

June 5, 2023

Phil Bouchard
Shadow Mountain Bike Park

Re: First Referral Response Letter –Shadow Mountain Bike Park ODP
Case No. 23-102980 RZ

Dear Mr. Bouchard,

This letter serves as your first submittal response to the Special Use case for the *Shadow Mountain Bike Park ODP* and a request for additional materials needed as a part of the process. Listed below is a summary of the comments received by Planning and Zoning Staff and the pertinent issues that must be addressed. Please refer to the attached comments from each referral agency for complete information. Where discrepancies or contradictions are encountered, please contact your case manager for clarification. Please do not add information or make revisions that are not requested unless they have been discussed and reviewed with me. Additions or changes that were not requested can lead to additional referrals and longer review times.

Key Issues to address with Case Manager:

General:

The submitted Written Restrictions do not clearly define the maximum impact of the proposed use nor the visual or audial impacts of the proposed park. The applicant will be required to provide a number of additional details to refine compatibility, visual impacts, proposed use, noise, wildfire hazards, and site design.

The applicant's proposal would not meet with the Conifer/285 Corridor Area Plan recommended land use for this site. The Comprehensive Master Plan recommends this area for 1 dwelling unit per 10 acres. Staff evaluated the following three factors when assessing proposed uses that are not supported by the Plan:

- a) how will the impacts associated with the proposed land use(s) be mitigated compared with the recommended Land Uses;
- b) are the proposed land uses compatible with the surrounding Land Use Recommendations and community character; and
- c) what change of circumstance has occurred in the local area since the Land Use Recommendation was adopted.

ODP Document:

- ***Land Use Area Definitions***
Day Lodge is not limited by size and includes notions of, "other services, Other Entertainment" that need to be more clearly defined. These limitations should have matching evaluations in trip generation, wastewater and other supporting documents.
- ***Permitted Uses***
Some of the proposed language seems vague. It is unclear how the park will be used during "closure" periods, maximum impact of some of the proposed uses and how the features on site will be limited. See Proposed Written Restrictions for full staff comments.
- ***Setbacks***
No setbacks are proposed beyond the typical A-2 standards. However, wildfire mitigation recommends 300-foot setbacks from property lines, this is strongly recommended by staff. Other setbacks may include distances from property lines "trails 30-foot from property lines" either written by cardinal direction or illustrated as "Non-Disturbance Areas" graphically on Page 5 of the submitted Written Restrictions supporting pages.
- ***Parking Standards***
No building maximum is proposed with this document. Maximum building size, occupancy and parking ratio are required to evaluate maximum impacts of use, parking, transportation, water and wastewater. Justification on how the proposed lot is compatible with surrounding residential uses is required.

- **Site Mitigation**
More could be done to meet the Temporary Area of Refuge and other recommendations of the Wildfire Risk Assessment. For instance, the proposed location of the parking lot makes it unable to meet these recommendations on-site. Similarly, staff has concerns with parking lot proposed over existing wetland, floodplain areas and in close proximity to property lines.

Please review the attached ODP document with red marks related to formatting and content.

Plan Recommendation:

The subject property is located within the Conifer/285 Corridor Plan. This parcel is recommended for residential development at 1 dwelling units per 10 acres.

Traffic & Engineering:

1. This land use does not align with a trip generation code identified in the ITE 10th editions. Greater justification for 1.5 turnover of vehicles per day using data collected from similar land uses is required.
2. Saturday and Sunday PM periods were not analyzed and will be required to be evaluated for the 2nd referral.
3. The County does not support the use of left turn acceleration lanes. Revise Table 1a, 1b and other places in the report which show a mitigated level of service.
4. Provide a justification for 1% annual growth rate used for future traffic projections in 2025 and 2042.
5. Per the narrative, the applicant will work with local Sheriff and/or Road and Bridge authority within ROW to enforce no-parking along Shadow Mountain Drive. Please describe the type of work that the applicant is committing to provide.
6. Engineering will require surface of roads or parking lots removed from Written Restrictions. If approved, these details are to be evaluated with Site Development Plan and Land Development Regulations processes. The applicant is advised to be aware that parking lots and roads exceeding 150 trips per day are required to be paved.

Noise:

Documents required for second submittal:

1. Revised ODP and Written Restrictions
2. Cover Letter addressing conformance with the Comprehensive Master Plan
3. Sensory Impact Study
4. Revised Transportation Information including maximum building limitations, similar land use data.
5. A Wildfire Mitigation Plan as well as an Analysis/Technical documentation for the chairlift as it relates to the probability of starting fires satisfactory to the CSFS Golden Field Office.
6. Updated Visual Analysis

Staff has summarized the pertinent comments that need to be addressed above. Please refer to the full agency responses for specific agency feedback. It is your responsibility to address the comments in the attached letters and contact the agencies as necessary.

Please feel contact me with any questions or set up a meeting to discuss any of the referral information.

Thank you,

Dylan Monke, Planner
Phone: 303-271-8718
E-mail: dmonke@jeffco.us

Cc: Case File

Notice:

*** PLEASE RETURN ALL REVISION PRINTS ELECTRONICALLY TO PLANNING & ZONING ***

The applicant shall submit electronically a revised application in response to referral comments within 180 calendar days after referral comments are provided to the applicant. The Director of Planning & Zoning or his / her appointed designee may extend this 180-day maximum response deadline for an additional 180 days if, in his or her opinion, the delay in response is beyond the applicant's control. If there is no response within the 180-day period and an extension has not been granted by the Director of Planning & Zoning or his / her appointed designee, the application will be considered withdrawn. The applicant will then have to submit a new application.



COLORADO

Parks and Wildlife

Department of Natural Resources

12102 South Elk Creek Road
Pine, CO 80470
P 303.291.7241 | F 303.291.7114
Email: mark.lamb@state.co.us

March 21, 2023

Attention: Dylan Monke

Jefferson County Planning & Zoning Division

100 Jefferson County Parkway, Suite 3550

Golden, CO 80419

Phone: (303) 271-8718

Re: Shadow Mountain Bike Park, Case #23-102980 RZ

Dear Dylan,

Thank you for providing Colorado Parks and Wildlife (CPW) the opportunity to comment on the proposed Shadow Mountain Bike Park development that incorporates approximately 235 acres of the 306-acre Colorado State Land Board parcel identified as ID 61-163-00-001, commonly referred to as the Shadow Mountain Parcel, in Conifer, CO. This property is located within Game Management Unit (GMU) 39 in Jefferson County Colorado.

The mission of CPW is to perpetuate the wildlife resources of the state, to provide a quality state parks system, and to provide enjoyable and sustainable outdoor recreation opportunities that educate and inspire current and future generations to serve as active stewards of Colorado's natural resources. CPW has a statutory responsibility to manage all wildlife species in Colorado and to promote a variety of recreational opportunities throughout Colorado. One way we achieve this goal is by responding to referral comment requests.

The Shadow Mountain Parcel is approximately 305 acres of mostly contiguous undeveloped land surrounded by residential mountain development. CPW District Wildlife Managers have conducted site visits of the property and have developed many years of on-the-ground working knowledge of the wildlife values of the property. The proposed property includes a riparian corridor along the lower elevations, rocky outcroppings at higher elevations, and a series of draws in heavily wooded timber. Currently, this property plays an important role in mitigating habitat fragmentation by connecting wildlife habitat on CPW and United States Forest Service (USFS) lands to the west with wildlife habitat on Jefferson County Open Space and Denver Mountain Parks lands to the east.

Elk and mule deer use the Shadow Mountain Parcel year round. The property is identified as summer range for elk, provides winter range habitat for bull elk, and is used by elk during the



breeding season. Resident herds of elk in the area also intermittently use the property throughout the year. The property is identified as summer range for mule deer, and provides connectivity to nearby winter range habitat. The riparian corridor on the property has been used increasingly by moose, and currently is one of the eastern most locations where CPW receives regular moose sightings in west Jefferson County. Mountain lions, bobcats, foxes, and coyotes use the property year round. District Wildlife Managers have observed significant use by these species along the rocky outcroppings at higher elevations, and have documented coyotes denning in the same area. District Wildlife Managers have also observed regular use of the property by black bears in the area. While nearby mountain residents have experienced conflicts with black bears, mountain lions, and elk in this area, the undeveloped Shadow Mountain Parcel provides refuge for these species where they can avoid human contact and reduce the potential for conflict and game damage issues.

CPW recognize there is important wildlife value in maintaining this parcel of undeveloped land and protecting it from development and regular use by human recreation, which the proposed Shadow Mountain Bike Park development would exacerbate. The Shadow Mountain Parcel plays an important role in maintaining connectivity of wildlife habitat in an area that is becoming increasingly fragmented by a combination of infrastructure, traffic, and growing recreational use of natural landscapes in Jefferson County.

If you have any additional questions regarding wildlife concerns for this property, please contact Jake Sonberg, District Wildlife Manager at jacob.sonberg@state.co.us

Sincerely,

Mark Lamb

Mark Lamb, Area Wildlife Manager

CC: Leslie, Region file, JSonberg, JNicholson, Area file

Dylan Monke

From: Dixon - CDOT, David <david.dixon@state.co.us>
Sent: Friday, March 24, 2023 2:33 PM
To: Dylan Monke
Subject: --{EXTERNAL}-- Re: 23-102980RZ - ELECTRONIC REFERRAL - EXTERNAL - Rezoning

This Message Is From an External Sender

This message came from outside your organization.

Report Suspicious

Good Afternoon Dylan,

This property is off the State Highway System. I have no objections or concerns. Thank you!

