasting or significant erosion areas were identified. The facilities that would intersect the WIZ are the Adventure Ridge and Pride Express mountain coasters. It also should be noted that the potential WIZ impacts are located in the upper most reach of the CV-1 intermittent sub-drainage area.

Mountain Front

Proposed facilities located in the Mountain Front watershed include the Aerial Adventure Course, the Riparian Experience, the Adventure Ridge Mountain Coaster, the Pride Express Mountain Coaster, and downhill mountain biking trails. Construction of these projects would increase the total amount of disturbed area within the watershed by up to 12.6 acres. Channel conditions could degrade from stable to unstable due to ground disturbance for construction of the proposed downhill mountain biking trails within the WIZ, and final layout of any approved mountain biking/hiking trails has potential to increase CDA. This would be addressed through the implementation of Management Requirements identified in Table 3H-7.

Two slope failure areas were found in the Mountain Front watershed, but the layout of proposed facilities would avoid impacts to these areas. Several erosion areas were identified in the Mountain Front watershed, the most significant of which was associated with recent tree clearing. The preliminary layout of facilities for Alternative 2 does not show any direct conflicts, and mountain biking trails can/should be routed to avoid these areas. Ongoing operations and maintenance activities at the ski area include drainage improvements and reclamation of disturbed areas, which would result in restoration of these

areas. The facilities that would intersect the WIZ are the proposed Riparian Experience, hiking and biking trails. The Riparian Experience is located in a current CDA and the project would include drainage improvements that would reduce the CDA in sub-drainage basin MF-3.

Mill Creek

Mill Creek is the largest watershed in the Analysis Area. Proposed facilities located in the Mill Creek watershed include the Front Side Canopy Tour, hiking trails, downhill and cross-county mountain biking trails, and the wedding venue at The 10th. These facilities would increase the total amount of disturbed area within the watershed by up to 25.2 acres.

Channel conditions could degrade from stable to unstable due to ground disturbance for construction of the proposed mountain biking trails. A slope failure and mass wasting areas adjacent to the West Fork of Mill Creek were identified. These areas potentially conflict with the preliminary location of towers for the proposed Font Site Canopy Tour and cross-country bike trails. Impacts to these slope failure and mass wasting areas can be avoided with proper location of these trails and activities, as based on the identification of sensitive areas throughout the watershed.

Several isolated erosion areas were found in the Mill Creek watershed, all of which were associated with roads and recent maintenance activities. The preliminary layout of facilities for Alternative 2 does not show any direct conflicts with these areas with the exception of a tower for the Front Side Canopy Tour. This erosion site is associated with a culvert outlet and road runoff. Ongoing operations and maintenance activities at the ski area include drainage improvements and reclamation of disturbed areas, which would result in restoration of this area.

The facilities that would intersect the WIZ are towers for the Front Side Canopy Tour, hiking trails and downhill and cross-country mountain biking trails.

Game Creek

Proposed facilities located in the Game Creek watershed include the Game Creek Canopy Tour, a horse trail, and downhill mountain biking trails. These facilities would increase the total amount of disturbed area within the watershed by up to 4.2 acres. Channel stability conditions in the Game Creek watershed would not be impacted by any of the proposed projects. The Game Creek Canopy Tour would span Game Creek and the WIZ and towers would be located well outside of the WIZ. No mass wasting or significant erosion areas were identified.

As proposed, there would be no increase in connected disturbed areas associated with facilities that would be located in the WIZ. The Game Creek Canopy Tour would cross the WIZ, but all of the towers for the canopy tour and all of the trails would be located outside of the WIZ. There would be no tree clearing or ground disturbance within the WIZ in the Game Creek watershed and existing stream health conditions would be maintained.

Golden Peak

Proposed facilities located in the Golden Peak watershed include the Front Side Canopy Tour and downhill and cross-country mountain biking trails. These facilities would increase the total amount of disturbed area within the watershed by up to 4.9 acres. Channel conditions could degrade from stable to unstable due to ground disturbance for construction of the proposed mountain biking trails. The preliminary layout of the mountain biking trails could increase CDA, but the layout of these trails can be modified to avoid impacts that could cause channel stability problems.

Five slope failure areas were identified in the Golden Peak watershed, all of which can be avoided to prevent further impacts. Three slope failures, two located adjacent to Mill Creek and one adjacent to a proposed downhill mountain biking trail, are located under the proposed Front Side Canopy Tour but would not be affected by any ground disturbance. A ski area maintenance road and ski trail are located immediately above these slope failures and drainage improvements have recently been completed to convey runoff around these areas. Proposed mountain biking trails could utilize this road without adverse impacts to these slope failures. Two slope failure areas are in locations that would not be affected by any of the proposed summer recreation facilities. The slope failure located to the east of Mill Creek would be spanned by the proposed Front Side Canopy Tour. Drainage improvements associated with the tower proposed to be located uphill from the slope failure would be implemented to route runoff away from the slope failure area.

The only significant erosion area found in the Golden Peak watershed is associated with recent tree clearing. The preliminary layout of facilities for Alternative 2 does not show any direct conflicts with this area. Ongoing operations and maintenance activities at the ski area include drainage improvements and reclamation of disturbed areas, would result in restoration of this area.

The facilities that would intersect the WIZ are downhill and cross-country mountain biking trails.

Wetlands

The projects included in Alternative 2 would not impact any known and previously identified wetlands. Detailed design and layout for implementation of the proposed hiking and biking trails would require surveys to assure the wetlands are avoided. It is likely that some stream crossings for proposed mountain biking, horse, and hiking trails would be required, in which case, project design features (e.g., bridges) and applicable BMPs would be implemented to avoid impacts to riparian wetlands and to minimize increases in CDA. If any wetland impacts are determined to be unavoidable, additional NEPA analysis and U.S. Army Corps of Engineers permitting would be required prior to construction.

Water Quality

The only water quality impacts associated with proposed projects and activities are those associated with potential increases in erosion and sedimentation associated with temporary ground disturbance during

construction and permanent disturbance from additional hiking, mountain biking and horse trails. Erosion from disturbed areas will be minimized through implementation of Management Requirements (refer to Table 3H-7).

Vail Ski Area is required to have a Stormwater Management Plan (SWMP) to operate under a State approved Permit for Stormwater Discharges Associated with Construction Activity (CDPS Permit No. COR-030541).

Alternative 3

Stream Health

Water Quantity and Hydrology

There would be 46.1 acres of additional temporary and permanent disturbed areas associated with the proposed projects included in Alternative 3. The average yield increase for the Analysis Area watersheds would range from 0.20 to 0.57 percent and the maximum increase, which would occur in wet years, would range from 0.26 to 0.73 percent (refer to Table 3H-8). The maximum increase in peak flows would range from 0.23 to 0.078 percent in dry years, which would be less than 0.2 cfs. This modeled increase would be too small to be measurable and would result in no adverse impact.

Channel Stability

Potential impacts to stream channel stability for each alternative are addressed under the discussion of Disturbed Areas and Connected Disturbed Areas.

Disturbed Areas and Connected Disturbed Areas

Total disturbed areas, including WIZ areas, were estimated for each watershed for existing conditions and the action alternatives and are shown in Table 3H-9. CDA within the WIZ of each watershed is shown in Table 3H-10 for each alternative.

Currently there are an estimated 45.5 acres of CDA within in the Analysis Area (refer to Table 3H-10). Most of the existing CDA is associated with roads and some constructed drainages and water bars that discharge directly to streams. Permanent increases in ground disturbance would result in an increase to CDA of 3.5 acres, approximately 7 percent, which would result in some increase in sediment loading to Gore Creek and the Eagle River. The 3.5-acre increase to CDA under Alternative 3 could therefore be fully offset by reductions to existing CDAs or through implementation of BMPs and project design features (e.g., drainage improvements to route runoff from disturbed areas to sediment basins or areas that are not directly connected to streams).

Cascade Village

Under Alternative 3, proposed facilities located in the Cascade Village watershed include the horse corral and downhill mountain biking trails. These proposed facilities would increase the total amount of

disturbed area within the watershed by up to 2.3 acres. Channel conditions would not be affected under Alternative 3. No mass wasting or significant erosion areas were identified.

As proposed, there would be no increase in CDA because the proposed mountain biking trails could be located outside the WIZ (refer to Table 3H-7 for more information). There would therefore be no change in stream health conditions.

Mountain Front

Proposed facilities located in the Mountain Front watershed would include the Aerial Adventure Course, hiking trails, and downhill mountain biking trails. These facilities would increase the total amount of disturbed area within the watershed by up to 9.7 acres. Channel conditions could degrade from stable to unstable due to ground disturbance for construction of the proposed downhill mountain biking trails within the WIZ. With implementation of BMPs and project design features, there would be no impacts to channel stability.

Potential impacts in the Mountain Front watershed for mass wasting and erosion areas would be the same as Alternative 2, in which the two slope failure and several erosion areas should be avoided. The facilities that would intersect the WIZ are the proposed the hiking and mountain biking trails.

Mill Creek

Under Alternative 3, proposed facilities located in the Mill Creek are the same as for Alternative 2 (i.e., facilities would increase the total amount of disturbed area within the watershed by up to 25.2 acres).

Potential impacts in the Mill Creek watershed for channel stability, mass wasting and erosion areas would be the same as Alternative 2.

Game Creek

Under Alternative 3, proposed facilities located in the Game Creek are the same as for Alternative 2 (i.e., facilities would increase the total amount of disturbed area within the watershed by up to 4.2 acres). Potential impacts in the Game Creek watershed for channel stability, mass wasting and erosion areas would be the same as Alternative 2.

Golden Peak

Under Alternative 3, proposed facilities located in the Golden Peak watershed are the same as for Alternative 2 (i.e., facilities would increase the total amount of disturbed area within the watershed by up to 4.9 acres). Potential impacts in the Golden Peak watershed for channel stability, mass wasting and erosion areas would be the same as Alternative 2.

Wetlands

The projects included in Alternative 3 would not impact any known and previously identified wetlands. Detailed design and layout for implementation of the proposed hiking and biking trails would require

surveys to assure the wetlands are avoided. It is likely that some stream crossings for proposed mountain biking, horse, and hiking trails would be required, in which case, project design features (e.g., bridges) and applicable BMPs would be implemented to avoid impacts to riparian wetlands and to minimize increases in CDA. If any wetland impacts are determined to be unavoidable, additional NEPA analysis and U.S. Army Corps of Engineers permitting would be required prior to construction.

Water Quality

The only water quality impacts associated with proposed projects and activities are those associated with potential increases in erosion and sedimentation associated with temporary ground disturbance during construction and permanent disturbance from additional hiking, mountain biking and horse trails. Erosion from disturbed areas will be minimized through implementation of BMPs and project design features and a surface water management plan (refer to Table 3H-7).

CUMULATIVE EFFECTS

The geographical area for this cumulative effects analysis therefore includes the Analysis Area for the Vail Ski Area summer recreation facilities: Gore Creek and Eagle River above Gore Creek watersheds. The cumulative influence of the Alternative 2 – Proposed Action and Alternative 3 considered in this study is generally very small within the scale of the Upper Eagle Watershed, which encompasses roughly 636,000 acres above the confluence with Gore Creek near Dowd Junction. The Gore Creek watershed has an area of approximately 100,000 acres, which by itself is an order-of-magnitude greater than the scale of the project-area drainages.

The past, present, and reasonably foreseeable future actions that affect hydrology, water quality and stream health within the Vail Ski Area SUP were most recently described in the *Final Environmental Impact Statement for the 2007 Vail Ski Area Improvement Project*.[97] Other activities that have affected watershed conditions include the 2009 Vail Beetle Tree Salvage Project, the 2009 Golden Peak Snowmaking and Race Course Improvements, the 2010, 2012, and 2013 Vail Mountain Summer Improvements, and the 2011 Vail Ski Area Forest Health Project. In addition, substantial drainage and revegetation work has been completed in the Golden Peak area in conjunction with ongoing ski area maintenance and improvement projects including relocation of the halfpipe to the lower Golden Peak area and installation of the Dragon's Breath stormwater pipeline. These efforts have significantly reduced erosion and sedimentation, which has been beneficial to stream health conditions in Mill Creek and Gore Creek.

The total water annual yield and peak flows from the Analysis Area watersheds would increase by a maximum of about 0.5 percent in dry years under Alternative 2. These changes would be too small to measure even within the individual watersheds of the Analysis Area and would be even more

[97] USDA Forest Service, 2009

insignificant in the context the of the much larger Eagle River and/or Gore Creek watershed scale. It is important to note that increase in water yield would be offset by growing water demands for municipal uses in the Eagle River Basin. However, runoff from larger impermeable areas associated with urban development would likely result in higher peak flows unless BMPs are implemented to attenuate runoff from snowmelt and rain events.

In addition to the ongoing stream health and water quality related activities described in the *2007 Vail Ski Area Improvements Project EIS*, a major effort has been underway to improve stream health conditions in Gore Creek in response to the addition of Gore Creek to the Colorado 303(d) List for aquatic life impairment. This effort is being coordinated by the Eagle River Watershed Council and has resulted in the recent completion of the "Gore Creek Water Quality Improvement Plan." Coordinated efforts are currently underway by the Town of Vail, the Eagle River Water & Sanitation District, Vail Associates, CDOT and other interested stakeholders to implement water quality protection and improvement programs and projects identified in the Plan.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

No irreversible and/or irretrievable commitment of resources have been identified that may impact the water resources in association with the alternatives analyzed in this document.

I. VEGETATION AND BOTANY

SCOPE OF THE ANALYSIS

The Analysis Area for vegetation and botany encompasses the front side of Vail Mountain, as well as Game Creek Bowl within the SUP boundary. The 3,050 feet of vertical relief within the Analysis Area ranges from a high of 11,250 feet to a low of 8,200 feet in elevation.

This analysis summarizes the more detailed Botanical Biological Report (Biological Assessment/ Biological Evaluation and Specialist Report) contained in the project file.[98] The Botanical Biological Report and this analysis describe the existing condition and disclose anticipated impacts to federally threatened, endangered, proposed, and Forest Service Region 2 (R2) sensitive plant species and other plant Species of Local Concern (SOLC).