Very Respectfully,

David Dixon
Assistant Access Manager



720-541-0441
2829 W. Howard Pl. 2nd Floor, Denver, CO 80204
david.dixon@state.co.us | www.codot.gov [codot.gov] | www.cotrip.org [cotrip.org]

On Fri, Mar 17, 2023 at 2:38 PM <AUTOMAILER@jeffco.us> wrote:



ELECTRONIC REFERRAL

This e-mail is to inform you that the application referenced below is now beginning the 1st Referral. Please review and provide comments on the referral documents found in the [Current Referral Documents](#) sub-folder. Comments should be submitted electronically to the Case Manager by the due date below.

Case Number: 23-102980 RZ
Case Type: Rezoning
Address: Shadow Mountain Bike Park, 80433

Description: Special Use Application for Development of a day-use lift-served bike park as a Class III Commercial Recreation Facility.

Case Manager: Dylan Monke

Case Manager Contact Information: dmonke@co.jefferson.co.us 303-271-8718

Comments Due: 03/24/2023

If you have any questions related to the processing of this application, please contact the Case Manager.



Jefferson County encrypted email system

If you received this disclaimer all email between Jefferson County and your organization is TLS encrypted.

Jefferson County Colorado



Golden District
1504 Quaker Street
Golden, Colorado 80401-2956
(303) 279-9757
FAX: (303) 278-3899

April 5, 2023

To:

Dylan Monke, Case Manager
Jefferson County Planning and Zoning
100 Jefferson county Parkway, Suite 3550
Golden, Colorado 80419
dmonke@co.jefferson.us; 303-271-8718

From:

Matt Piscopo, Supervisory Forester
Colorado State Forest Service
1504 Quaker Street
Golden, Colorado 80401
Matt.Piscopo@colostate.edu; 303-279-9757

Regarding:

Case Type:	Rezoning
Case Number:	23-102980RZ
Address:	Shadow Mountain Bike Park, 80433
Description:	Special Use Application for Development of a day-use lift-served bike park as a Class III Commercial Recreation Facility.
Comments Due:	April 7, 2023

Regarding this case (23-102980RZ), CSFS has the following response:

_____ The Colorado State Forest Service does not need to receive any further referrals on this case. No site visit or forest management plan is necessary for the proposed action on this property. Either we have no concerns, or our concerns for the proposed action on this property would be addressed with the defensible space requirements of a County building permit. See additional comments below.

_____ A Wildfire Mitigation Plan (Forest Management Plan) is NOT necessary for the proposed action on this property. However, the Colorado State Forest Service will need to further

review this case and/or visit the site to develop specific recommendations to address wildfire hazard mitigation and/or forest health needs for the property. A \$200 review fee must be submitted for CSFS costs associated with this further review.

 X A Wildfire Mitigation Plan (Forest Management Plan), prepared by an individual meeting Jefferson County standards, is recommended for this case. A \$300 review fee must be submitted for CSFS costs associated with the review of the Plan. Please give the applicant a copy of the Jefferson County Planning & Zoning Department's Wildfire Mitigation Plan requirements, and have them contact the Colorado State Forest Service - Golden Field Office at 303-279-9757 to discuss plan needs.

Additional Comments:

CSFS requests an analysis / technical documentation for the installed equipment on the property (ie. chairlift) as it relates to the probability of starting fires. This will allow CSFS to determine the appropriate level of vegetation management / wildfire mitigation activities on the property.

Sincerely,



Matt Piscopo
Supervisory Forester
CSFS Golden Field Office



COLORADO
Division of Water Resources
Department of Natural Resources

March 20, 2023

Dylan Monke
Jefferson County Planning and Zoning
Transmission via email: dmonke@co.jefferson.co.us

Re: Shadow Mountain Bike Park Rezoning
Case Number 23-102980 RZ
Pt. W½ Sec. 16, T6S, R71W, 6th P.M.
Water Division 1, Water Districts 9 & 80

Dear Mr. Monke:

We have reviewed the above referenced application for Rezoning/Special Use for a chairlift-accessed mountain bike park. The submitted material does not qualify as a “subdivision” as defined in section 30-28-101(10)(a), C.R.S. Therefore, pursuant to the State Engineer’s March 4, 2005 and March 11, 2011 memorandums to county planning directors, this office will only perform a cursory review of the referral information and provide comments regarding the proposed water supply. The comments will not state an opinion on the adequacy of the water supply or the ability of the water supply plan to satisfy any County regulations or requirements, and cannot be used to guarantee the physical availability of water or the issuance of a well permit.

The applicant proposes to construct and operate a mountain bike park on a 235-acre portion of a 306-acre parcel owned by the Colorado State Land Board. The facility will have a chairlift to access approximately 16 miles of mountain biking trails for varying ability levels. A lodge and parking area for up to 300 vehicles will be located near the base of the chairlift. The lodge is anticipated to provide guest services including indoor seating, ticketing, restrooms, changing rooms, bike and equipment rentals, and a deck for outdoor guest space and seating. The lodge will not contain a kitchen space. Instead, the applicant plans to partner with local food truck vendors to meet food and beverage needs for guests. The property will also contain a maintenance building with an additional restroom and 20 employee parking spaces. The proposed source of water supply for the property is a well to be constructed onsite.

At full build-out, water requirements for the property are estimated to total 1.57 acre-feet per year based on an estimated water requirement of 4 gallons per guest per day and an average of 300 guests per day, and an estimated water requirement of 10 gallons per day per employee and an average of 20 employees per day, 365 days per year. To allow for variability in water use, including during potential special events, the applicant is proposing to use a water requirement of 2 acre-feet of water per year. The applicant does not anticipate needing this full amount of water during the first few years of construction and operation. Therefore, the applicant proposes to obtain a commercial exempt well permit for initial operation. This type of well permit would allow for the withdrawal of up to ⅓ acre-foot of water per year for use in drinking and sanitary facilities inside a commercial business. The well would be required to be equipped with a totalizing flow meter with



meter readings reported to this office on a monthly basis. A commercial exempt well may also be permitted for fire-fighting use, including to fill a storage tank for this purpose so long as the outlet to the storage tank is kept capped and locked and available only for use in fighting fires. The applicant has stated that they are aware that they would need to pursue obtaining a non-exempt commercial well permit as visitation grows, and a plan for augmentation. A non-exempt well permit would be required to withdraw more than $\frac{1}{3}$ acre-foot of water per year, and could only be issued if the well were first included in a plan for augmentation decreed by the water court or a substitute water supply plan approved by the state engineer. The ability for the applicant to obtain well permit(s) and the allowed use(s) will be determined at the time permit application(s) are submitted to and reviewed by the State Engineer's Office.

A detention pond is proposed to be constructed in the southeast portion of the site to capture runoff from the lodge and parking area. Water from the detention pond will be discharged to North Turkey Creek. The applicant should be aware that, unless the structure can meet the requirements of a "storm water detention and infiltration facility" as defined in section 37-92-602(8), C.R.S., the structure may be subject to administration by this office. The applicant should review the Division of Water Resources' Administrative Statement Regarding the Management of Storm Water Detention Facilities and Post-Wildland Fire Facilities in Colorado, available at <https://dwr.colorado.gov/services/water-administration/rainwater-storm-water-graywater>, to ensure that the notification, construction and operation of the proposed structure meets statutory and administrative requirements. The applicant is encouraged to use the Colorado Stormwater Detention and Infiltration Facility Notification Portal, located at <https://maperture.digitaldataservices.com/gvh/?viewer=cswdif>, to meet the notification requirements.

The applicant may need to obtain a permit from the U.S. Army Corps of Engineers prior to the commencement of any construction or other activities that may temporarily disturb or permanently fill any wetlands on site.

Should you or the applicant have any questions, please contact me at 303-866-3581 ext. 8249 or sarah.brucker@state.co.us for assistance.

Sincerely,

A handwritten signature in blue ink, appearing to read "Sarah Brucker", is positioned above the printed name.

Sarah Brucker, P.E.
Water Resources Engineer

Cc: Referral file no. 30302



ELK CREEK FIRE PROTECTION DISTRICT

11993 South Blackfoot Road P.O. Box 607 Conifer, CO 80433

March 20, 2023

Dylan Monke
Jefferson County Planning and Zoning
100 Jefferson County Parkway
Suite 3550
Golden, Colorado 80419-3550

RE: 23-102980-RZ – SHADOW MOUNTAIN BIKE RANCH

Dylan Monke:

The Elk Creek Fire Protection District has reviewed the re-zoning submittal for the above-mentioned project. Below are my comments based on the information submitted:

- Fire apparatus access roads would be required in accordance with the International Fire Code, Section 503.
 - The culverted crossing needs to be designed and built to handle the weight of fire apparatus.
 - The parking lot and work road needs to be designed and built to handle fire and EMS apparatus.
- The day lodge, maintenance shop and any other future permanent buildings need to meet the minimum fire code requirements:
 - An approved fire protection water supply capable of supplying the required fire flow for fire protection would be required in accordance with the International Fire Code, Section 507.
 - Based on the information available at this time the minimum fire protection water supply would be 180,000 gallons.
 - The applicant needs to have their engineer submit a fire code required fire flow report based on the proposed structures.
 - The application shows a proposed 15,000-gallon water tank, which does not meet the minimum fire code fire flow requirements for structures.
 - A fire hydrant system would be required in accordance with the International Fire Code, Section 507. A minimum of 1 – 3 fire hydrants may be required depending on the proposed buildings.
 - A fire pump may be required depending on the proposed buildings and water system.
 - A building fire alarm system would be required in accordance with the International Fire Code, Section 907, as amended.
- These comments are based on currently available information. If plans or conditions change in the future, there may be additional requirements. A more detailed plan review would be conducted as more details become available.