AFFECTED ENVIRONMENT

Vegetation Communities

Vegetation types within the Analysis Area include lodgepole pine forests (*Pinus contorta* ssp. *latifolia*), Engelmann spruce-subalpine fir forests (*Picea engelmannii-Abies bifolia*), aspen (*Populus tremuloides*) forests, meadows, and riparian and wetland habitats. In addition, there are graminoid dominated ski runs which are interspersed throughout the fragmented forest landscape. Each of the vegetation types is summarized below. A vascular plant species list for the Analysis Area may be found in the project file.

Lodgepole Pine Forest

Lodgepole pine forests occur throughout the Analysis Area and are found either as pure stands, as a dominant mixed with Engelmann spruce and subalpine fir, and as a minor species component with aspen. Common associates in lodgepole pine stands generally include whortleberry (*Vaccinium myrtillus* subsp. *oreophilum*, *V. scoparium*), buffaloberry (*Shepherdia canadensis*), common juniper (*Juniperus communis*), heartleaf arnica (*Arnica cordifolia*), lupine (*Lupinus argenteus*), and harebell (*Campanula rotundifolia*). Almost all stands of lodgepole pine have been affected by the mountain pine beetle or mountain pine beetle (MPB), (*Dendroctonus ponderosae*). In areas with greater than 80 percent lodgepole pine mortality, there is greater sunlight penetration onto the forest floor, which has fostered the growth of a diverse suite of native forbs and graminoids such as slender wheatgrass (*Elymus trachycaulus*), blue wildrye (*Elymus glaucus*), butterweed groundsel (*Senecio serra*), American vetch (*Vicia americana*), aspen fleabane (*Erigeron speciosus*), strawberry (*Fragaria virginiana*), manyray goldenrod (*Solidago multiradiata*), and beautiful cinquefoil (*Potentilla pulcherrima*).

[98] Western Ecological Resource, 2013

Engelmann Spruce-Subalpine Fir Forest

Spruce-fir forests occur at the higher elevations of the Analysis Area, particularly on the slopes below the Two Elk Lodge. Engelmann spruce is dominant, however subalpine fir also occurs. The understory density varies with degree of shading. In dense forests, whortleberry carpets the ground with occasional forbs such as sickletop lousewort (*Pedicularis racemosa* ssp. *alba*) and heartleaf arnica. In more open areas, fringed brome (*Bromopsis canadensis*), sweet cicely (*Osmorhiza depauperata*), hemlock parsley (*Conioselinum scopulorum*), and subalpine fleabane (*Erigeron peregrinus*) occur. Overall, spruce-fir forests are a minor component of the vegetation within the Analysis Area and are often mixed with other conifers such as lodgepole pine. Deadfall is abundant.

Aspen Forest

Well-developed stands of aspen occur both on the north-facing slopes above the Town of Vail as well as in Game Creek Bowl. The aspen forests in Game Creek Bowl contain a lush and dense herbaceous understory comprised of native forbs and graminoids. Common species include mountainlover (*Paxistima myrsinites*), red elderberry (*Sambucus microbotrys*), green needlegrass (*Nassella viridula*), Thurber fescue (*Festuca thurberi*), nettleleaf giant hyssop (*Agastache urticifolia*), tall fleabane (*Erigeron elatior*), cow parsnip (*Heracleum sphondylium*), fireweed (*Epilobium angustifolium*), butterweed groundsel, sweet cicely (*Osmorhiza chilensis, O. depauperata*), and Fendler meadowrue (*Thalictrum fendleri*). Those aspen forests on the front side of the Vail Mountain additionally support a shrub layer of serviceberry (*Amelanchier alnifolia*), mountain maple (*Acer glabrum*) and snowberry (*Symphoricarpos rotundifolius*), and contain numerous wetland seeps, which are described below.

Meadows

There are a few areas of native meadow located near the top of the Eagle Bahn Gondola. These are dominated by Thurber fescue along with a diverse compliment of native forbs. Species include mariposa lily (*Calochortus gunnisonii*), yarrow (*Achillea lanulosa*), harebell, subalpine buckwheat (*Eriogonum subalpinum*), hairy golden aster (*Heterotheca villosa*), aspen fleabane, aspen sunflower (*Helianthella quinquenervis*), and beautiful cinquefoil.

Riparian and Wetland Habitats

Riparian and wetland habitats primarily occur along Mill Creek, Gore Creek, Game Creek, and along other unnamed streams in the Analysis Area. In addition, numerous aspen wetland seeps are present on the lower slopes of the front side of Vail Mountain. Within the Analysis Area, the limits of the riparian habitat roughly correspond to those of the wetland boundaries and hence these habitats are discussed together. Brief vegetation descriptions of the riparian and wetland habitats are provided below.

The riparian and wetland habitats occurring within the Analysis Area are typical of upper montane and lower subalpine wetlands of the region. Forested wetlands along the perennial Mill Creek, for example, are characterized by an overstory of Engelmann spruce and subalpine fir, with minor components of

lodgepole pine and aspen. The narrow wetland fringe is comprised of Drummond willow (*Salix drummondiana*), mountain maple, field horsetail (*Equisetum arvense*), chiming bells (*Mertensia ciliata*), cow parsnip, and heartleaf bittercress (*Cardamine cordifolia*). In other areas, such as along small intermittent tributaries to Mill Creek, the wetland vegetation is comprised of common native forbs and graminoids such as arrowleaf groundsel (*Senecio triangularis*), chiming bells, Fendler cowbane (*Oxypolis fendleri*), bishop's cap (*Mitella pentandra*), brook saxifrage (*Micranthes odontoloma*), cow parsnip, softleaf sedge (*Carex disperma*), and millet wood rush (*Luzula parviflora*). Finally, the numerous aspen seeps on the north portion of the Analysis Area are comprised of alder (*Alnus incana* ssp. *tenuifolia*), river birch (*Betula fontinalis*), Drummond willow, monkshood (*Aconitum columbianum*), arrowleaf groundsel, heartleaf bittercress, field horsetail, and cow parsnip. There are no fens present within the Analysis Area.

Note: all proposed project activity areas identified in alternatives 2 and 3 were surveyed for wetlands and other Waters of the U.S., with the exception of the proposed mountain biking and hiking trails.

Disturbed Lands – Ski Runs and Roadsides

Disturbed land and introduced plants occur on developed ski terrain as well as along edges of roads and along pipelines. The majority of the ski runs are dominated by non-native graminoids such as smooth brome (*Bromus inermis*), intermediate wheatgrass (*Thinopyrum intermedium*), timothy (*Phleum pratense*), and orchardgrass (*Dactylis glomerata*), as well as native colonizing forbs such as manyray goldenrod (*Solidago multiradiata*), pearly everlasting (*Anaphalis margaritacea*), spreading goldenbanner (*Thermopsis divaricarpa*), Whipple's penstemon (*Penstemon whippleanus*), and fireweed.

Invasive Non-Native Weeds

Six species of Colorado Noxious Weeds were documented within the Analysis Area. These include one List A species: orange hawkweed (*Hieracium auranticum*); and five List B species: Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans* ssp. *macrolepis*), plumeless thistle (*Carduus nutans* ssp. *macrolepis*), ox-eye daisy (*Leucanthemum vulgare*), and toadflax (*Linaria vulgaris*). Most abundant are ox-eye daisy, musk thistle, and Canada thistle, which are extremely common on the ski terrain of the front side of Vail Mountain. Plumeless thistle was also observed, but is less frequent. Orange hawkweed was only found in one location along the proposed equestrian trail in Game Creek Bowl. This species has been designated for eradication by the state of Colorado and is a top priority for control by the WRNF. No other non-native invasive species were observed, except for several species of rhizomatous agricultural grasses present on ski trails.

Forest Health

Since the mid-2000s the Eagle Valley has experienced a heavy mortality of lodgepole pine due to an epidemic of MPB. In 2011, the Forest Service authorized the implementation of *The Vail Ski Area Forest Health Project* (2011 Forest Health Project), which presented plans to treat approximately 984 acres of NFS lands within Vail Ski Area's SUP boundary. The 2011 Forest Health Project is designed to protect

human health and infrastructure from hazard trees, enhance the growth of new and existing forest areas, and maintain the visual setting. The 2011 Forest Health Project includes a variety of silvicultural methods including partial cuts, clear cuts of varying size, and hazard tree removal. Vail Ski Area is currently implementing the project. Many of the authorized treatment units in the 2011 Forest Health Project overlap the proposed recreation enhancement activity areas currently being analyzed, including mountain coasters, the Front Side Canopy Tour, and portions of the proposed hiking and mountain biking trails.

Recent Forest Service forest health aerial surveys indicate that MPB populations in the area are declining as many of the large pine trees in the area have already been killed. The data for the Analysis Area show that 88 acres of lodgepole pine forest had active MPB in 2011, reduced to 30 acres in 2012.[99] Overall, however, more than 80 percent of the lodgepole pine stands within the Analysis Area have been affected by the MPB and have an enormous amount of standing dead timber interspersed with live unaffected trees. Outbreaks of other forest insects and pathogens have also been recorded in the Analysis Area. In 2011, 4.6 acres of spruce-fir forest showed evidence of subalpine fir decline from the western balsam bark beetle (*Dryocoetes confusus*), and in 2012 approximately 100 acres of spruce-fir forest showed evidence of the western balsam bark beetle.[100]

Pre-Field Review and Field Reconnaissance

A pre-field review was conducted of all Threatened, Endangered and Sensitive (TES) and SOLC plants known or suspected to be present in the Analysis Area. This preliminary review included a review of the Regional Forester's Sensitive Plant List, a review of the Colorado Natural Heritage Program's Biological Database records for TES and SOLC plants present within the Analysis Area, a review of the USFWS Internet site (IPaC) for the most current listing of TES and candidate species, and a review of Forest Service files and records for the Analysis Area.

Based on the above review, the following section describes rare plants known or suspected from the Analysis Area. Collectively, this represents consideration of the best available science. The species considered and evaluated include: Threatened, Endangered and Proposed plants; Forest Service designated R2 Sensitive plants; and SOLC.

Threatened and Endangered Species

USFWS plant species with potential habitat in the Analysis Area include the federally threatened Penland's alpine fen mustard (*Eutrema penlandii*) and the federally threatened Ute ladies'-tresses orchid (*Spiranthes diluvialis*). No critical habitats are currently designated for any listed plant species within the Analysis Area. The two listed plant species are listed in Table3I-1. Both species were excluded from

[99] USDA Forest Service, 2011 and 2012a
[100] USDA Forest Service, 2011 and 2012a

further analysis due to lack of suitable habitat and elevational differences between known occurrences and the Analysis Area. As a result, neither species will be discussed further in this document.

Table 3I-1:
Federally Listed & Proposed Plants Considered in Analysis

Species	Habitat Description	Species Excluded from Analysis?	Rationale
Penland's alpine fen mustard *Eutrema penlandii*	Alpine constantly moist areas, often near snowbeds. Elev. 11,800–12,800'	Yes	No habitat within Analysis Area
Ute ladies'-tresses orchid *Spiranthes diluvialis*	Seasonally moist soils and wet meadows of drainages and margins of ditches, below 7,000' elevation	Yes	No habitat within Analysis Area

Region 2 Sensitive Species

Forest Service Manual 2670 defines a Sensitive plant as one that is not presently listed as threatened or endangered by the USFWS, but concerns about the population viability have been identified as evidenced by:

1. Significant current or predicted downward trends in population numbers or density.
2. Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

The Regional Forester has identified Sensitive species for R2.[101] Table 3I-2 lists the 33 species either known or suspected to occur on the WRNF along with brief habitat descriptions, and shows the plant species either analyzed or excluded from further analysis, and the rationale for exclusion. A total of nine Sensitive plant species (bold text in Table 3I-2) are carried forward into the analysis.

Table 3I-2:
USFS Region 2 Sensitive Plant Species for the White River National Forest

Name	General Habitat and Colorado Range	Species Excluded from Analysis?	Rationale
Armeria maritima ssp. *sibirica** Sea pink	Grassy tundra slopes, on wet, sandy, or spongy organic soils; 11,460–12,580'; Park & Summit counties, Colorado.	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities

[101] Regional Supplement 2600-2011-1 to FSM 2670

Table 3I-2:
USFS Region 2 Sensitive Plant Species for the White River National Forest

Name	General Habitat and Colorado Range	Species Excluded from Analysis?	Rationale
Astragalus leptaleus **Park milkvetch**	**Ecotone of saturated and dry soils; moist swales and meadows; 6,000–10,000'; Chaffee, Custer, Eagle, Fremont, Gunnison, Jackson, Larimer, Park & Summit counties, Colorado.**	**No**	**Species Analyzed**
Botrychium ascendens **Upswept moonwort**	**Disturbed but stabilized subalpine areas; several sites in Colorado.**	**No**	**Species Analyzed**
Botrychium lineare+ **Narrowleaf moonwort**	**Disturbed but stabilized sites, barren sites, grass or grass-herb forest meadows, aspen stands, upper montane to alpine, 7,900–12,500'; numerous east and west-slope counties.**	**No**	**Species Analyzed**
Botrychium paradoxum **Paradox moonwort**	**Moist meadows to sparsely vegetated upland.**	**No**	**Species Analyzed**
Braya glabella Smooth rockcress	Calcareous substrates, especially Leadville limestone; sparsely vegetated gravelly slopes above timberline; 12,000–13,000'	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities
Carex diandra Lesser panicled sedge	Montane and subalpine wetland fens; 7,000–9,600'; Boulder, Garfield, Grand, Jackson, Larimer & Saguache counties, Colorado.	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities
Carex livida Livid sedge	Mineral rich wetland fens; 9,000–10,100'; Boulder, Grand, Jackson, Larimer & Park counties, Colorado.	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities
Cypripedium parviflorum **Yellow lady's slipper**	**Moist forests including ponderosa pine, Douglas-fir, and aspen; 7,400–8,500' in CO; Clear Creek, Custer, Douglas, El Paso, Garfield, Huerfano, Jefferson, La Plata, Larimer, Las Animas, Montrose, Park, Pueblo & Teller counties, Colorado.**	**No**	**Species Analyzed**
Draba exunguiculata Clawless draba	Alpine on rocky and gravelly slopes or fell fields; 11,700–14,000'; Boulder, Clear Creek, El Paso, Gilpin, Grand, Lake, Park & Summit counties, Colorado.	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities

Table 3I-2:
USFS Region 2 Sensitive Plant Species for the White River National Forest

Name	General Habitat and Colorado Range	Species Excluded from Analysis?	Rationale
Draba grayana Gray's Peak draba	Alpine and subalpine on tundra, gravelly slopes or fell fields; 11,600–14,100'; Chaffee, Clear Creek, Gilpin, Grand, Huerfano, Larimer, Park, Pitkin, Saguache & Summit counties, Colorado.	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities
Draba weberi	Splash zones, among the rocks along streams and lakes and spruce forests. Above 11,000'	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities
Drosera rotundifolia Roundleaf sundew	Among sphagnum peat moss on the margins of ponds, fens, and floating peat mats; 9,100–9,800'; Grand, Gunnison and Jackson counties, Colorado.	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities
Epipactis gigantea Giant helleborine	Warm-water seeps and springs. 4,800 to 8,000' Archuleta, Las Animas, Chaffee, Delta, Mesa, Montrose, Moffat, Saguache counties, Colorado	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities
Eriogonum exilifolium Dropleaf buckwheat	Sagebrush flats; North and Middle Parks in Larimer, Jackson and Grand counties, Colorado. 7,500–9,000'	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities
Eriophorum altaicum var. *neogaeum** Altai cottongrass	Open areas with hydric soils, fens; 10,160–13,200'; Eagle, Gunnison, Hinsdale, La Plata, Mineral, Park, Pitkin, Saguache, San Juan & San Miguel counties; includes *Eriophorum chamissonis*	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities
Eriophorum chamissonis Chamisoi cottongrass	Open areas with hydric soils, fens; 10,160–13,200'; Eagle, Gunnison, Hinsdale, La Plata, Mineral, Park, Pitkin, Saguache, San Juan & San Miguel counties; includes *Eriophorum altaicum* var. n*eogaeum*	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities
Eriophorum gracile Slender cottongrass	Montane and subalpine fens, saturated soils; 8,100–11,140' in CO; Gunnison, Jackson, Larimer, Las Animas, Park, San Miguel & Summit counties, Colorado.	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities
Festuca hallii **Plains rough fescue**	**Alpine and subalpine grasslands and meadows; 8,500–11,500'; Huerfano & Larimer counties, Colorado.**	**No**	**Species Analyzed**

Table 3I-2:
USFS Region 2 Sensitive Plant Species for the White River National Forest

Name	General Habitat and Colorado Range	Species Excluded from Analysis?	Rationale
Kobresia simpliciuscula Simple kobresia	Fens and moist alpine areas; Boulder, Clear Creek, Grand, Gunnison, Park, Summit counties, Colorado. 8,970 to 12,800'	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities
Machaeranthera coloradoensis* **Colorado tansyaster**	**Gravelly areas in mountain parks, slopes and rock outcrops up to dry tundra; 7,600–13,000'; Dolores, Gunnison, Hinsdale, La Plata, Lake, Mineral, Park, Pitkin, Gunnison, Rio Grande, Saguache & San Juan counties, Colorado.**	**No**	**Species Analyzed**
Parnassia kotzebuei* **Kotzebue's grass of Parnassus**	**Alpine and subalpine, in wet rocky areas, amongst moss mats and along streamlets; 10,000–12,000'; north-central and southwestern Colorado, Boulder, Clear Creek, Garfield, Larimer, Grand, Park, San Juan, Summit counties, Colorado.**	**No**	**Species Analyzed**
*Penstemon harringtonii** Harrington penstemon	Sagebrush communities, often on calcareous substrates; 6,800–9,000'; endemic to Eagle, Garfield, Grand, Pitkin, Routt, and Summit counties, Colorado.	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities
*Ptilagrostis porteri** Porter's false needlegrass	Hummocks in fens and willow carrs; 9,350–12,000'; El Paso, Lake, Park & Summit counties, Colorado. Also, New Mexico.	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities
*Ranunculus karelinii** Ice cold buttercup	Alpine slopes among rocks and scree; 12,000–14,100'; central Colorado, including Chaffee, Clear Creek, Gunnison, Hinsdale, Lake, Ouray, Park & Summit counties, Colorado.	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities
Rubus arcticus* ssp. *acaulis **Dwarf raspberry**	**Wetlands in willow carrs and mossy streamsides; 7,000–9,720'; Clear Creek, Grand, Park counties, Colorado.**	**No**	**Species Analyzed**
Salix candida Silver willow	Often associated, but not restricted to rich and extremely rich fens; 8,900–10,400'; Lake, Larimer & Park counties, Colorado.	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities
Salix serissima Autumn willow	Wetland areas including marshes, fens, and bogs; 7,800–10,200'; Boulder, Custer, La Plata, Park, Larimer & Routt counties, Colorado.	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities

Table 3I-2:
USFS Region 2 Sensitive Plant Species for the White River National Forest

Name	General Habitat and Colorado Range	Species Excluded from Analysis?	Rationale
Sphagnum angustifolium Narrowleaf sphagnum	Acidic fens with high concentrations of iron and other ions. San Juan & Gunnison National Forests, Colorado.	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities
Sphagnum balticum Baltic sphagnum	Acidic fens with high concentrations of iron and other ions. San Juan National Forest, Colorado.	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities
*Thalictrum heliophilum** Sun-loving meadowrue	Endemic to sparsely vegetated steep shale talus slopes of the Green River Formation; 6,300–8,800'	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities
Utricularia minor Lesser bladderwort	Shallow water of subalpine ponds; 8,200->10,000' in CO; Boulder, Delta, Gilpin. Jackson, La Plata, Larimer, Montezuma and Park counties, Colorado.	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities
Viburnum opulus var. *americanum* American cranberry bush	Riparian and riparian transition to cottonwood, river birch and hawthorn. 6,000–7,000'	Yes	No known or suspected plants or habitat in areas potentially affected by proposed project activities

* Species of viability concern.
+ includes forms assigned to provisional name *Botrychium* "furcatum," to be subsumed under *B. lineare*.
Source: USDA Forest Service, 2002

No occupied habitat was observed for any of the R2 Sensitive plant species during comprehensive field reconnaissance. The field survey efforts were completed by an experienced botanist, focusing on areas of potential habitat for the sensitive species, and none of the plants were found. However, because moonworts occur in mixed species aggregations and may not emerge every year, it is possible that the R2 listed moonworts (*Botrychium ascendens, B. lineare,* and *B. paradoxum)* may be present among populations of common moonworts described below. The project file contains a detailed account of those areas included in the botanical surveys, including a vascular plant species list.

Species of Local Concern

Plant SOLC are species suspected to be at risk at a forest-wide scale, but do not meet criteria to be classified as R2 Sensitive species because their populations are reasonably secure or stable within portions of R2 of the Forest Service. Plant SOLC include species with declining trends in only a portion of R2. Risk to SOLC viability may differ at national, regional, and local scales. Species at the edge of their range may not merit regional Sensitive Species status, but may be important elements of biological diversity for the Forest/Grassland unit.

The 2002 Forest Plan does not include direction (standards or guidelines) for the management of plant SOLC. However, direction for the management of these species is provided in Forest Service Manual, which states to "Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on NFS lands."[102] Eighty-one SOLC plants are documented as occurring on or within 1 mile of the WRNF. These plants were included in the botanical surveys conducted in 2013.

Four SOLC were documented within the Analysis Area. These include: *Botrychium lanceolatum, B. hesperium, B. minganense,* and *B. neolunaria.* These moonworts were found in three aggregations; two aggregations were found near proposed towers of the Game Creek Canopy Tour, and the third is located along the proposed Adventure Ridge Mountain Coaster. Detailed maps, tables and Element Occurrence Records (EORs) for each of the locations of these plant species are contained in the project record.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Table 3I-3 summarizes the impact to R2 Sensitive species resulting from alternatives 1 through 3.

Table 3I-3:
Summary of Determinations for USFS Region 2 Sensitive Plant Species

Name	Alternative 1	Alternative 2	Alternative 3.
Astragalus leptaleus Park milkvetch	NI	NI	NI
Botrychium ascendens Upswept moonwort	NI	MAII	MAII
Botrychium lineare Narrowleaf moonwort	NI	MAII	MAII
Botrychium paradoxum Paradox moonwort	NI	MAII	MAII
Cypripedium parviflorum Yellow lady's slipper	NI	NI	NI
Festuca hallii Plains rough fescue	NI	NI	NI
Machaeranthera coloradoensis Colorado tansyaster	NI	NI	NI
Parnassia kotzebuei Kotzebue's grass of Parnassus	NI	NI	NI
Rubus arcticus ssp. *acaulis* Dwarf raspberry	NI	NI	NI

NI= No impact
MAII= May adversely impact individuals, but not likely to result in a loss of viability on the Planning area, nor cause a trend towards federal listing or a loss of species viability rangewide

[102] FSM 2670.22, number 2

Alternative 1 – No Action

Region 2 Sensitive Species

A determination of ***no impact*** was made for all nine R2 Sensitive plant species carried forward into the analysis for Alternative 1. Although occurrence(s) of three *Botrychium* spp. could have been overlooked during surveys, there would be no impacts to these species because no additional activities or ground disturbance would be authorized under Alternative 1.

Species of Local Concern

Under the No Action Alternative, there would be a continuation of existing management practices and therefore there would be no direct or indirect impacts to SOLC. Therefore, the No Action Alternative is not expected to compromise the long term viability of these plant species within the planning area or rangewide.

Alternative 2 – Proposed Action

In order to minimize potential resource impacts, Management Requirements have been developed and incorporated into the Proposed Action. A full list of Management Requirements, by resource, is contained in Table 2-3. The potential effects of implementing the Proposed Action were analyzed with Management Requirements applied.

Critical to this analysis is the requirement that, prior to implementing any approved project activities that were not included in the 2013 botanical survey area, the specific project areas will be surveyed using established protocol. Surveys need to be conducted for Threatened, Endangered, Proposed and Candidate Species, Sensitive Species, and SOLC. More specifically, site-specific surveys will be conducted along the final alignment of any approved mountain biking and hiking trails and in any other areas where changes to the disturbance footprint have been made since the 2013 botanical survey. Such areas potentially include, but are not limited to, the proposed horse corral, the upper portion of the Pride Express Mountain Coaster, and construction access routes to Game Creek Canopy Tour towers.

Region 2 Sensitive Species

A determination of ***no impact*** was made for six of the nine plant species carried forward into the analysis for Alternative 2. These include *Astragalus leptaleus*, *Cypripedium parviflorum*, *Festuca hallii*, *Machaeranthera coloradoensis*, *Parnassia kotzebuei*, and *Rubus arcticus* ssp. *acaulis*. None of these species are known to occur or were documented during the botanical survey work of 2013. Thus, these species are presumed to be absent.

No occurrences of the three R2 Sensitive moonworts were found during surveys that were focused in areas that would be directly impacted under Alternative 2. Therefore, it is unlikely that there would be any direct effects to these species. However, because occurrences of *Botrychium* spp. could have been

overlooked due to their small size and phenological development, there is a remote possibility of direct and/or indirect effects. Direct impacts could potentially result from trampling, breaking, crushing, or uprooting of individuals as produced by machinery during the construction process. Individuals could also be directly impacted by smothering with slash, chips, or soil, and could also have trees fall on them during forest overstory removal. Individuals impacted may die or experience reduced growth and development as well as reduced or eliminated seed-set and reproduction. If direct impacts are large enough, the reduced population size may change meta-population structure, potentially affecting species viability on the planning unit or rangewide.

Indirect effects to *Botrychium* spp. could also occur as a result of the Proposed Action. Increased light regime from forest overstory removal and creation of skid trails or access routes could potentially benefit moonworts in the long run by creating open, disturbed sites that these plants prefer. Other indirect impacts, such as noxious weed invasion, altered hydrologic patterns, or increased dust from vehicular construction traffic may be a detriment to *Botrychium* spp., and impacted individuals may die or show reduced growth and reproduction. However, over time, disturbances related to the Proposed Action would stabilize and create additional habitat for moonworts, which would benefit these species as a whole.

It is anticipated that the direct and indirect impacts associated with Alternative 2 would be localized and not of sufficient intensity or scale to cause a significant effect. A determination of ***May adversely impact individuals, but not likely to result in a loss of viability on the Planning area, nor cause a trend towards federal listing or a loss of species viability rangewide*** was made for three *Botrychium* spp. *(Botrychium ascendens*, *B. lineare* and *B. paradoxum*.), due to the remote possibility that the species could occur in the Analysis Area.

Management Requirements would be implemented to protect and minimize direct and indirect impacts to occupied moonwort habitat that may contain the sensitive *Botrychium* spp. Such requirements include avoidance and minimization of impacts to occupied moonwort habitat, utilization of barriers to delineate occupied habitat, and implementation of Forest Service-approved revegetation procedures and noxious weed control (refer to Table 2-3). If any previously unknown occurrences of *Botrychium* spp. are encountered within areas not previously surveyed, a Forest Service Botany Representative will need to be notified to derive suitable mitigation measures to avoid or minimize impacts as appropriate.

Species of Local Concern

Alternative 2 may impact up to 200 square feet of occupied *Botrychium* spp. habitat. These relatively small impacts are due to the construction of two tower foundations for the proposed Game Creek Canopy Tour and for the footers for the Adventure Ridge Mountain Coaster. Other indirect effects to moonwort SOLC may also occur under Alternative 2. These include the potential for increased noxious weed invasion, increased sedimentation or erosion, deceased light associated with shading created by mountain

coasters, or altered hydrologic regimes. However, both direct and indirect impacts to SOLC would be avoided and/or minimized through the application of Management Requirements (refer to Table 2-3).

Alternative 3

Management Requirements for Alternative 3 are identical to Alternative 2.