ELK CREEK FIRE PROTECTION DISTRICT
11993 South Blackfoot Road P.O. Box 607 Conifer, CO 80433

Please contact me if I can be of further assistance.

Sincerely,

A handwritten signature in black ink that reads "Roger V. Parker". The signature is written in a cursive style with a large, looping 'R' and a distinct 'V'.

Roger Parker
Fire Marshal
Elk Creek Fire Protection District

Memorandum

To: Dylan Monke
Planner

From: Patrick O'Connell
Engineering Geologist

Date: April 12, 2023

Re: Shadow Mountain Bike Park, Case No. 23-102980RZ

I have reviewed the submitted documents for the subject project. I have the following comments:

1. The site is not within a zoned or unzoned geologic hazard area and reports are not required with the rezoning process.
2. The property is located within the Mountain Ground Water Overlay District. Based the uses (bike park, lodge, maintenance building) on 235 acres, it appears the water requirement will not exceed the 0.28 acre feet per acre per year threshold as described in Section 21 of the LDR. If the water requirement exceeds 0.28 acre feet per acre per year, an Aquifer Test in accordance with Section 21 of the LDR is required with the rezoning application. If the water requirement exceeds 0.10 acre feet per acre per year, an Aquifer Test in accordance with Section 21 of the LDR is required with the SDP application. Additional information regarding the square footage of the lodge and maintenance building should be provided to complete the WAA.
3. The applicant submitted a plan that describes the process to obtain legal rights to the water supply. Adequate legal water rights will be required with the SDP process.
4. The map for the Water Availability Analysis (WAA) is attached. The WAA will be completed once additional details regarding the square footage of the buildings is provided.
5. Grading within the Jefferson County Floodplain Overlay District (flood prone area) will require a separate Floodplain Development Permit.

Shadow Mountain Bike Park

Phase I Drainage Report



November 2022

Prepared For:



Prepared By:



PHASE I DRAINAGE REPORT

For

Shadow Mountain Bike Park

November 2022

Prepared For



Shadow Mountain Bike Park

Conifer, CO

Prepared By



SE Group

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I. General Location and Description

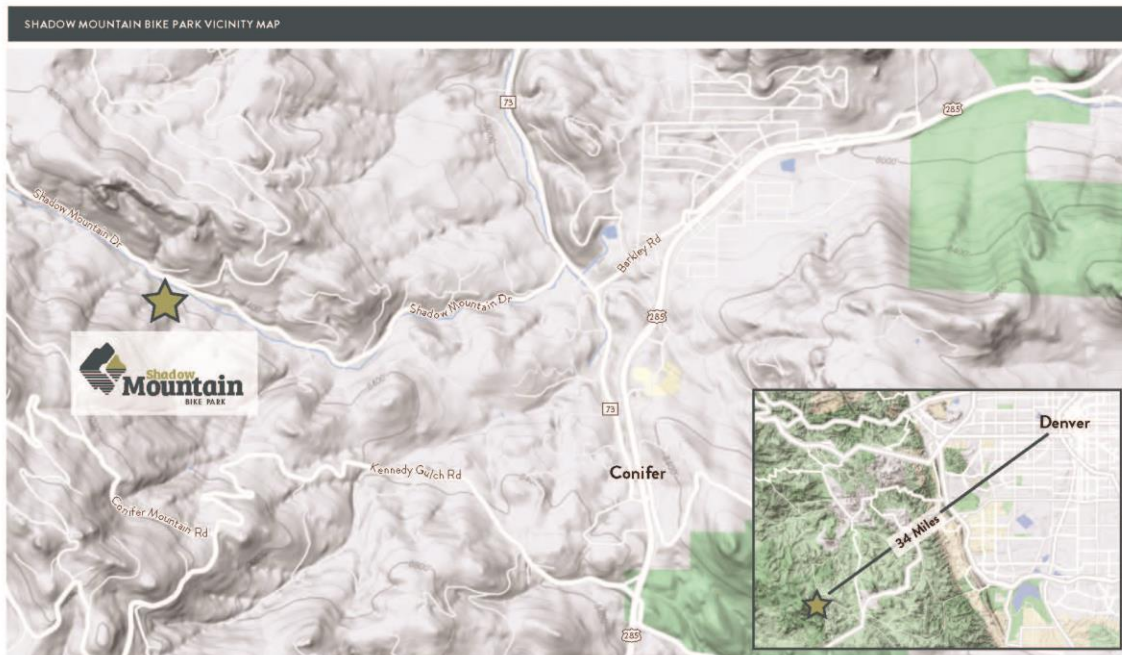
The Shadow Mountain Bike Park is to be designed in accordance with the Jefferson County Storm Drainage criteria. This report will review at a conceptual level the feasibility and design characteristics of the proposed development and is to accompany the project's Special Use Application materials. The Phase I Drainage Report is prepared in accordance with Jefferson County standards.

A. LOCATION

The Shadow Mountain Bike Park is proposed to be located at 29611 Shadow Mountain Drive in Conifer, CO. Conifer is an unincorporated community of Jefferson County, and the property is subject to the rules and regulations set by the County. The property is in Section 16, Township 6 South, Range 71 West of the 6th Principal Meridian, County of Jefferson, State of Colorado and is owned by the State Land Board. The property is comprised of approximately 306 acres of undeveloped land per County Assessor records, but the project is proposed only within the approximately 235-acre portion of the property south of Shadow Mountain Drive. It is proposed that the bike park would lease this southern portion of the property from the State Land Board and only develop and disturb a small fraction of the parcel.

The site is in a primarily rural, residential setting, bounded by residential neighborhoods along all property lines. The Conifer Senior High School and US Highway 285 are due east of the project. North Turkey Creek runs along the south side of Shadow Mountain Dr and bisects the front portion of the property; there are no exiting drainage facilities. The project site is about four (4) miles from downtown Conifer and approximately 34 miles from Denver.

Figure 1. Vicinity Map



B. DESCRIPTION OF PROPERTY

The 235-ac portion of the property to be developed is located on an undeveloped hillside, sloping towards the North Turkey Creek and Shadow Mountain Dr. The northeastern portion of the site along Shadow Mountain Dr is relatively flat, from approximately 4% to 8%, as it extends from the roadway and then steepens up the mountain heading south-southwest, from 12% to 45%. The high point is in the southwestern most portion of the property at approximately 9250' and flows primarily due east-northeast into North Turkey Creek. The total vertical fall across the site is approximately 870 vertical feet. The flatter areas are predominantly meadows and grassy areas, and the hillside is primarily wooded. There are a series of low flow channels that bisect the property and flow into the North Turkey Creek. Throughout the site there are also wetlands on both the hillside and along the creek. The hillside is relatively consistent in grade with some knolls but no defined ridge. There are a series of small gullies formed by the low flow channels.

The property is in Zone X (unshaded) according to FIRM Map No 08059C0365F in Jefferson County, CO last revised February 5, 2014. Zone X (unshaded) is defined by FEMA as areas of minimal flood hazard, outside of the Special Flood Hazard Area (SFHA), and higher than the elevation of the 0.2-percent-annual-chance flood. A copy of the property FIRMette is included in Appendix A.

Shadow Mountain Bike Park is a lift-served mountain bike park. The facility would include driveway access from Shadow Mountain Dr, onsite vehicular parking and guest drop-off, a base lodge with guest services (food & beverage, restrooms, seating, and bike/equipment rentals), and a mid-mountain maintenance building area. All access into the property would be via a two-lane (single in/single out) culvert crossing over North Turkey Creek. Water would be supplied by a water well and sewage would be handled by an onsite septic system.

The driveway access, internal drives & walkways, landscaping, and parking space design are to comply with the standards outlined by the Jefferson County Section 14 – Off-Street Parking and Loading. The parking and access would create impacts to waters of the U.S., including wetlands located in this area. Permitting would be required with the U.S. Army Corps of Engineers to comply with the Clean Water Act and County regulations. The culvert crossing of North Turkey Creek is to be sized according to the criteria set in Chapter 11.5 Culvert Sizing of the Jefferson County Storm Drainage Design & Technical Criteria.

It is anticipated that mountain access be provided via a four-passenger chairlift to be constructed to transport guests and bikes to the top of the property for gravity flow and downhill trails. The proposed lift would include a bottom and top terminal building with an accessory lift attendant building; all lift infrastructure (terminals and towers) would comply with the height limit of 35-feet. The facility may provide, but would not be limited to, approximately 20 miles of trails. These trails would be primarily constructed of earthen materials, and would include wooden, steel and other materials. Vegetation removal would be necessary for the construction of the chairlift and trails. Industry trail design practices would be utilized for construction and maintenance of trails and the lift corridor.

A work road would be constructed from the main base area to the north to the location of a maintenance shop. The work road would also be constructed to the chairlift top terminal location providing construction and maintenance access, as well as emergency access through the bike park. The maintenance shop is likely to be located mid-mountain and constructed atop a hard, gravel surface. The approximate location is provided on the attached Drainage Map, but the final footprint and location is subject to change.

The maintenance access road and designated bike trails will likely cross the existing low flow channels within the site. Both the trails and road are to be routed and designed to minimize impacts to the channels and delineated wetland areas.

II. Drainage Basins and Sub-Basins

A. MAJOR BASIN DESCRIPTION

The proposed site is tributary to the North Turkey Creek and is part of the Turkey Creek Major Drainage Basin. The North Turkey Creek begins in the hillside above Shadow Mountain Dr, flows east-northeast alongside Rte. 285 and N. Turkey Creek Rd before its confluence with Turkey Creek. According to the Hydrologic Conditions and Assessment of Water Resources in the Turkey Creek Watershed completed in 2001, the site is entirely within the North Turkey Creek sub-basin. This sub-basin is designated as Subbasin K. Applicable sections of the report are included in Appendix B.

Subbasin K is approximately 4,800 acres and is largely undeveloped with areas of residential and limited commercial development, and some roadways, both gravel and paved county roads. The basin encompasses much of the unincorporated community of Conifer, including the commercial district along Rte. 285 and the Conifer High School; the basin does not include the Aspen Park area. Historically, flows start from the ridgeline along the southwest edge of the Major Basin and sheet flows or enters small drainageways to the north/northeast into North Turkey Creek. The basin also includes minor flows from the north of the creek. North Turkey Creek flows to the east and the Major Basin delineation ends at Route 70. The creek continues to flow north before its confluence with Turkey Creek. Slopes vary throughout the Major Basin ranging from steep slopes at upwards of 40-45% to flat grassy areas from 2-5%.

There are no existing major drainage facilities within the Major Basin.

Added imperviousness for the developed site is assumed to be negligible within the Major Basin because full spectrum detention is to be provided onsite and attenuated to historic levels. Thus, no negative impacts are anticipated to the North Turkey Creek major drainageway basin because all increases in site imperviousness, although very small, are treated and detained onsite.

The Major Basin follows Jefferson County zoning and is a mix of Mountain Residential (MR) & Suburban Residential (SR), Planned Development (PD), Commercial (C), and Agricultural (A) Districts. The property is zoned for A-2 Agricultural Two District. The project's proposed development would be defined as a Class III Commercial Recreational Facility and is thus subject to a Special Use/Rezoning review process before proceeding with the Site Development Plan process. The project aligns with the goals of the Conifer-285 Corridor Area Plan by providing an active recreational area that maintains the mountain community character.

There are no known irrigation facilities such as ditches that will or would be influenced by the North Turkey Creek in the vicinity of the property.

B. SUB-BASIN DESCRIPTION

Historically, the property drains into the North Turkey Creek via sheet flow or channelized flow in a series of low flow channels bisecting the hillside. Runoff largely flows to the east-northeast into the abutting property before entering the creek. The site is undeveloped with majority of the surface area covered by wooded areas and meadows along Shadow Mountain Drive.

The USDA Soils Survey states that the site is largely Leguault-Hiwan stony loamy sands, 5 to 15 and 5 to 30 percent slopes, or rock outcrop complex 30 to 50 percent slopes on the hillside and then Kittredge-Earcree complex, 9 to 20 percent slopes, along the street frontage. The stony loamy sands and rock outcrop complex are Hydrologic Soil Group (HSG) D and the Kittredge-Earcree complex is HSG B. Soils with a B HSG rating are in the above average soils class for infiltration and D HSG rating is the lowest group and has the least amount of runoff infiltration. According to the USDA, 95% of the property has a HSG D soils rating. A copy of the Soils Survey is provided in Appendix C.

The property is split into distinct developed areas that impact the existing property: the new mountain bike trails, the lift and associated terminal and tower structures, the maintenance building and access road, and base services and parking area. It is proposed that the trails, lift areas, access road, and maintenance building use stormwater best management practices to mitigate impacts. Runoff generated by the new base lodge and parking area is to be redirected to an onsite detention facility to treat and detain access flows prior to being released into the North Turkey Creek. The detention facility is to be designed per Jefferson County and Mile High Flood District (MHFD) standards; preliminary calculations are provided in this report. The site improvements will not alter the existing minor and major drainage patterns of the property and all flows will continue to enter the creek.

The section of North Turkey Creek that crosses the property is to remain functional and stay adequately protected during construction to the greatest extent possible. The proposed driveway crossing over the creek is to be designed and constructed per county and MHFD standards and best practices. The functionality and capacity of the existing drainageway is to be restored to the historic conditions.

III. DRAINAGE FACILITY DESIGN

The preliminary drainage facility design has been prepared in accordance with Jefferson County Storm Drainage Design & Technical Criteria and the latest MHFD Urban Storm Drainage Criteria Manuals (USDCM), Vol. I revised August 2018, Vol. II revised September 2017, and Vol. III revised January 2021 and MHFD design tools for Detention Design, v4.06 revised July 2022 and Rational Method revised May 2017.

A. GENERAL CONCEPT

Historically the runoff from the site is un-detained and directly discharging to North Turkey Creek. The developed site will produce a higher runoff volume due to increased imperviousness from the base lodge and parking area, and this runoff is to be detained to or below existing runoff rates per MHFD standard through the addition of storm sewer and the on-site full spectrum detention pond. All new onsite drainage facilities are to be encumbered by drainage easements per County regulations. Easement delineation and language to be provided within final construction documents.

There are flows that enter the site from the abutting properties to the west. All offsite flows are to be redirected around the proposed developed areas to the creek and not collected by the new drainage facilities.

The added imperviousness from the mountain bike trails, lift terminals, access road, and maintenance area are to be mitigated using Low Impact Development (LID) best practices and selection and sizing of stormwater BMPs that improve runoff quality and minimize impacts to the existing surfaces.

Surface disturbance from construction activities to be mitigated and controlled by temporary erosion control measures and follow a Grading, Erosion and Sediment Control Plan. The plan is to be provided as part of the final construction documents and reviewed during the Site Development Plan process.

1. HYDROLOGIC CRITERIA

The Rational Method ($Q=CIA$) is used to determine runoff peak discharges for the historic and developed site basins at given design points. The composite runoff coefficients (C) are calculated using site imperviousness and hydrologic soil type (HSG B & C/D) to define an area-weighted coefficient per basin. The rainfall intensity (I) in inches per hour are defined using the time of concentration (t_c) and provided intensity-duration curve table provided within the County Storm Criteria Manual Chapter 5.4 for Jefferson County Rainfall Zone IIB. The Time-Intensity-Frequency curves for each zone were developed by distributing the one-hour point rainfall values using the factors obtained from the NOAA Atlas 14 for durations of less than one hour. The point rainfall values from Table 501 within the Criteria Manual are as follows:

Table 1: One-Hour Point Rainfall Values for Jefferson County Rainfall Zone IIB (in)

2-YR	5-YR	10-YR	50-YR	100-YR
0.85	1.19	1.39	1.93	2.20

Will need this to be discussed/analyzed in further detail at time of Phase III D.R.

Each basin was evaluated based on area (A) in acres. Final peak discharge (Q) is defined in cubic feet per second (cfs). Post-development time of concentration calculations for each subbasin, corresponding rainfall intensities, and composite runoff coefficients for each sub-basin as calculated using the MHFD UD-Rational Method spreadsheet are provided in Appendix D.

The proposed base lodge and parking facilities are to disturb approximately 6.75 acres of historically undeveloped area:

- **Basin H:** The historic basin, labelled as Basin H is split into two sub-basins H1 and H2 for the HSG D and HSG B soils respectively.
- **Basin D:** The developed basin, labelled as Basin D, is split into two sub-basins D1 and D2 for the HSG and HSG soils respectively as well. Basin D represents all disturbed areas that are tributary to the proposed detention basin.
- **Basin OS:** All flows that cannot be conveyed to the basin are analyzed within the OS (offsite) basin. All soils within the Basin OS are HSG B.

Per Chapter 6 of the MHFD Urban Storm Drainage Criteria Manual (USDCM) Vol. I, Table 6-3, packed gravel surfaces are 40%, drive and walks are 90%, and roofs are 90% impervious. The proposed plaza area around the building and bottom lift terminal is likely to be a hardpacked dirt surface and is assumed 25% imperviousness.

The calculated peak flows for the minor storm event (5-year) and the major storm event (100-year) for the base lodge and parking area are as follows:

Table 2: Runoff Summary Table

Basin	Total Area (ac)	HSG	Imperviousness (%)	Q5 (cfs)	Q100 (cfs)
H1	2.74	D	2	0.43	7.68
H2	4.01	B	2	0.10	6.89
D1	2.74	D	43	2.98	11.06
D2	3.61	B	31	3.04	10.93
OS	0.40	B	2	0.56	0.81

The calculated release rates through the Rationals Method to be used as reference only. The final detention basin design and required release rates to be determined using the MHFD standards outlined below.

The proposed detention basin is to be designed to MHFD standards for an Extended Detention Basin (EDB). An EDB is proposed for the site in lieu of other drainage options, such as bioretention, because there is at least 5 acres of tributary area to the basin. The EDB is to be sized to store the tributary water quality control volume (WQCV), excess urban runoff volume (EURV), and 100-year storm event using the latest MHFD Detention Basin Design Workbook.

Preliminary calculations for basin storage are provided in Appendix E.

2. HYDRAULIC CRITERIA

Site runoff is proposed to be conveyed via sheet flow into a series of storm inlets and storm sewers before outfalling into the EDB. All site drainage design within the parking facilities to comply with the standards set by the Jefferson County Zoning Resolution, Section 14 – Off-Street Parking and Loading. Per the manual, sheet flow shall not exceed 200 feet, parking areas wider than 42 feet shall control concentrated flow via swales and/or underdrains, and no drainage from areas other than parking shall be diverted to and cross parking areas.