Region 2 Sensitive Species

As with Alternative 2, a determination of ***no impact*** was made for six of the nine plant species carried forward into the analysis for Alternative 3. These include *Astragalus leptaleus*, *Cypripedium parviflorum*, *Festuca hallii*, *Machaeranthera coloradoensis*, *Parnassia kotzebuei*, and *Rubus arcticus* ssp. *acaulis*. None of these species are known to occur or were documented during the botanical survey work of 2013. Thus, these species are presumed to be absent.

A determination of ***may adversely impact individuals, but not likely to result in a loss of viability on the Planning area, nor cause a trend towards federal listing or a loss of species viability rangewide*** was made for the three *Botrychium* spp. *(Botrychium ascendens*, *B. lineare* and *B. paradoxum*.), due to the remote possibility that the species could occur in the Analysis Area. Refer to the discussion of Alternative 2 for a description of the potential impacts and rationale.

Species of Local Concern

The anticipated impacts for Alternative 3 are similar to those listed above for Alternative 2. However, because the Adventure Ridge Mountain Coaster would not be constructed under Alternative 3, potential direct impacts to occupied moonwort habitat would be limited to the installation of the Game Creek Canopy Tour. Management requirements would avoid and/or minimize impacts to *Botrychium* SOLC.

CUMULATIVE EFFECTS

For alternatives 2 and 3, there is a remote possibility of cumulative effects to the moonwort species, especially because the rarity of *Botrychium ascendens*, *B. lineare* and *B. paradoxum* make them extremely vulnerable to extirpation. Assuming presence of the above listed species; past actions likely had both positive and negative effects on *Botrychium* spp. Historic activities within the Analysis Area such as ski trail development and forest thinning that reduced forest cover while minimizing ground disturbance and sterilization likely benefitted moonworts by creating open habitats preferred by these species. However, introduction of invasive species, infrastructure development (e.g., buildings, lift tower foundations) and creation of new roads and trails may have been detrimental to moonworts by increasing competition for light, causing erosion and sedimentation, and eradicating habitat. Present and future projects would likely cause similar effects to those in the past, and the actions and effects described above can be additive. Forest Service Standards as found in the 2002 Forest Plan mandate that, "*Activities will be managed to avoid disturbance to sensitive species that would result in a trend toward federal listing or loss of viability*." Thus, from a cumulative effects perspective, none of the proposed projects are expected

to contribute to increases in any current, or predicted, downward trend in sensitive plant species population numbers, extent, or habitat across the planning unit.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Ground disturbance related to ski trail and chairlift development would represent an irretrievable effect to botanical resources within the SUP area and adjacent private lands. However, this is not considered an irreversible commitment because vegetation is a renewable resource. Should ground disturbance occur to the point where potential habitat is removed entirely, an irreversible commitment of this resource could occur. However, as stated in the analysis, Threatened and Endangered species were not identified in the areas of disturbance, and R2 Sensitive Plant Species could be avoided and impacts minimized if any were encountered.

Chapter 4
Consultation and Coordination

4. CONSULTATION AND COORDINATION

A. PREPARERS

FOREST SERVICE TEAM

The following people participated in initial scoping, were members of the Interdisciplinary Team, and/or provided direction and assistance during the preparation of this Draft EIS.

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FEDERAL GOVERNMENT

US Army Corps of Engineers

US Environmental Protection Agency

US Fish and Wildlife Service

TRIBAL GOVERNMENT

Ute Indian Tribe

Southern Ute Indian Tribe

Ute Mountain Tribe

STATE GOVERNMENT

Colorado Parks and Wildlife

LOCAL GOVERNMENT

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Avon Town Manager

Minturn Town Manager

Eagle County Government

Eagle Town Manager

Eagle County Commissioners

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Breckenridge Outdoor Education Center

Choose Outdoors

Vail Local Marketing District Advisory Council

Eagle Valley Land Trust

Vail LivingWell™ Summit and Vail LivingWell™ Experience

Outdoor Industry Association

Walking Mountains Science Center

Glenwood Caverns Adventure Park

Vail Valley Foundation

Specialty Sports Venture

Colorado “I Have a Dream” Foundation

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Chapter 5
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Chapter 6

Figures

6. FIGURES

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FIGURE 1: ALTERNATIVE 1 – NO ACTION

FIGURE 2: ALTERNATIVE 2 – PROPOSED ACTION

FIGURE 3: ALTERNATIVE 3

FIGURE 4: WATERSHED BOUNDARIES

FIGURE 5: WATERSHED RESOURCES INCLUDING SENSITIVE AREAS

White River
National Forest

Vicinity Map

Vail Mountain Recreation Enhancements Project EIS

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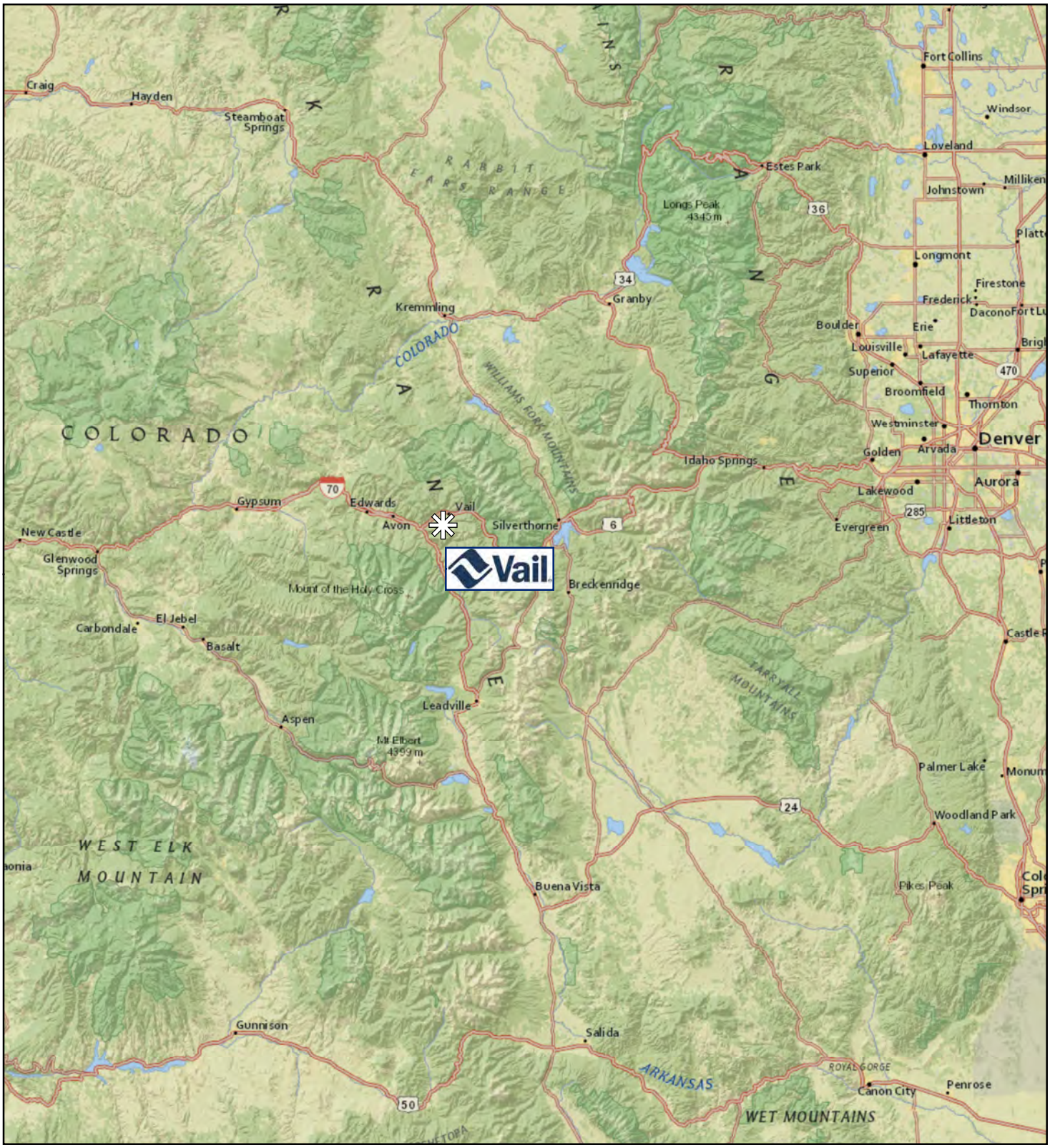

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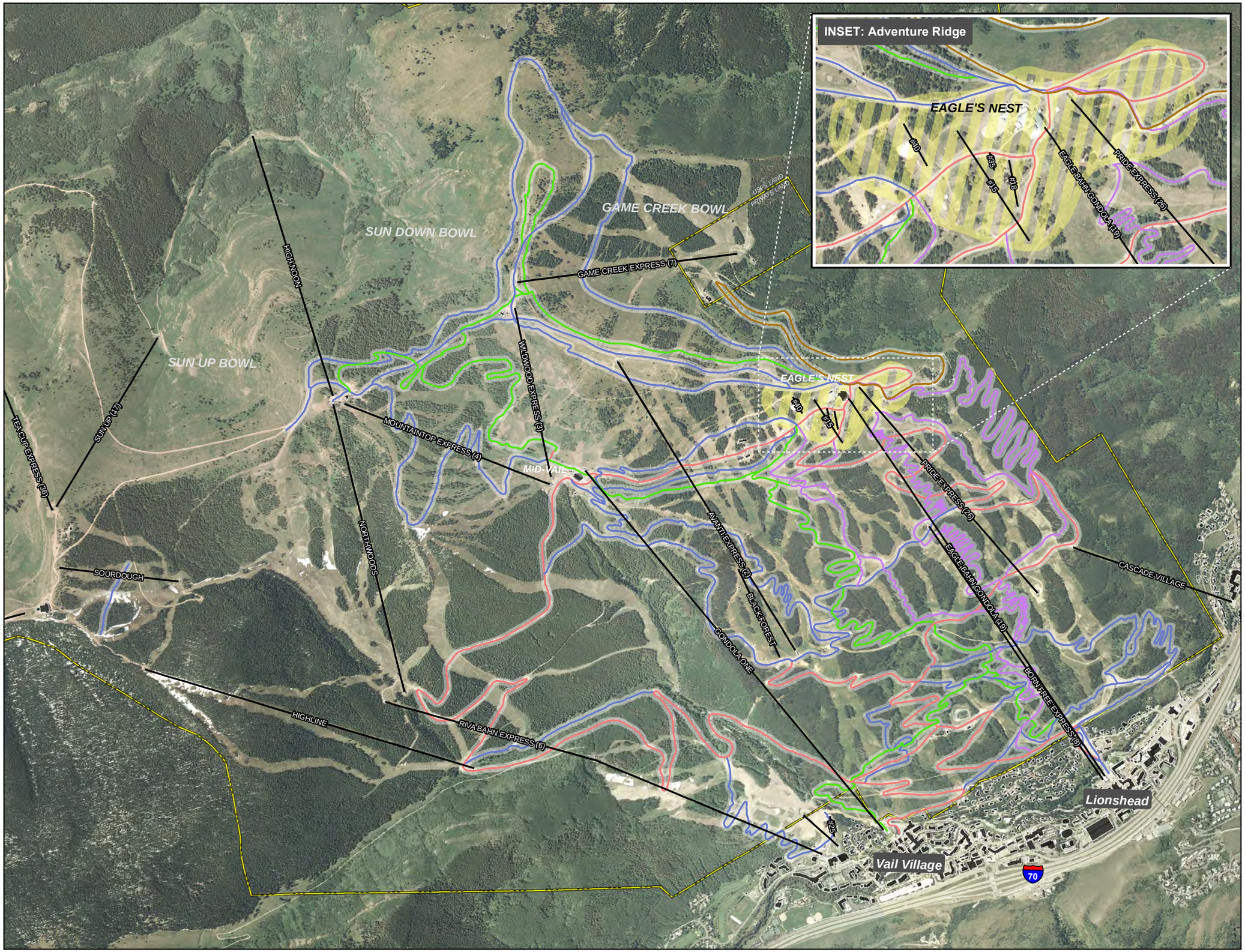

White River National Forest

Vail Mountain Recreation Enhancements Project EIS

Figure 1: Alternative 1– No Action

LEGEND

Existing Conditions

- Lifts
- SUP Boundary
- Multi-Use Trail
- Hiking Trail
- Cross Country Mountain Biking Trail
- Downhill Mountain Biking Trail
- Horse Tour Route
- Adventure Ridge Activity Area

Activities at Adventure Ridge include:
-Sightseeing
-On-mountain Dining
-Rebound Trampoline
-Eagle's Nest Wedding Deck
-Pony Rides
-Horse Tours
-Jeep Tours
-Hiking
-Mountain Biking
-Nature Center
-Zip Runner
-Challenge Courses
-Disc Golf