Final hydraulic design to be provided during the Site Development Plan process as part of a Phase III Drainage Report. The final storm sewer system is to be designed in accordance with MHFD USDCM Volume I Chapter 7 and sized accordingly. The storm sewer network is to be analyzed for the 5-year and 100-year storm events and is to include capacity, minimum and maximum velocity, and HGL considerations; it is the intent for the final storm sewer design to be sized so that the 100-year HGL remains below the finished grade. The storm inlets are to also be analyzed for the minor and major storm event to ensure adequate capacity and bypass in accordance with Chapter 7 design criteria.

The driveway culvert crossing at North Turkey Creek is to be designed and constructed in accordance with the Criteria Manual Chapter 11, specifically complying with 11.5.1 Culverts within Drainageways; final calculations and details to be provided during the Site Development Plan process. The culvert is to be designed to the minimum design standard set by the Criteria because the crossing remains outside of the 100-year floodplain. If only a small increase in culvert size is required to prevent overtopping, then a larger culvert is to be proposed. Final culvert sizing is to require additional major basin flow analysis using the Colorado Urban Hydrograph Procedure (CUHP) to establish the 10-year and 100-year flows within the creek.

B. SPECIFIC DETAILS

The EDB is to be designed to MHFD standard and include forebays at entering storm sewer outfalls, trickle channels, outlet structure, and an emergency overflow embankment. Each structure within the basin is to be designed and sized with calculations, design considerations, and construction details provided in the construction documents. The basin is also to be designed to maintain vegetation and have max 3:1 to 4:1 side slopes planted with turf grass that allows for consistent coverage and a mowable surface. Detailed access is also to be provided into the basin which may include a stabilized path to the internal structures or a detailed maintenance plan for sediment removal within the outlet structure, micropool, forebays, etc. The final basin footprint is to be as naturally and aesthetically shaped as possible with the outlet structure remaining as hidden from the right of way as possible and not deter its functionality.

The preliminary volume calculations and water surface elevations are as follows:

Table 3: Preliminary Basin Summary

Drainage Area (ac)	Required WQCV (ac-ft)	Required 100- year Volume (ac-ft)	Required Total Basin Volume (ac-ft)	Volume Provided (ac-ft)	100-yr Release Rate (cfs)
6.35	0.095	0.184	0.440	0.578	7.9

PERMANENT STORMWATER BMPS & MAINTENANCE

EDBs have low to moderate maintenance requirements with potentially significant maintenance required every 15-25 years. The proposed site EDB is to be maintained routinely per MHFD Vol III recommendations. Routine maintenance includes debris and litter removal, mowing and plant care, sediment removal, and erosion and structural repairs. Native grass and other drought tolerant plantings may be proposed to maintain effective vegetation without requiring permanent irrigation facilities.

The mountain bike trails are to be routinely inspected and maintained to ensure functionality and limit erosion and sediment travel downstream. Temporary erosion control measures to be implemented during active construction may include sediment fencing or sediment control logs, sediment basins, temporary rock check dams, and stabilized construction entrances. Permanent structures may include bridge crossings or cross culverts at existing seasonal waterways, ditch turnouts or constructed filter berms, and drainage swales.

IV. CONCLUSION

The Shadow Mountain Bike Park is to comply with the design criteria set by Jefferson County. This Phase I Drainage Report reviews at a conceptual review the feasibility and design characteristics of the proposed bike park development.

A. COMPLIANCE WITH STANDARDS

The proposed drainage facilities for the development of Shadow Mountain Bike Park are to be designed in accordance with Jefferson County rules and regulations including the criteria set by the Storm Drainage Design & Technical Criteria and the Zoning Resolution. Per County recommendations, the facilities are to follow design criteria and recommendations set by the MHFD within the USDCM Criteria Manuals.

B. DRAINAGE CONCEPT

The proposed drainage facilities at the base area are to be designed for full spectrum detention and will thus not have a negative impact on downstream properties and the existing North Turkey Creek functionality. The project is to be subject to a sitewide Grading, Erosion and Sediment Control Plan that will dictate temporary construction stormwater BMPs and construction practices to protect the area during active earthwork and construction. The bike trails, lift areas, access road, and maintenance area are to be constructed with stormwater BMPs to provide permanent solutions erosion and sediment control. All proposed improvements are to be adequately maintained to ensure functionality.

V. REFERENCES

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Urban Storm Drainage Criteria Manual, Vol. 1: Management, Hydrology and Hydraulics, Revised August 2018.

Urban Storm Drainage Criteria Manual, Vol. 2: Structures, Storage and Recreation. Revised September 2017.

Urban Storm Drainage Criteria Manual, Vol. 3: Stormwater Best Management Practices (BMPs). Revised January 2021.

FIRM Flood Insurance Rate Map, Map Number 08059C0365F, Jefferson County, Colorado. Federal Emergency Management Agency. Revised February 5, 2014.

United States Department of Agriculture, Natural Resources Conservation Service. Custom Soil Resource Report.

APPENDICES

APPENDIX A – FIRM MAP

APPENDIX B – REDACTED MAJOR DRAINAGEWAY PLAN

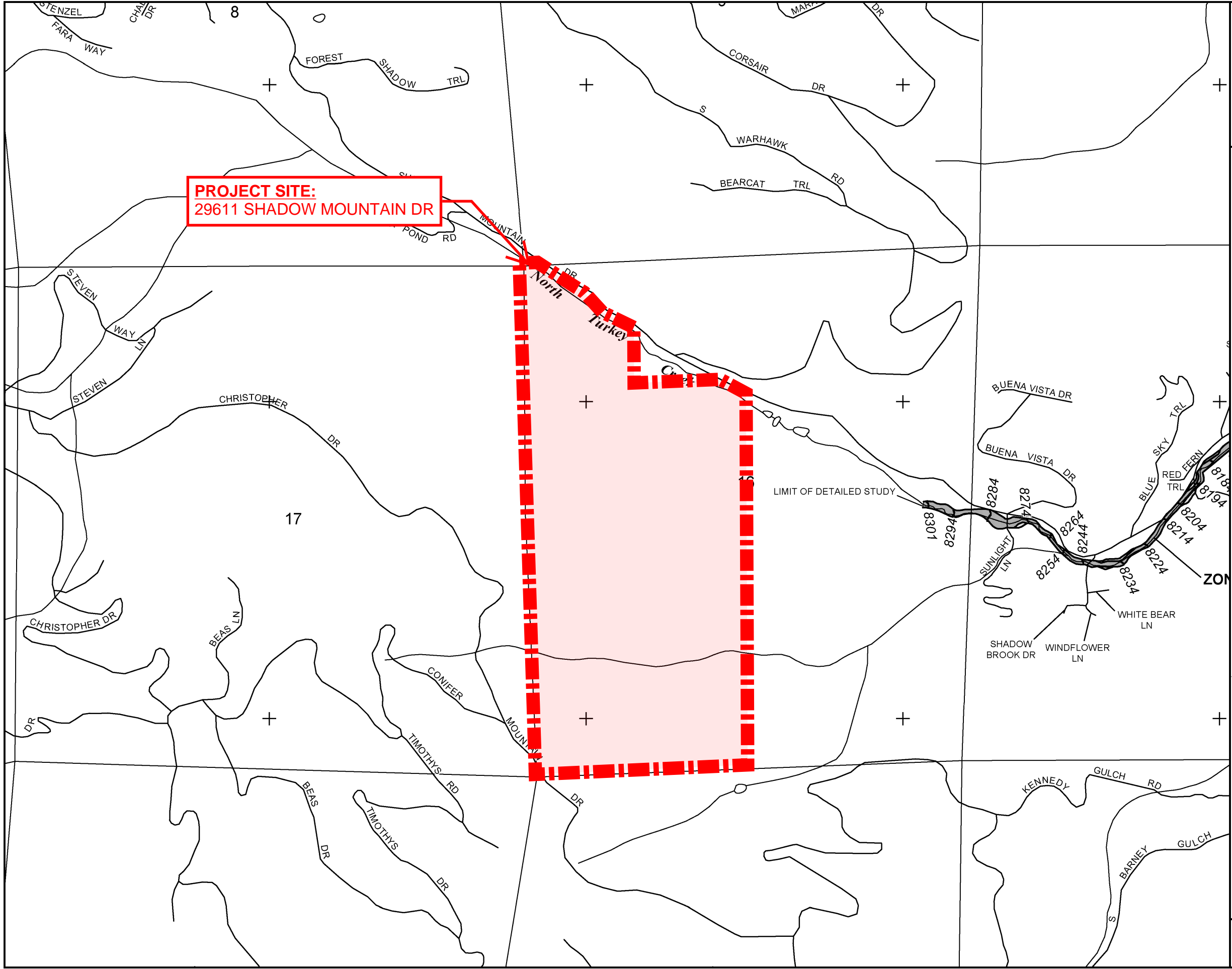
APPENDIX C – SOILS SURVEY

APPENDIX D – SITE SUB-BASIN RATIONAL CALCULATIONS

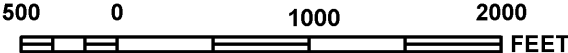
APPENDIX E – PRELIMINARY DETENTION BASIN CALCULATIONS

DPE – GENERAL LOCATION MAP

DPP – DEVELOPED DRAINAGE PLANS



MAP SCALE 1" = 1000'



NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0365F

FIRM

FLOOD INSURANCE RATE MAP

JEFFERSON COUNTY,
COLORADO
AND INCORPORATED AREAS

PANEL 365 OF 675
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:	COMMUNITY	NUMBER	PANEL	SUFFIX
	JEFFERSON COUNTY	080087	0365	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.



MAP NUMBER
08059C0365F
MAP REVISED
FEBRUARY 5, 2014

Federal Emergency Management Agency

This is an official FIRMette showing a portion of the above-referenced flood map created from the MSC FIRMette Web tool. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For additional information about how to make sure the map is current, please see the Flood Hazard Mapping Updates Overview Fact Sheet available on the FEMA Flood Map Service Center home page at <https://msc.fema.gov>.

Hydrologic Conditions and Assessment of Water Resources in the Turkey Creek Watershed, Jefferson County, Colorado, 1998–2001

By Clifford R. Bossong, Jonathan Saul Caine, David I. Stannard,
Jennifer L. Flynn, Michael R. Stevens, and Janet S. Heiny-Dash

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations Report 03–4034

SHADOW MOUNTAIN BIKE PARK - PHASE I DRAINAGE REPORT

Only sections of this report as they apply to the project site for the proposed Shadow Mountain Bike Park are included to be used as reference only. A full report can be located at <https://pubs.usgs.gov>

Prepared in cooperation with the
JEFFERSON COUNTY PLANNING AND ZONING DEPARTMENT

Denver, Colorado
2003

U.S. DEPARTMENT OF THE INTERIOR
GALE A. NORTON, Secretary

U.S. GEOLOGICAL SURVEY
Charles G. Groat, Director

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CONVERSION FACTORS, VERTICAL DATUM, AND ABBREVIATIONS

Multiply	By	To obtain
Length		
inch	2.54	centimeter (cm)
inch	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
Area		
acre	4,047	square meter (m ²)
acre	0.004047	square kilometer (km ²)
square mile (mi ²)	2.590	square kilometer (km ²)
square mile (mi ²)	640	acre
Volume		
liter (L)	0.2642	gallon
acre-foot (acre-ft)	1,233	cubic meter (m ³)
acre-foot (acre-ft)	0.001233	cubic hectometer (hm ³)
Flow		
cubic foot per second (ft ³ /s)	0.02832	cubic meter per second (m ³ /s)
cubic foot per second per square mile [(ft ³ /s)/mi ²]	0.01093	cubic meter per second per square kilometer [(m ³ /s)/km ²]
gallon per minute (gal/min)	0.06309	liter per second (L/s)
Power		
watt	1	joules per second

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$^{\circ}\text{F} = 1.8 (^{\circ}\text{C}) + 32$$

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

$$^{\circ}\text{C} = (^{\circ}\text{F} - 32) / 1.8$$

Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929. Horizontal is referenced to the North American Datum of 1927.

Elevation, as used in this report, refers to distance above or below NGVD29. NGVD29 can be converted to the North American Vertical Datum of 1988 by using the the National Geodetic Survey Conversion Utility available at URL <http://www.ngs.noaa.gov/TOOLS/Vertcon/vertcon.html>

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (μS/cm at 25°C).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (μg/L).

Additional Abbreviations

mL	milliliter
m ² /m ³	square meter per cubic meter
g m ⁻² s ⁻¹	gram per square meter per second
Wm ⁻²	watt per square meter
kPa	kilopascal
J	joule
min	minute

GLOSSARY OF SELECTED TERMS

The following terms are defined as they are used in this report.

Aperture.—The width of individual fracture openings in rock. Aperture is measured across the fracture, perpendicular to the fracture length.

Base flow.—Streamflow that emanates from ground water contained in a conceptual base-flow reservoir that exists in the subsurface. It is base flow that typically sustains streamflow during rainless periods.

Brittle structures.—Fractures, joints, and faults in rocks that are the result of brittle rather than ductile deformation.

Contemporary.—This term is used in this report to indicate data that were collected as part of this study, or to indicate methods that were applied to data that were collected for this study.

Evapotranspiration.—The process of moisture moving from the surface and near-surface areas of the Earth to the atmosphere; it is the sum of evaporation from wet surfaces (leaves, wet soils and rock, surface-water bodies, for example), sublimation from snow or ice, and transpiration, which is water evaporated from plant stomates.

Fracture set.—A group of fractures that have a set of properties such as orientation or length, or both, that are similar.

Fracture network.—A group of fracture sets that comprise all of the fractures in a volume of rock.

Fracture porosity.—Porosity resulting from open fractures, faults, or cracks.

Ground water.—As used in this report, water in the subsurface under water-table conditions. Some unknown amount of ground water is not associated with local streamflow. As used in this report, ground water represents the contents of interflow and base-flow reservoirs and additional unaccounted for ground water that is not associated with local streamflow.

GSNK.—Ground water that percolates to a conceptual area of the watershed that is not available to support local streamflow.

Hydrologic response unit (HRU).—A land surface with similar slope and aspect properties defined for modeling surface and near-surface hydrologic processes.

Interflow.—Streamflow that emanates from ground water in direct response to precipitation or snowmelt, or both, that is contained in a conceptual interflow reservoir in the subsurface. Interflow may consist of streamflow contributions from subsurface areas that are saturated or perched, or some combination of both.

Interflow and base-flow reservoirs.—Conceptual subsurface portions of the watershed used for accounting purposes in runoff modeling.

Overland flow.—That part of precipitation that passes over the surface of the land and into the nearest surface-water body without first passing beneath the surface. Generally in direct response to precipitation.

Potential porosity.—An estimate of porosity made on the basis of mathematical characterizations of outcrop fracture measurements extrapolated to rock groups.

Recharge.—As used in this report, water added to the subsurface below the soil zone; it is the residual of precipitation, evapotranspiration, and overland flow. Recharge supports interflow, base flow, and underflow.

Rock group.—An assemblage of mappable rock types aggregated into a group on the basis of similarities.

Transmissivity.—Rate of movement of a volume of fluid through a medium. Units of measurement are L^2/T , where L is length and T is time.

Underflow.—Ground water that leaves the watershed by means other than streamflow or evapotranspiration.

Hydrologic Conditions and Assessment of Water Resources in the Turkey Creek Watershed, Jefferson County, Colorado, 1998–2001

By Clifford R. Bossong, Jonathan Saul Caine, David I. Stannard, Jennifer L. Flynn, Michael R. Stevens, and Janet S. Heiny-Dash

Abstract

The 47.2-square-mile Turkey Creek watershed, in Jefferson County southwest of Denver, Colorado, is relatively steep with about 4,000 feet of relief and is in an area of fractured crystalline rocks of Precambrian age. Water needs for about 4,900 households in the watershed are served by domestic wells and individual sewage-disposal systems. Hydrologic conditions are described on the basis of contemporary hydrologic and geologic data collected in the watershed from early spring 1998 through September 2001. The water resources are assessed using discrete fracture-network modeling to estimate porosity and a physically based, distributed-parameter watershed runoff model to develop estimates of water-balance terms.

A variety of climatologic and hydrologic data were collected. Direct measurements of evapotranspiration indicate that a large amount (3 calendar-year mean of 82.9 percent) of precipitation is returned to the atmosphere. Surface-water records from January 1, 1999, through September 30, 2001, indicate that about 9 percent of precipitation leaves the watershed as streamflow in a seasonal pattern, with highest streamflows generally occurring in spring related to snowmelt and precipitation. Although conditions vary considerably within the watershed, overall watershed streamflow, based on several records collected during the 1940's, 1950's, 1980's, and 1990's near the downstream part of watershed, can be as high as about 200 cubic feet per

second on a daily basis during spring. Streamflow typically recedes to about 1 cubic foot per second or less during rainless periods and is rarely zero. Ground-water level data indicate a seasonal pattern similar to that of surface water in which water levels are highest, rising tens of feet in some locations, in the spring and then receding during rainless periods at relatively constant rates until recharged. Synoptic measurements of water levels in 131 mostly domestic wells in fall of 2001 indicate a water-table surface that conforms to topography. Analyses of reported well-construction records indicate a median reported well yield of 4 gallons per minute and a spatial distribution for reported well yield that has relatively uniform conditions of small-scale variability. Results from quarterly samples collected in water year 1999 at about 112 wells and 22 streams indicate relatively concentrated calcium-bicarbonate to calcium-chloride type water that has a higher concentration of chloride than would be expected on the basis of chloride content in precipitation and evapotranspiration rates. Comparison of the 1999 data to similar data collected in the 1970's indicates that concentrations for many constituents appear to have increased. Reconnaissance sampling in the fall of 2000 indicates that most ground water in the watershed was recharged recently, although some ground water was recharged more than 50 years ago. Additional reconnaissance sampling in the spring and fall of 2001 identified some compounds indicative of human wastewater in ground water and surface water.

Outcrop fracture measurements were used to estimate potential porosities in three rock groups (metamorphic, intrusive, and fault zone) that have distinct fracture characteristics. The characterization, assuming a uniform aperture size of 100 microns, indicates very low potential fracture porosities, on the order of hundredths of a percent for metamorphic and intrusive rocks and up to about 2 percent for fault-zone rocks. A fourth rock group, Pikes Peak Granite, was defined on the basis of weathering characteristics. Short-term continuous and synoptic measurements of streamflow were used to describe base-flow characteristics in areas of the watershed underlain by each of the four rock groups and are the basis for characterization of base flow in a physically based, distributed-parameter watershed model.