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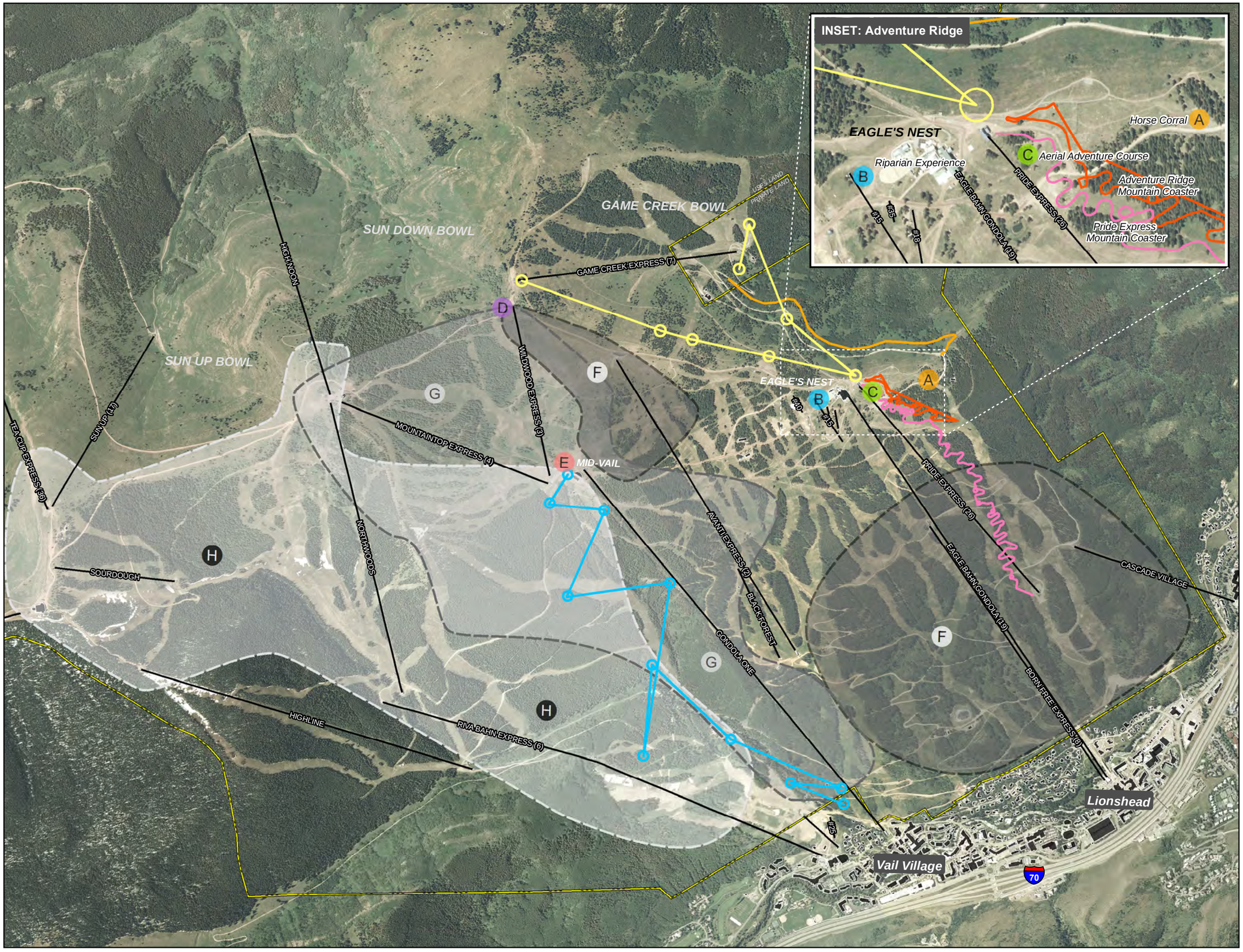

White River National Forest

Vail Mountain Recreation Enhancements Project EIS

Figure 2: Alternative 2– Proposed Action

LEGEND

Existing Conditions

- Lifts
- SUP Boundary

Proposed Projects

- Pride Express Mountain Coaster
- Adventure Ridge Mountain Coaster
- Horse Trail
- Game Creek Canopy Tour
- Front Side Canopy Tour
- A Horse Corral
- B Riparian Experience
- C Aerial Adventure Course
- D Wildwood Observation Deck
- E Wedding Venue at The 10th
- F Downhill Mountain Biking Trails
- G Hiking Trails
- H Cross Country Mountain Biking Trails

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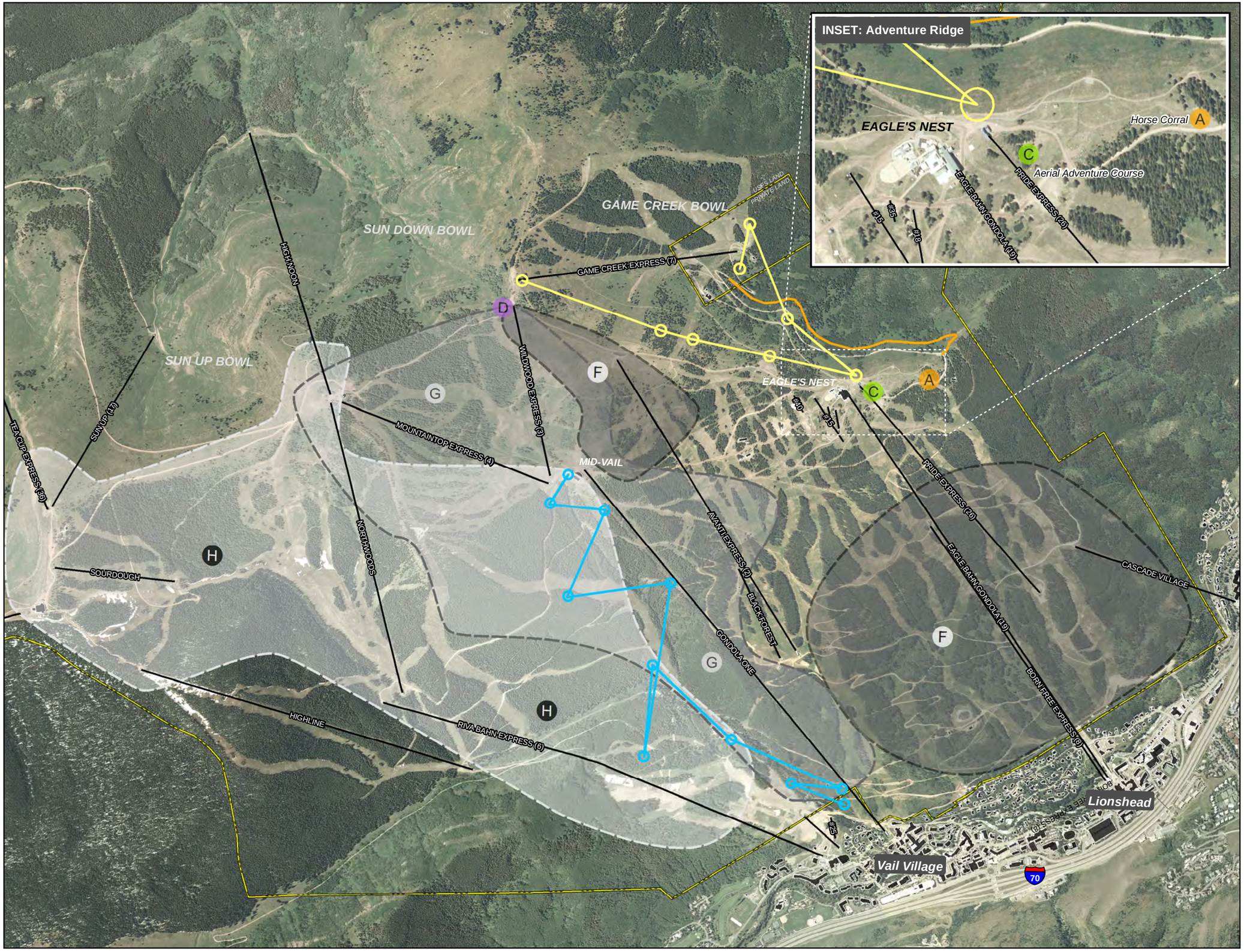
Date: March 2014



White River National Forest

Vail Mountain Recreation Enhancements Project EIS

Figure 3: Alternative 3

LEGEND

Existing Conditions

- Lifts
- SUP Boundary

Proposed Projects

- Horse Trail
- Game Creek Canopy Tour
- Front Side Canopy Tour
- A Horse Corral
- C Aerial Adventure Course
- D Wildwood Observation Deck
- F Downhill Mountain Biking Trails
- G Hiking Trails
- H Cross Country Mountain Biking Trails

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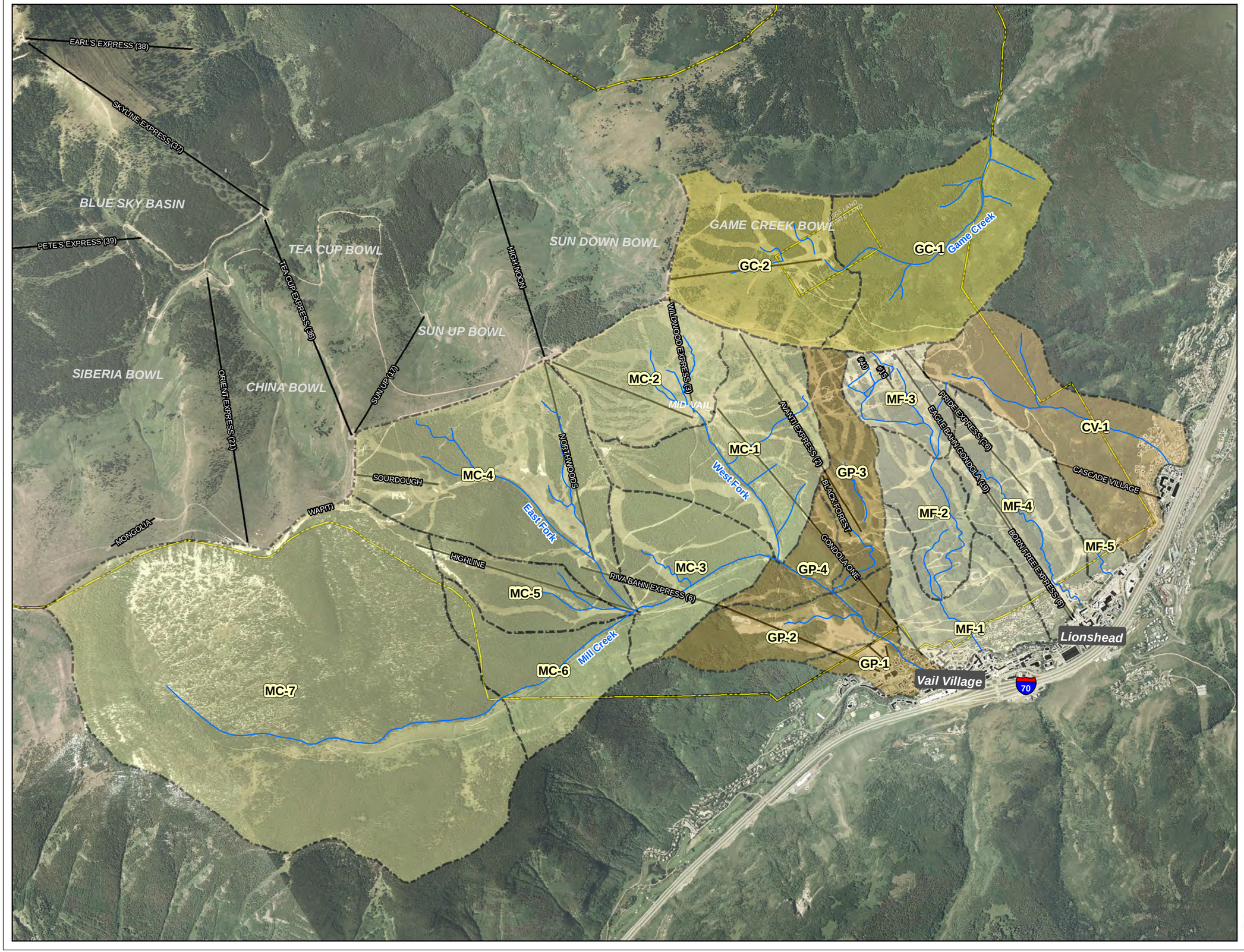

White River National Forest

Vail Mountain Recreation Enhancements Project EIS

Figure 4: Watershed Boundaries

LEGEND

Existing Conditions

- Lifts
- SUP Boundary
- Streams

Sub-Basin Watersheds

- Cascade Village
- Game Creek
- Golden Peak
- Mill Creek
- Mountain Front

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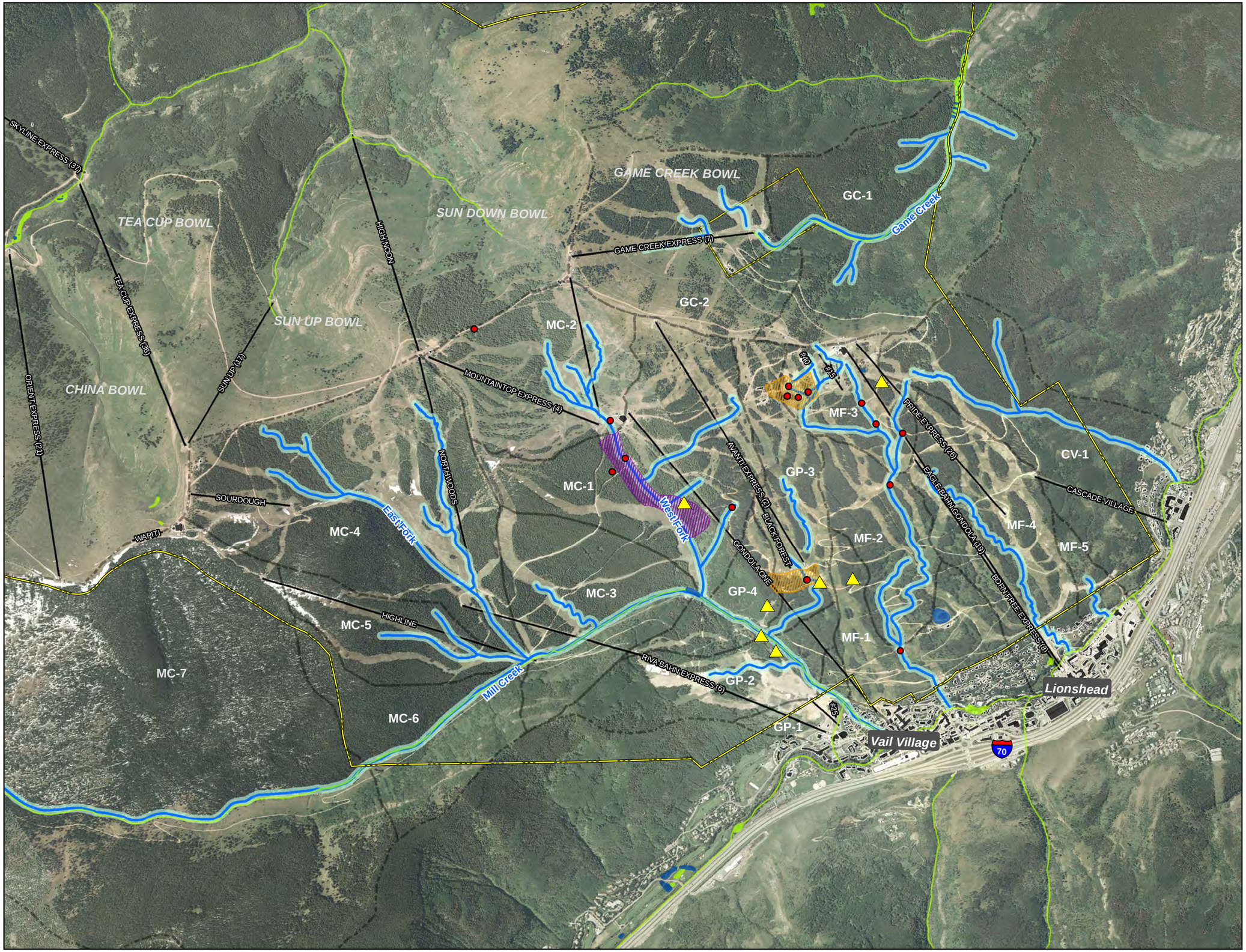
Created by: SE GROUP

Date: March 2014



White River National Forest

Vail Mountain Recreation Enhancements Project EIS

Figure 5: Watershed Resources *Including Sensitive Areas*

LEGEND

Existing Conditions

- Lifts
- SUP Boundary
- Streams
- Erosion
- Slope Failure
- Mass Wasting Area
- Tree Removal
- WIZ Zones
- Wetlands
- Ponds
- Watershed Boundary

Sub-Basin Watersheds
CV: Cascade Village
GC: Game Creek
GP: Golden Peak
MC: Mill Creek
MF: Mountain Front

0 1,000 2,000 4,000 Feet

Created by: SE GROUP

Date: March 2014

Chapter 7

Glossary

7. GLOSSARY

Ability level: The relative rank of difficulty given to a hiking or mountain biking trail. The four ability levels used in this analysis are as follows: beginner, intermediate, advanced, and expert.