The watershed model, the Precipitation-Runoff Modeling System (PRMS), was used to characterize hydrologic conditions on the basis of precipitation and air temperature in 112 hydrologic response units for which physical characteristics were derived from mostly digital data. The watershed model also was used to characterize hydrologic conditions in subsurface portions of the watershed that are associated with streamflow. The model was conditioned, using a relatively small set of parameters, to match measurements of watershed and intrawatershed streamflow and point measurements of evapotranspiration, air temperature, and soil moisture. Results from the watershed model provide simulated estimates for water-balance terms in a contemporary simulation (January 1, 1999, through September 30, 2001) using precipitation and adjusted temperature data from within the watershed, and in a long-term simulation (October 1, 1948, through September 30, 1999) using precipitation and temperature data from near the watershed. The results of both simulations indicate that, on a watershed scale, base-flow reservoirs consistently contain about enough water to cover the watershed with 0.1 to 0.2 inch of water. The long-term simulations indicate that during a year with about 14 inches of precipitation, the watershed base-flow reservoir may have about a -0.06 inch

change in contents during periods with relatively small amounts of recharge. The results from watershed simulations also indicate that contents of base-flow reservoirs vary within the watershed; base-flow reservoirs contain little or no recoverable water for significant portions of many years in about 90 percent of the watershed. In areas where base-flow reservoirs contain no water, the only source of water for wells is water that has percolated to relatively deep parts of the system that are not associated with local streamflow; water withdrawn under these conditions will need to be replaced before base flow can resume. Estimates of the amount of water withdrawn by wells in 2001 in the Turkey Creek watershed are equal to a watershed depth of about 0.43 to 0.65 inch (about 0.0012 to 0.0018 inch per day).

INTRODUCTION

Water quality, water quantity, and population growth in the foothill portions of Jefferson County are of concern to the Jefferson County Board of County Commissioners and the Planning and Zoning Department. The Planning and Zoning Department desires to meet the needs of current residents for adequate supplies of good quality water and to prepare for the projected growth and demands on the water resource from future development. The Turkey Creek watershed is representative of the foothills portions of Jefferson County. Contemporary (2001) population in the Turkey Creek watershed is estimated at 11,064 residents with projected population growth, using a 2-percent per year rate, at 13,186 residents in 2010, and 15,313 residents in 2020 (Jefferson County Planning and Zoning Department, written commun., 2001).

Water supply in the foothills portions of Jefferson County is typically derived from domestic wells developed in the fractured crystalline rocks. There are many anecdotal reports of wells “going dry” or requiring modifications to maintain production, and the prospect of continued development raises some questions regarding water supply. In addition, domestic water is treated in individual sewage-disposal systems (ISDS) and returned to the local system as ISDS effluent from leach fields, and this has raised some concerns regarding the quality of water.

An understanding of hydrologic processes, especially those related to ground water, is a fundamental step in assessing contemporary (2001) quality and quantity of ground water. Together, the U.S. Geological Survey (USGS) and Jefferson County undertook a cooperative study of hydrologic conditions and assessment of water resources in Turkey Creek watershed beginning in 1998.

Purpose and Scope

The purpose of this report is to describe contemporary (2001) hydrologic conditions and to provide a hydrologic assessment of water resources in the Turkey Creek watershed. Hydrologic conditions are described on the basis of evapotranspiration, surface water, ground water, and water quality. In addition, a description of rock-fracture characteristics based on outcrop-scale measurements is included. The watershed assessment includes estimates of fracture porosity and a characterization of water-balance terms using a watershed precipitation-runoff model.

The scope of the study includes historical climatologic data collected by study-area residents, contemporary data collected during the study from 1998 to 2001, and historical data from agencies such as the Colorado Climate Center, State Engineers Office (SEO), and the USGS. Various methods, including geologic mapping and precipitation-runoff modeling, were used to assess water resources in the study area.

Location and Setting

The study area is the 47.2-mi² Turkey Creek watershed (fig. 1), in Jefferson County southwest of Denver, Colo., in the foothills of the Front Range Section of the Southern Rocky Mountains physiographic province (Fenneman, 1931). Included in the study area are many developed areas such as Conifer, Aspen Park, and Indian Hills. It is estimated that there are about 4,900 households in the study area, or, on average, about one household for every 6 acres (Jefferson County Planning and Zoning Department, written commun., 2001). About 62 percent of households in the watershed are single-family detached homes.

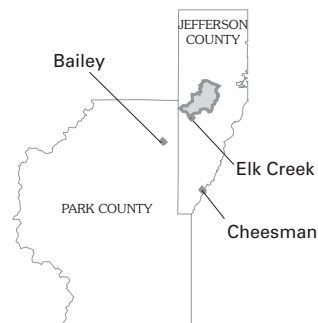
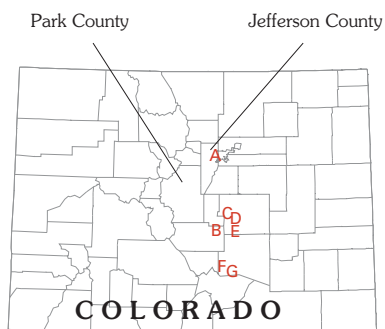
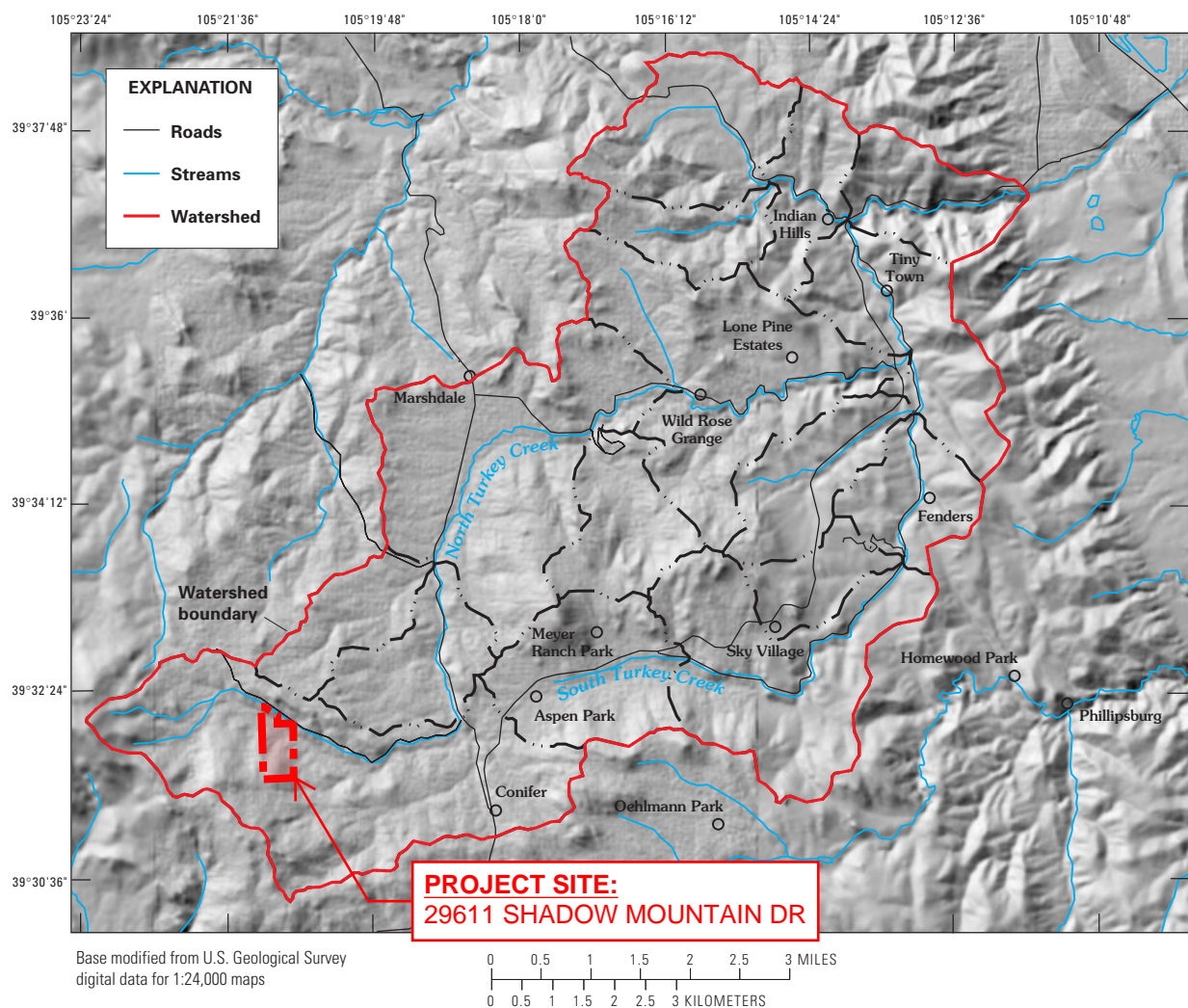
The watershed topography is mostly steep and often rocky with elevations ranging from about 10,500 ft in the southwestern part of the watershed to about 6,000 ft at the mouth of Turkey Creek canyon where the stream exits the foothills. Numerous bedrock outcrops in the study area border relatively gentle, open parks, such as Aspen Park, and stream valleys, such as North and South Turkey Creeks. Bedrock consists of fractured igneous and metamorphic crystalline rocks of Precambrian age that are extensively deformed. A more detailed geologic description is presented in the “Geologic Framework” section.