Acre foot: The amount of water necessary to cover 1 acre to a depth of 1 foot; equals 43,560 cubic feet or 325,851 gallons.

Action Alternative: Any alternative that includes upgrading and/or expansion of existing recreational development within the area.

Affected environment: The physical, biological, social, and economic environment that would or may be changed by actions proposed and the relationship of people to that environment.

Alternative: One of several conceptual development plans described and evaluated in the EIS.

Analysis Area: The spatial extent of analysis for each resource. In some cases, the Analysis Area may be larger than the Project Area.

Annual Average Daily Traffic (AADT): Annual average two-way daily traffic volume represents the total traffic on a section of roadway for the year, divided by 365. It includes both weekday and weekend traffic volumes.

Army Corps of Engineers (USACE): The federal agency charged with enforcing the Clean Water Act by regulation of dredge and fill activities in waters of the United States, including wetlands.

Artifact: A simple object (such as a tool or ornament) showing early human workmanship or modifications.

Average Daily Traffic (ADT): Average daily two-way traffic volume represents the total traffic on a section of roadway for a given day or sampling period, but not necessarily for a given year. It is equivalent to Vehicle Per Day (VPD), defined below.

Background distance zone: A landscape viewing area visible to a viewer from approximately 3 to 5 miles to infinity.

Baseline condition: The existing dynamic conditions prior to development, against which potential effects are judged.

Best Management Practices (BMPs): Methods, measures, and practices specifically adopted for local conditions that minimize or avoid impacts to resources. BMPs include, but are not limited to, construction practices, structural and nonstructural controls, operations protocol, and maintenance procedures.

Biodiversity: The variety of biotic communities, species, and genes and their interaction with ecological processes and functions, within ecosystems and across landscapes. The number of species present is the basic unit of measurement. More complex measurements also exist.

Biological Evaluation: An evaluation conducted to determine whether a proposed action is likely to affect any species which are listed as sensitive (USFS), candidate (USFS), or other special designations.

Candidate species: Those plant and animal species that, in the opinion of the U.S. Fish and Wildlife Service, may become threatened or endangered. Not protected under the Endangered Species Act.

Canopy: The more-or-less continuous cover of leaves, needles and/or branches collectively formed by the crowns of adjacent trees in a stand or forest.

Colorado Department of Public Health and Environment (CDPHE): The State of Colorado Department responsible for overseeing water quality regulation within Colorado.

Clean Water Act: An act that was enacted by the U.S. Congress in 1977 to maintain and restore the chemical, physical, and biological integrity of the waters of the United States. This act was formerly known as the Federal Water Pollution Control Act (33 U.S.C. 1344).

Corridor: A linear strip of land identified for the present or future location of transportation or utility rights-of-way within its boundaries. Also, a contiguous strip of habitat suitable to facilitate animal dispersal or migration.

Council on Environmental Quality (CEQ): An advisory council to the President established by the National Environmental Policy Act of 1969. It reviews federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

Cover: Vegetation used by wildlife for protection from predators and weather conditions, or in which to reproduce.

Cover density: Forest cover density is an index which theoretically ranges from zero to less than one. It references the capability of the stand or cover to integrate and utilize the energy input to transpire water. Cover density represents the efficiency of the three-dimensional canopy system to respond to the energy input. It varies according to crown closure, vertical foliage distribution, species, season, and stocking.

Critical habitat: A formal designation pursuant to the Endangered Species Act which may be applied to a particular habitat that is essential to the life cycle of a given species, and if lost, would adversely affect that species. Critical habitat can have a less formal meaning when used outside the context of the Endangered Species Act.

Cubic feet per second (cfs): Unit measure of streamflow or discharge, equivalent to 449 gallons per minute or about 2 acre feet per day.

Cultural resource: Cultural resources are the tangible and intangible aspects of cultural systems, living and dead, that are valued by a given culture or contain information about the culture. Cultural resources include, but are not limited to sites, structures, buildings, districts, and objects associated with or representative of people, cultures, and human activities and events.

Cumulative impact: The impact on the environment which results from the incremental impact of the action when added to other past, present and reasonable foreseeable future actions regardless of what agency or person undertakes such other actions. Each increment from each project may not be noticeable but cumulative impacts may be noticeable when all increments are considered together.

Destination visitor: A visitor that stays overnight within the resort community (as opposed to a "Day-Skier").

Developed recreation site: An area with characteristics that enable to accommodate, or be used for intense recreation. Such sites are often enhanced to augment the recreational value. Improvements range from those designed to provide great comfort and convenience to the user to rudimentary improvements in isolated areas.

Developed terrain network: Consists of its named, defined, lift-served, maintained (groomed) runs. These trails represent the baseline of the terrain at any resort, as they are where the majority of guests ski, and are usually the only place to ski during the early season, periods of poor or undesirable snow conditions, avalanche closures, and certain weather conditions.

Direct impact: An effect which occurs as a result of an action associated with implementing the proposal or one of the alternatives, including construction, operation, and maintenance.

Dispersed recreation: Recreation that occurs outside of a developed recreation site and includes such activities as scenic driving, hunting, backpacking, and recreation activities in primitive environments.

Distance zone: One of three categories used in the visual management system to divide a view into near and far components. The three categories are (1) foreground, (2) middleground, and (3) background. See individual entries.

District Ranger: The official responsible for administering the National Forest System lands on a Ranger District.

Diversity: The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan.

Ecosystem: The system formed by the interaction of a group of organisms and their environment, for example, marsh, watershed, or lake.

Effects: Results expected to be achieved from implementation of the alternatives relative to physical, biological, economic, and social factors. Effects can be direct, indirect, or cumulative and may be either beneficial or detrimental.

Endangered species: An official designation for any species of plant or animal that is in danger of extinction throughout all or a significant portion of its range. An endangered species must be designated in the Federal Register by the appropriate Federal Agency Secretary.

Environmental Assessment (EA): A concise public document required by the regulations implementing the National Environmental Policy Act which briefly provides sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact.

Environmental Impact Statement (EIS): A disclosure document required by the National Environmental Policy Act (NEPA) that documents the anticipated environmental effects of a proposed action that may significantly affect the quality of the human environment.

Environmental Protection Agency (EPA): The federal agency charged with lead enforcement of multiple environmental laws, including review of Environmental Impact Statements.

Erosion: The detachment and movement of soil from the land surface by wind, water, ice, or gravity.

Erosion control: Materials, structure, and techniques designed to reduce erosion. Erosion control may include rapid revegetation, avoiding steep or highly erosive sites, and installation of cross-slope drainage structures.

Erosion hazard: Soil ratings to predict the erosion hazard or potential to be eroded.

Forage: All browse and non-woody plants used for grazing or harvested for feeding livestock or game animals.

Forb: Any non-grass-like plant having little or no woody material on it. A palatable, broadleaved, flowering herb whose stem, above ground, does not become woody and persistent.

Foreground distance zone: The landscape area visible to an observer from the immediate area to 0.5 mile.

Forest Supervisor: The official responsible for administering the National Forest System lands in a Forest Service administrative unit who reports to the Regional Forester.

Forest Plan: A comprehensive management plan prepared under the National Forest Management Act of 1976 that provides standards and guidelines for management activities specific to each National Forest. The WRNF Forest Plan was approved in 2002.

Full-Time Equivalent (FTEs): Sufficient work to keep one person employed full-time for one year. In seasonal industries one FTE may be represented by several employment positions.

GIS: Geographic Information System, a computer mapping system composed of hardware and software.

Glades: Trees stands that are naturally thin, or have been thinned specifically in varying degrees to improve the skiing experience by increasing the spacing between individual trees. Stands with tree clearing to the extent that they can be groomed are described as "Groomable Glades."

GPS: Global Positioning System, a satellite-based surveying system.

Gradient: The vertical distance divided by the horizontal distance, usually measured as percent. Gradient is used to describe streams and ski slopes.

Grading: The practice of moving or re-contouring earthen materials to achieve a specified slope in the landform.

Groundwater: Subsurface water in the part of the ground that is wholly saturated.

Guest Services Facilities or Guest Services: Facilities or services that are supplied by a resort – both on-mountain and at the base area – to accommodate guests' needs and to enhance the quality of the recreational experience. Examples of guest services facilities include: restaurants, general information desks, resort lost and found departments, restrooms and lounges, first aid clinics, etc.

Guests At One Time (GAOT): A model developed to approximate distribution of guests across a range of recreation activities at any given moment in time. For the purposes of this analysis, GAOT only applies to summer activities at Vail Ski Area.

Guideline: A preferred course of action designed by policy to achieve a goal, respond to variable site conditions, or respond to an overall condition.

Habitat: The sum of environmental conditions of a specific place that is occupied by an organism, a population, or a community.

Habitat type: A classification of the vegetation resource based on dominant growth forms. The forested areas are more specifically classified by the dominant tree species.

Hydric soils: Soils characterized by, or requiring an abundance of moisture, used in the identification of wetlands.

Impacts: See effects.

Indicator species: An animal species used to represent a group of species that utilize the same habitat. For monitoring purposes, the well-being of the indicator species is assumed to reflect the general health of the community.

Indirect impact: Secondary consequences to the environment resulting from a direct impact. An example of an indirect impact is the deposition of sediment in a wetland resulting from surface disturbance in the upland.

Instream flow: The volume of surface water in a stream system passing a given point at a given time.

Interdisciplinary Team (ID Team): A group of individuals each representing specialty resource areas assembled to solve a problem or perform a task through frequent interaction so that different disciplines can combine to provide new solutions.

K-factor: A measure of soil erodibility based on soil texture, organic matter, structure and runoff potential.

Management Area 8.25: According to the 2002 Forest Plan, is administered for "winter sports activities and other intensively managed outdoor recreation opportunities for large numbers of national and international visitors in highly developed settings."

Management direction: A statement of multiple-use and other goals and objectives, the associated management prescriptions, and standards and guidelines for attaining them.

Management emphasis: Long-term management direction for a specific area or type of land.

Management Indicator Species (MIS): A representative group of species that are dependant of a specific habitat type. The health of an indicator species is used to gauge function of the habitat on which it depends.

Management practice: A specific activity, measure, course of action, or treatment.

Master Development Plan (MDP): A document that is required as a condition of the ski area term special use permit, designed to guide resort planning and development in the long- and short-term – typically across both public and private lands.

Middleground distance zone: The landscape area visible to a viewer from 0.5 mile to about 3 to 5 miles.

Mitigation: Actions taken to avoid, minimize, or compensate for adverse environmental impacts.

National Environmental Policy Act (NEPA): A law enacted by Congress in 1969 that requires federal agencies to analyze the environmental effects of all major federal activities that may have a significant impact on the quality of the human environment.

National Forest Management Act (NFMA): A law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act that requires the preparation of regulations to guide that development.

National Forest System (NFS) lands: National Forests, National Grasslands, and other related lands for which the Forest Service is assigned administrative responsibility.

National Historic Preservation Act (NHPA): An act that was enacted by the U.S. Congress in 1966 to protect historic sites and artifacts (16 U.S.C. 470). Section 106 of the Act requires consultation with members and representatives of Indian tribes.

National Register of Historic Places: A listing maintained by the National Park Service of areas which have been designated as historically significant. The register includes places of local and state significance, as well as those of value to the nation in general.

No action alternative: The management direction, activities, outputs, and effects that are likely to exist in the future if the current trends and management would continue unchanged. Under NEPA, it means following the current approved Forest Plan management direction and guidance.

Objective: A concise, time-specific statement of measurable planned results that respond to pre-established goals. An objective forms the basis for further planning to define the precise steps to be taken and the resources to be used in achieving identified goals.

Project Area: The area in which proposed projects are located throughout Vail Ski Area's SUP.

Project Design Feature (PDF): Specific measures designed to minimize or avoid impacts anticipated to occur as a result of implementation of the action alternatives. PDF are incorporated within the proposal of specified action alternatives.

Record of Decision (ROD): A document prepared within 30 days after the final EIS is issued which states the agency's decision and why one alternative was favored over another, what factors entered into the agency's decision, and whether all practicable means to avoid or minimize environmental harm have been adopted, and if not, why not.

Revegetation: The re-establishment and development of self-sustaining plant cover. On disturbed sites, this normally requires human assistance such as seedbed preparation, reseeding, and mulching.

Revegetation potential: The ability or capacity of a site to be revegetated after a disturbance, which often depends on the quantity and quality of topsoil remaining in place.

Rilling: Erosion by concentrated overland flow.

Riparian habitat or area: Land situated along the bank of a stream or other body of water and directly influenced by the presence of water (e.g., streamsides, lake shores, etc.).

Scenic integrity: State of naturalness or, conversely, the state of disturbance created by human activities or alteration. Integrity is stated in degrees of deviation for the existing landscape character in a national forest.

Scenic Integrity Objectives (SIOs): The objectives that define the minimum level to which landscapes are to be managed from an aesthetics standpoint. There are five objectives that describe the landscape in varying degrees from naturalness: Very High (Unaltered), High (Appears Unaltered), Moderate (Slightly Altered), Low (Moderately Altered), Very Low (Heavily Altered).

Scenery management: The art and science of arranging, planning and designing landscape attributes relative to the appearance of places and expanses in outdoor settings.

Scoping process: A process that determines the issues, concerns, and opportunities which should be considered in analyzing the impacts of a proposal by receiving input from the public and affected agencies. The depths of analysis for these issues identified are determined during scoping.

Sediment: Solid material, both organic and mineral, that has been transported from its site of origin by air, water, or ice.

Sensitive species: Species which have appeared in the Federal Register as proposed additions to the endangered or threatened species list; those which are on an official State list or are recognized by the Regional Forester to need special management in order to prevent them from becoming endangered or threatened.

Short-term: In this analysis, short-term describes the period from construction up to five years after project completion.

Significant impact: A somewhat subjective judgement based on the context and intensity of the impact. Generally, a significant impact is one that exceeds a standard, guideline, law, or regulation.

Ski Area Recreational Opportunity Enhancement Act (SAROEA): A 2011 Act amending the National Forest Ski Area Permit Act of 1986 to clarify the authority of the Secretary of Agriculture regarding additional recreational uses of NFS land subject to ski area permits, and for other purposes. Among its provisions, SAROEA expands the authority of the Secretary to authorize other seasonal or year-round natural resource-based recreational activities and associated facilities on National Forest System land subject to a ski area permit as the Secretary determines to be appropriate.

Soil: A dynamic natural body on the surface of the Earth in which plants grow, composed of mineral and organic materials and living forms.

Soil productivity: The capacity of a soil for producing plant biomass under a specific system of management. It is expressed in terms of volume or weight/unit area/year.

Special Use Permit (SUP): A legal document, similar to a lease, issued by the U.S. Forest Service. These permits are issued to private individuals or corporations to conduct commercial operations on National Forest System lands. They specify the terms and conditions under which the permitted activity may be conducted.

Special Use Permit (SUP) area: Area of National Forest System lands encompassed within the SUP.

Stand: A community of trees or other vegetation, which is sufficiently uniform in composition, constitution, age, spatial arrangement, or condition to be distinguishable from adjacent communities and to thus, form a management entity.

Standard: A course of action which must be followed; adherence is mandatory.

Threatened species: Any species which is likely to become an endangered species within the foreseeable future and which has been designated in the Federal Register as a threatened species.

Understory: Low-growing vegetation (herbaceous, brush or reproduction) growing under a stand of trees. Also, that portion of trees in a forest stand below the overstory.

U.S. Fish and Wildlife Service (USFWS): The agency of the Department of the Interior responsible for managing wildlife, including non-ocean going species protected by the Endangered Species Act.

Vehicles Per Day (VPD): The total two-way daily traffic volume on a section of roadway.

Vehicle trips: The number of times vehicles use a segment of road.

Visual resource: The composite of basic terrain, geologic features, water features, vegetative patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for visitors.

Water rights: The legal right to use water.

Watershed: The entire area that contributes water to a drainage system or stream.

Watershed Conservation Practices Handbook (WCPH): A Forest Service Region 2 manual suggesting design criteria and guidelines for watershed projects.

Wilderness: Under the 1964 Wilderness Act, wilderness is undeveloped federal land retaining its primeval character and influence without permanent improvements of human habitation. It is protected and managed so to preserve its natural conditions.

Water Influence Zone (WIZ): The land next to water bodies where vegetation plays a major role in sustaining long-term integrity of aquatic systems. It includes the geomorphic floodplain (valley bottom), riparian ecosystem, and inner gorge. Its minimum horizontal width (from top of each bank) is 100 feet or the mean height of mature dominant late-seral vegetation, whichever is most.

Chapter 8

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Appendices

APPENDIX A: CUMULATIVE EFFECTS PROJECTS

The physical, biological, recreational and socio-economic character of the Eagle Valley has been shaped by over five decades of development on both NFS and private lands. This has culminated in the developed, four-season recreational experience that exists today within the Vail Ski Area SUP area and on adjacent private lands. Furthermore, the opening of the Eisenhower Tunnel in 1973 greatly improved access to mountain towns and national forests (including ski areas) in Summit and Eagle counties from the expanding Front Range communities.

Notable developments and activities that have occurred over five decades within the Vail Ski Area SUP area and in the Eagle Valley include (but are not limited to):

1960s

- 1962: Vail Ski Area opens to the public with two chairlifts and one gondola
- 1966: Town of Vail is established
- 1967: Golden Peak opens
- 1968: first snowmaking system is installed
- 1969: Lionshead base area and Lionshead Gondola open; Game Creek Bowl opens

1970s

- 1973: Free bus system is established

1980s

- 1985: Vail Ski Area prepares its Master Development Plan
- 1985: Vista Bahn chairlift and four other high-speed quad chairlifts are installed
- 1985 (circa): first summer trails are constructed on Vail Mountain
- 1988: China Bowl opens
- 1989: World Alpine Ski Championship held at Vail Ski Area

1990s

- 1996: Adventure Ridge opens with night skiing on Chair 15, snowtubing, ice skating, a half-pipe, ski bikes, and snowshoeing
- 1997: The Eagle Bahn Gondola is installed, replacing the original Lionshead Gondola
- 1999: World Alpine Ski Championship held at Vail Ski Area and Beaver Creek Ski Area
- 1999: Work begins on Category III, the third phase of Vail Ski Area's 1985 Master Development Plan

2000s

- 2000/01: Blue Sky Basin opens, including three high-speed quads and 525 acres of terrain
- 2010: Chair 5 (High Noon) is upgraded to a high-speed detachable quad; The 10th opens at Mid-Vail
- 2012: Gondola One replaces the Vista Bahn chairlift
- 2013: Additional non-skiing activities added at Adventure Ridge include two aerial challenge courses and a 4-line zipline

Average annual visitation has exceeded 1.5 million skiers since 1997. Dating back to the original development of chairlifts and trails within the SUP area, development of Vail Ski Area for lift-served skiing has involved clearing of trails, grading, chairlifts construction, roads, and buildings. Today, Vail Ski Area offers 193 trails and 5,289 skiable acres, served by 31 chairlifts. Of that, 647 acres include snowmaking. The on-mountain seating capacity is 20,044 (indoor + outdoor) and 13,380 (indoor only). Approximately 3,899 parking spaces are located primarily in the Lionshead and Village parking structures.

Adventure Ridge, which was brought on-line in 1996, has become the focal point for Vail Ski Area's summer and multi-season activities within its SUP area. Between 2008 and 2013, summer visitation at Vail Ski Area (Adventure Ridge) has averaged 97,500 guests. It now includes numerous activities that are designed to engage Vail Ski Area's guests throughout the year, including:

- Sightseeing
- Zip Line
- Challenge Courses
- Pony Rides
- Horse Tours
- Hiking
- Mountain Biking
- Jeep Tours
- Nature Center
- Rebound Trampoline
- Disc Golf
- On-Mountain Dining
- Eagle's Nest Wedding Deck

A miniature golf course is located on private lands at the base of the Eagle Bahn Gondola. Also, in 2012, a climbing wall and summer tubing were approved at Eagles Nest; however, until additional Forest Service policy is issued which would allow these activities to be constructed and operated on NFS lands, they cannot be installed.

A. DEVELOPMENT WITHIN THE EAGLE VALLEY AND CAMP HALE LYNX ANALYSIS UNITS

The Eagle Valley and Camp Hale Lynx Analysis Units (LAUs) are located in Eagle County. Growth and populations trends in Eagle County for the last five years have steadily increased from 48,214 to 51,776

individuals between 2006 and 2011.[1] Population for Eagle County is projected to increase significantly over the next 20 years to 92,430 by 2035.[2] Much of this growth is expected to occur within private land surrounding towns along the I-70 corridor such as Vail, Avon, Minturn, Edwards, Eagle, and Eagle-Vail. This growth will cause an increase in traffic along I-70, Highway 91, and Highway 24. It may be assumed that this increase in traffic may inhibit connectivity between quality habitats for Canada lynx, specifically because lynx have limited and specific travel corridors that are safe and undisturbed.

Major developments within the Eagle Valley LAU include the following: Town of Vail, Town of Avon, unincorporated towns of Eagle-Vail and Edwards, north half of Vail Ski Area, Beaver Creek Ski Area, and the I-70 Mountain Corridor. The 2011 I-70 Mountain Corridor Programmatic Environmental Impact Statement examines the potential impacts of expanding and modifying the I-70 Corridor. These modifications may include additional lanes, light rail systems, interchange modification ortunnels that would increase traffic and number of recreationists within the area.

Major developments within the Camp Hale LAU include the following: south half of Vail Ski Area, Town of Red Cliff, residential area of Tennessee Pass, Ski Cooper Ski Area, and the Climax mine. The Climax mine, mined for molybdenum, was shut down in 1995, but reopened operations in May 2012. Activities at Climax mine could deter lynx from moving through the area, filtering them into Vail Pass Winter Recreation Area (VPWRA) or towards the Tenmile Range.

[1] Colorado Department of Local Affairs: State Demography Office. https://dola.colorado.gov/ddb/dashboard.jsf?county=37
[2] Ibid.

Table A-1:
Cumulative Effects Matrix

Project	Project Location (Straight Line Distance to Vail Ski Area SUP)	Project Description	Project Approval/ Implementation	Project Area (acres/length)	Lynx Analysis Unit where the Project is Located	Resources Potentially Affected
VAIL SKI AREA PROJECTS						
2013 Vail Summer Improvements DM	Within SUP area	Analyzed upgrading the Gopher Hill and Mountain Top Express at Vail Ski Area to increase uphill capacity.	DM signed 2013, implementation ongoing	Approximately 30 acres		Recreation Scenery Soils Vegetation Watershed Wildlife
2012 Vail Summer Improvements DM	Within SUP area	Analyzed relocation of the half-pipe platform and addition of summer tubing, aerial challenge courses, a 4-line zipline, a zip adventure course, and climbing wall and freestanding climbing features at Adventure Ridge.	DM signed 2012, implementation ongoing	Approximately 25 acres		Recreation Scenery Soils Vegetation Watershed
2011 Vail Ski Area Forest Health Project EA	Within SUP area	Analyzed vegetation treatments in response to the Mountain Pine Beetle epidemic, including insecticide, hazard tree removal, clearcut, small clearcuts within a thinning and partial cut to reduce risk to the public.	DN signed 2011, implementation ongoing	984 acres		Recreation Scenery Soils Vegetation Watershed Wildlife

Table A-1:
Cumulative Effects Matrix

Project	Project Location (Straight Line Distance to Vail Ski Area SUP)	Project Description	Project Approval/ Implementation	Project Area (acres/length)	Lynx Analysis Unit where the Project is Located	Resources Potentially Affected
2010 Vail Mountain Summer Improvements DM	Within SUP area	Analyzed replacing the existing tubing hill surface lift with an elevated, covered, carpet lift as well as regrading the existing tubing hill slope. Also added a downhill bike trail between Simba and the Eagle Bahn Gondola and a hiking trail from Eagle's Nest to Mid-Vail.	DM signed 2010, fully implemented	4 acres		Recreation Scenery Soils Vegetation Wildlife
2009 Golden Peak Snowmaking and Race Course Improvements DM	Within SUP area (Golden Peak)	Analyzed upgrading the existing snowmaking system on *Golden Peak Race Trail* and half-pipe to an automated system to facilitate early season race training and half-pipe construction.	DM 2009, fully implemented	Approximately 130 acres		Recreation Scenery Soils Vegetation Watershed Wildlife
2009 Vail Beetle Tree Salvage Project DM	Within SUP area	Approved removal of dead and dying lodgepole infested with the mountain pine beetle on approximately 26 acres of National Forest System Land distributed throughout Vail Ski Area's SUP area.	DM 2009, implementation ongoing	26 acres		Scenery Soils Vegetation Watershed Wildlife
2009 Vail Ski Area Improvements Project Final EIS	Within SUP area (front side of Vail Mountain and Sundown/Sun Up bowls)	Analyzed projects identified in 2007 MDP, including: upgrading High Noon, new Sun Down Bowl; improvements to the Snow Summit Cat Garage; a new Mid-Vail restaurant (The 10th); and additional snowmaking on the front side Vail Mountain	ROD 2009, implementation ongoing	12,590 acres (specifically, Vail Mountain, Golden Peak, Sun Up/Sun Down Bowls)		Recreation Scenery Soils Vegetation Watershed Wildlife

Table A-1:
Cumulative Effects Matrix

Project	Project Location (Straight Line Distance to Vail Ski Area SUP)	Project Description	Project Approval/ Implementation	Project Area (acres/length)	Lynx Analysis Unit where the Project is Located	Resources Potentially Affected
2007 Vail Resort Master Development Plan Update	Extent of SUP area	Supplemented Vail Ski Area's 1985 Master Development Plan and the subsequent 1986 DN/FONSI that approved it, as well as the 1996 Vail Category III Final Environmental EIS and ROD. Planned projects included: chairlift installation/upgrades; new trails, chairlifts and snowmaking on Golden Peak; terrain improvements across the SUP area; guest service improvements; and improvements to maintenance, utilities operations and snowmaking. The MDP also addresses alternative experiences and summer trails at Adventure Ridge.	Various projects accepted, approval dependent upon analysis, implementation ongoing	12,590 acres (Acreage of SUP)		Recreation Scenery Soils Vegetation Watershed Wildlife
2006 Vail Ski Area West Lionshead Lift EA	Within SUP area	Analyzed the installation of the West Lionshead chairlift, originating in West Vail and terminating above Pride Express.	DN 2006, pending implementation	3.5 acres of vegetation removal on NFS land and 0.5 acre on private land in West Vail		Recreation Scenery Soils Vegetation Watershed

Table A-1:
Cumulative Effects Matrix

Project	Project Location (Straight Line Distance to Vail Ski Area SUP)	Project Description	Project Approval/ Implementation	Project Area (acres/length)	Lynx Analysis Unit where the Project is Located	Resources Potentially Affected
2006 Golden Peak Terrain Modification DM	Within SUP area (Golden Peak)	Analyzed grading related to construction of a proposed half-pipe on Golden Peak.	DM 2006, fully implemented	130 acres (Approximate acreage of Golden Peak)		Recreation Scenery Soils Vegetation Watershed Wildlife
2005 Vail Chair 10 & 14 EA	Within SUP area	Analyzed replacement of the Highline and Sourdough chairlifts.	DN 2005, implemented in 2010	Approximately 30 acres		Recreation Scenery Soils Vegetation Watershed Wildlife

Table A-1:
Cumulative Effects Matrix

Project	Project Location (Straight Line Distance to Vail Ski Area SUP)	Project Description	Project Approval/ Implementation	Project Area (acres/length)	Lynx Analysis Unit where the Project is Located	Resources Potentially Affected
1996 Vail Category III Ski Area Development EIS	Within SUP area	Analyzed chairlifts, trails, guest service facilities, food service (indoor and outdoor), restrooms, ski patrol, and utilities in the Category III portion of the SUP area.	ROD 1996, Many approved upgrades implemented, including four proposed chairlifts, 645 acres of developed terrain (out of a total of 800 approved), utility installation, food services (Belle's Camp warming hut and The Dog House), and patrol facilities.	Category III portion of SUP area		Recreation Scenery Soils Vegetation Watershed Wildlife
1996 Adventure Ridge Redevelopment DM	Within SUP area	Analyzed activities and facilities in the Eagle's Nest vicinity including; a snowboard park and half-pipe, tubing park and chairlift, ice skating rink, night lighting around Eagle's Nest and the Chair 15 pod and snowmobile tours.	DM 1996, implemented	Approximately 30 acres		Recreation Scenery Wildlife

Table A-1:
Cumulative Effects Matrix

Project	Project Location (Straight Line Distance to Vail Ski Area SUP)	Project Description	Project Approval/ Implementation	Project Area (acres/length)	Lynx Analysis Unit where the Project is Located	Resources Potentially Affected
EAGLE VALLEY REGIONAL PROJECTS						
2011White River National Forest Travel Management Plan	Forest-wide	Analyzes transportation needs of the public and the need to provide adequate access for forest and resource management, while still allowing for protection of natural resources.	ROD signed 2011, implementation ongoing	2,482,000 acres within the WRNF		Recreation Wildlife
2011 CDOT Final Programmatic EIS	Adjacent to SUP area	Improvements including non-infrastructure related components, advance guideway system and highway improvements needed along the I-70 Mountain Corridor, from Glenwood Springs to Denver metropolitan area.	ROD signed 2011, implementation ongoing	150 miles		Air Quality Traffic/Parking Recreation Watershed Wildlife
2011 Beaver Creek Mountain Improvements Project Final EIS	5 miles west of Vail Ski Area SUP area	Analyzed key components of Beaver Creek's 2010 MDP related to hosting the 2015 World Alpine Ski Championships. Included construction of new race courses, and improvements to Red Tail Camp for the racecourse finish area.	ROD signed 2012, implementation ongoing	Beaver Creek SUP area (3,849 acres)		Recreation Scenery Soils Vegetation Watershed Wildlife

Table A-1:
Cumulative Effects Matrix

Project	Project Location (Straight Line Distance to Vail Ski Area SUP)	Project Description	Project Approval/ Implementation	Project Area (acres/length)	Lynx Analysis Unit where the Project is Located	Resources Potentially Affected
2009 Forest-Wide Hazard Tree Removal and Fuels Reduction	Forest-wide	Proposal to remove or fell hazardous trees in compliance with the Healthy Forest Restoration Act of 2003 (HFRA).	2009, implementation ongoing	Portions of WRNF lands in Eagle, Garfield, Pitkin, and Summit, for a total acreage of 1.2 million acres.		Scenery Soils Vegetation Watershed Wildlife
2009 Amended Eagle County Local Resident Housing Guidelines	County-wide	Promote sustainable communities in Eagle Country through the creation of affordable and permanent-resident housing units with guidelines, such as a base rate for Local Resident Housing at 35% of total square footage of a project.	2009, implementation ongoing	Eagle County		Socioeconomic
2009 Vail Transportation Master Plan Update	Town of Vail	Objectives include establishing Frontage Road improvement plan, developing transportation demand management measures for peak traffic, developing Frontage Road Access Management Plan, and identifying a strategy towards a Town parking plan.	2009, implementation ongoing	Town of Vail		Traffic/Parking

Table A-1:
Cumulative Effects Matrix

Project	Project Location (Straight Line Distance to Vail Ski Area SUP)	Project Description	Project Approval/ Implementation	Project Area (acres/length)	Lynx Analysis Unit where the Project is Located	Resources Potentially Affected
2009 Holy Cross Grazing Allotment EA	County-wide	Adaptive Grazing Livestock Management including design criteria, mountain plans, and adaptive management options. North side of Vail Mountain eliminated from Meadow-Vail allotment.	DN signed 2009, implementation ongoing	185,764 acres		Recreation Scenery Soils Vegetation Watershed Wildlife
2006 Vail Valley Forest Health Project EIS	Eagle Valley along the I-70 corridor between Vail Pass and Avon	Emphasized vegetation management actions, including green tree removal, sanitation and salvage, felling in place, pile and broadcast burning, pruning, and chipping, that would improve forest health and reduce the accumulation of fuels near communities in the Eagle Valley.	ROD 2006, implementation ongoing	72,405 acres (including 57,598 on NFS, 13,726 on private, and 1,081 on state)		Scenery Soils Vegetation Watershed Wildlife
Zip Adventures of Vail	15 miles west of Town of Vail on I-70	Private recreational facility offering six zip lines varying in length from 200 to 1,000 feet. Operates April through December.	2005	N/A		Recreation Socioeconomic
2002 White River National Forest Resource Management Plan Revision	Forest-wide	Provides guidance for all resource management activities on a National Forest including forest-wide multiple-use goals and objectives, forest-wide standards and guidelines, and monitoring and evaluation requirements.	2002, implementation ongoing	2,285,970 acres		Recreation Scenery Soils Vegetation Watershed Wildlife

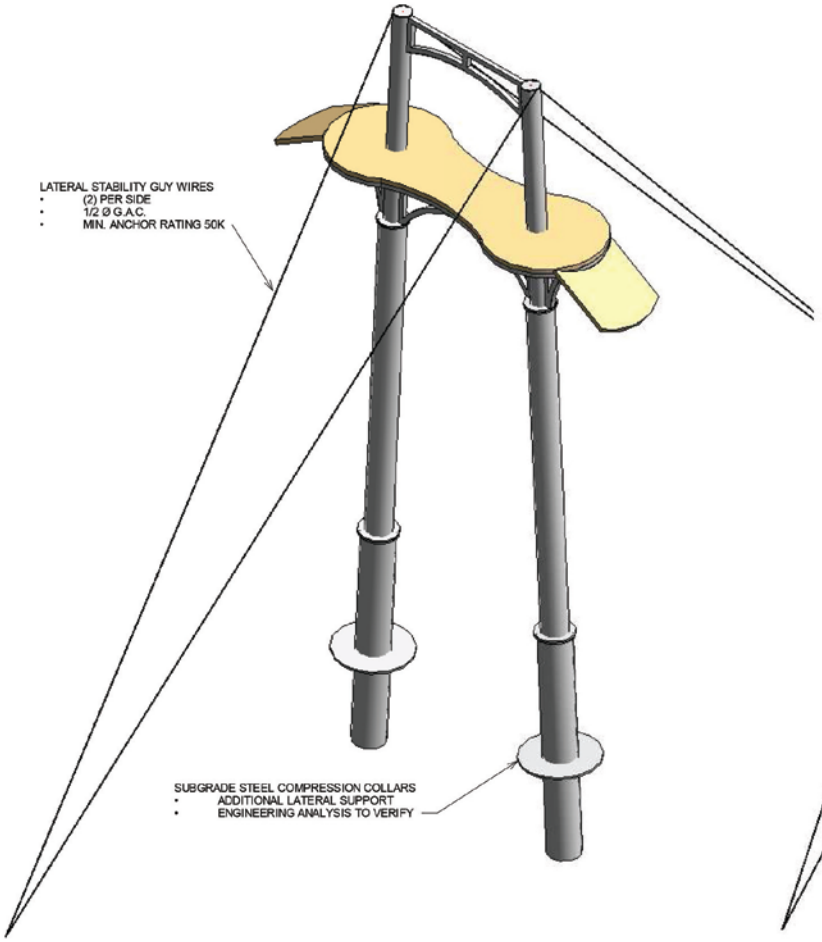
Table A-1:
Cumulative Effects Matrix

Project	Project Location (Straight Line Distance to Vail Ski Area SUP)	Project Description	Project Approval/ Implementation	Project Area (acres/length)	Lynx Analysis Unit where the Project is Located	Resources Potentially Affected
Glenwood Caverns Adventure Park	60 miles west of the Town of Vail in Glenwood Springs	Private recreational facility, open year-round. Offers the following attractions: • cave tours • an alpine coaster • a roller coaster • a family roller coaster • a giant swing • a zip ride • a 4D movie theatre • laser tag • gemstone panning • a climbing wall • a giant maze • a Ferris wheel • other kids' attractions	1999	N/A		Recreation Socioeconomic
Wolcott Planned Community	20 miles west of the Town of Vail, in Wolcott	Community development in Wolcott with 577 residential unites	2013, implementation ongoing	373 acres		Socioeconomic Wildlife

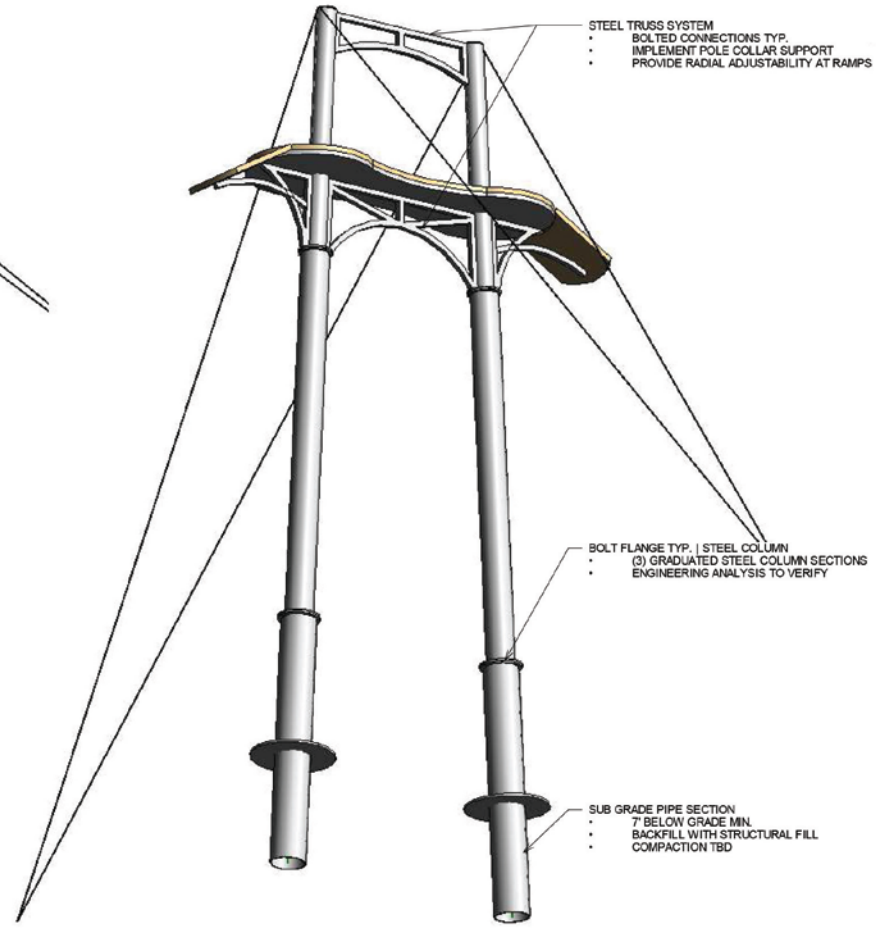
Table A-1:
Cumulative Effects Matrix

Project	Project Location (Straight Line Distance to Vail Ski Area SUP)	Project Description	Project Approval/ Implementation	Project Area (acres/length)	Lynx Analysis Unit where the Project is Located	Resources Potentially Affected
Berlaimont Estates Residential Development	13 miles west of the Town of Vail, in Edwards	19 homes are planned on a private inholding surrounded by the WRNF. Access to the inholding across NFS lands would require NEPA analysis and authorization from the WRNF.	An application for a Variance from Improvement Standards for road construction is pending with Eagle County. No formal proposal has been submitted to the WRNF.	680 acres of private land accessed year-round by a paved, maintained road. The roughly 5-mile long road would use a combination of existing Forest System roads and new road segments.		Scenery Soils Vegetation Wildlife
Schmidt Special Use Permit	15 miles west of the Town of Vail in Edwards	Christmas Tree Farm	NA	2.4 acres		Socioeconomic Wildlife

APPENDIX B: ZIP LINE CANOPY TOUR TOWER TYPICAL



3 AERIAL 3D



4 GROUND 3D