Previous Investigations

Several previous studies have been done on the chemical quality and physical quantity of the water resource in the Turkey Creek watershed. Snow (1968, 1972) and Waltz (1972) discussed the importance of fractured-bedrock aquifer characteristics in influencing the ground-water flow regime. Hofstra and Hall (1975a, 1975b) collected, compiled, and analyzed water-quality data for Phase I of an investigation to determine the effects of development on the water availability, water quality, and controlling factors in several mountain communities. Phase II of that investigation (Hall and Johnson, 1979) indicated that, although water quality was degrading, it was still acceptable for drinking. Seasonal fluctuations in water levels were observed (Hall and Johnson, 1979), and over a 3-year period there was an overall decline in water levels that may reflect short-term climatological factors or increased withdrawal from ground water. Recent work by Bruce and McMahon (1997) and Stevens and others (1997) provides water-quality data from the Turkey Creek watershed and other Front Range mountainous settings that can be compared to the results of this study.

Acknowledgments

The authors thank various local, State, and Federal agencies for their cooperation in providing information and data that were used in preparing this report, specifically the Colorado Department of Public Health and Environment; Colorado Division of Water Resources; Jefferson County Board of Commissioners; Jefferson County Planning and Zoning Department;



EXPLANATION

C Site with specific-conductance measurement

Figure 1. Location of Turkey Creek watershed in Jefferson County, Colorado; identifier and locations for sites with specific-conductance measurement; and location of Bailey, Cheesman, and Elk Creek climatologic monitoring stations.

members of the Mountain Ground-Water Resource Study Steering Committee; and the U.S. Environmental Protection Agency, Region VIII. Thanks also to Stephanie R.A. Tomusiak, Department of Geological Sciences, University of Colorado, Boulder, for her contributions to the fracture-data collection, analyses, and modeling efforts. Field assistance for outcrop measurements of fracture characteristics was provided by Ari Menitove, Jessica Beck, Sonya Cadle, Ben Glass, David Gardner, and Jared Lewis. Special appreciation also is expressed to Dick Burrows and Dorothy Hatch, dedicated volunteers that made monthly water-level measurements throughout the watershed during the study, as well as individuals who collected precipitation data, and homeowners who allowed various activities on their property such as water-level measurements, precipitation measurements, access to outcrops for fracture measurements, access to stream-sampling sites, and ground-water sample collection.

GEOLOGIC FRAMEWORK

A compilation of existing USGS geologic quadrangle maps for the Turkey Creek watershed shows a complex arrangement of Precambrian-age crystalline metamorphic and intrusive rock types (fig. 2 and table 1; Char, 2000, modified from Sheridan and others, 1972; Bryant and others, 1973; Scott, 1972; Bryant, 1974). Figure 3 is a simplified version of the geology shown in figure 2 and the rock types in table 1, produced by combining individual rock types into rock groups. Rock groups were identified on the basis of lithologic similarity, structural history, and geologic setting. For each rock group it is assumed that (1) ground-water flow and storage predominantly occurs in fracture networks, and that (2) because each rock group is composed of similar rock types that have a similar geological history and response to brittle deformation, they will exhibit similar hydrogeological properties (for example, porosity). Three important rock groups that contain subgroups were used to aid in establishing a geologic and hydrologic framework model. The rock groups are (1) metamorphosed and foliated gneisses and schists, referred to as the “metamorphic rock group;” (2) large-scale intrusive quartz monzonites found in plutons and consisting mostly of the Silver Plume Quartz Monzonite, referred to as the “intrusive rock group;” and (3) major fault zones that cut all rock types, referred to as the “fault-zone rock group” (fig. 3). Further division of the metamorphic and intrusive rock

groups results in three subgroups: (1a) amphibolites, calc-silicates, and quartzites, (2a) the Pikes Peak Granite, and (2b) granitic pegmatite dikes that cross-cut the metamorphic and intrusive rock groups (table 1). The metamorphic, intrusive, and fault-zone rock groups plus subgroup 2a (the Pikes Peak Granite) are collectively referred to as the “four rock groups” in this report; group 1a is included in the metamorphic rocks and group 2b is included in the intrusive rocks.

The major rock types include approximately 1.7-billion-year-old gneisses and schists (metamorphic rocks). These rocks are typically well layered due to original compositional variations and metamorphic processes (Bryant, 1974; Bryant and others, 1975). They are part of the Turkey Creek Formation and are similar to the rocks in the Idaho Springs Formation (Lickus and LeRoy, 1968). The metamorphic rocks are intruded or cut by the approximately 1.4-billion-year-old Silver Plume Quartz Monzonite, which is a rock type similar to granite (intrusive rocks) (Bryant, 1974). These intrusive rocks are heterogeneously distributed in the watershed. The intrusive bodies range in size from small, dike-like features 50–100 ft long to large and irregular pluton-like bodies with large apophyses miles long. Pegmatitic dikes also cut the intrusive rocks. The pegmatites are highly irregular in shape and size and are less than a few feet to several miles long.

The major geologic structures in the watershed include folds and fault zones. The layering in the metamorphic rocks is generally steeply to moderately tilted and generally strikes northwest to southeast. This tilting is associated with the proximity of the observed outcrops to the limbs of several regional scale folds (Bryant and others, 1973). Many local-to outcrop-scale folds and highly contorted layering zones are present throughout the watershed.

A variety of brittle fault structures or fault zones are present in the watershed (fig. 3), and the Appendix contains a detailed discussion of these features. Brittle fault zones are in the form of unusually wide fracture networks (tens of feet to greater than miles wide) where most of the zone is composed of open fractures with little offset on them and a few discrete fractures where most of the offset has occurred. Other brittle fault zones are relatively narrow (a few feet wide) fault breccia zones that have anastomosing and discrete fractures where motion has taken place and where fracture networks have been mineralized with quartz, calcite, and other associated minerals.

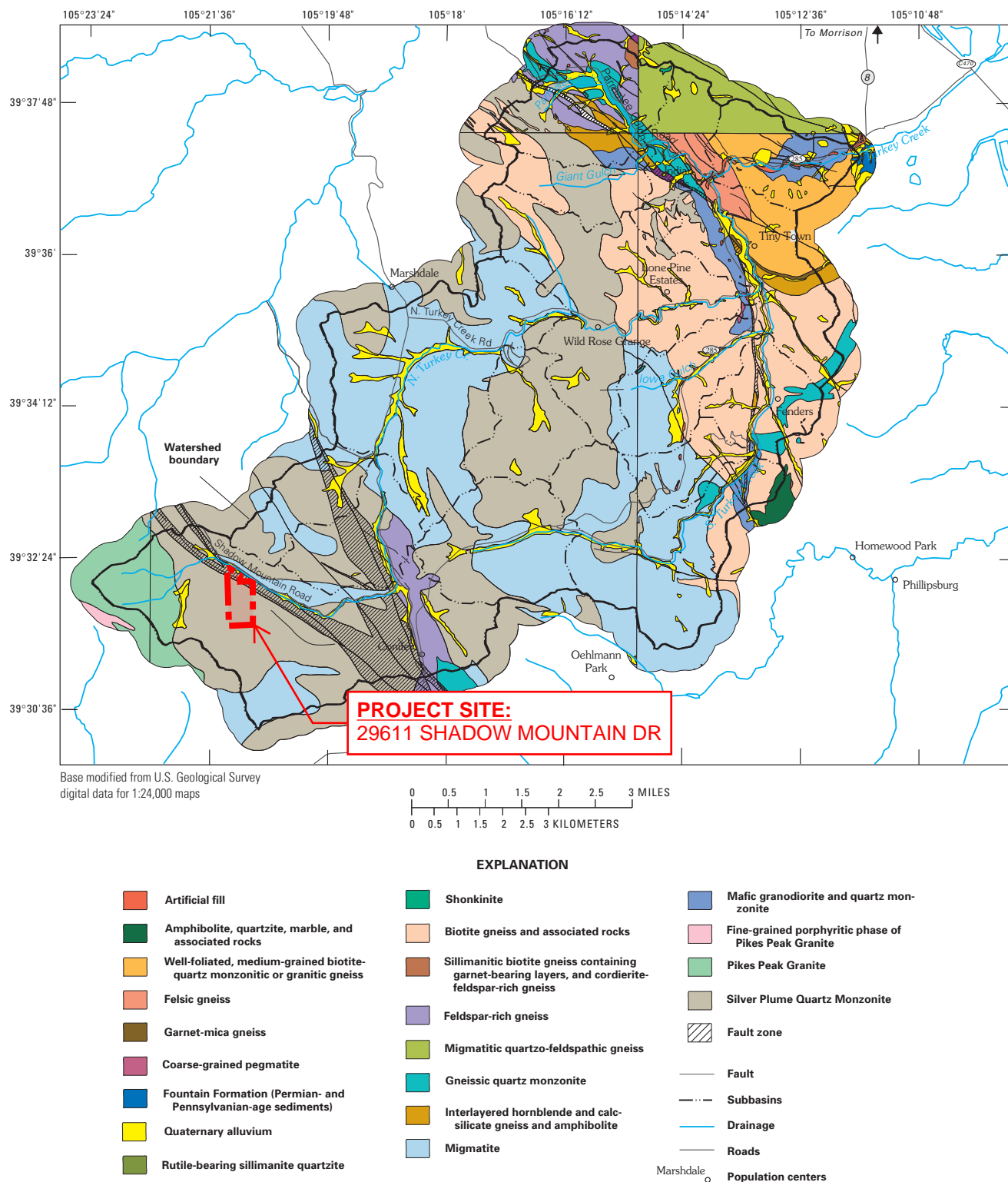


Figure 2. Compilation of parts of the existing Evergreen, Indian Hills, Morrison, Conifer, and Meridian Hills U.S. Geological Survey Geologic Quadrangle Maps.

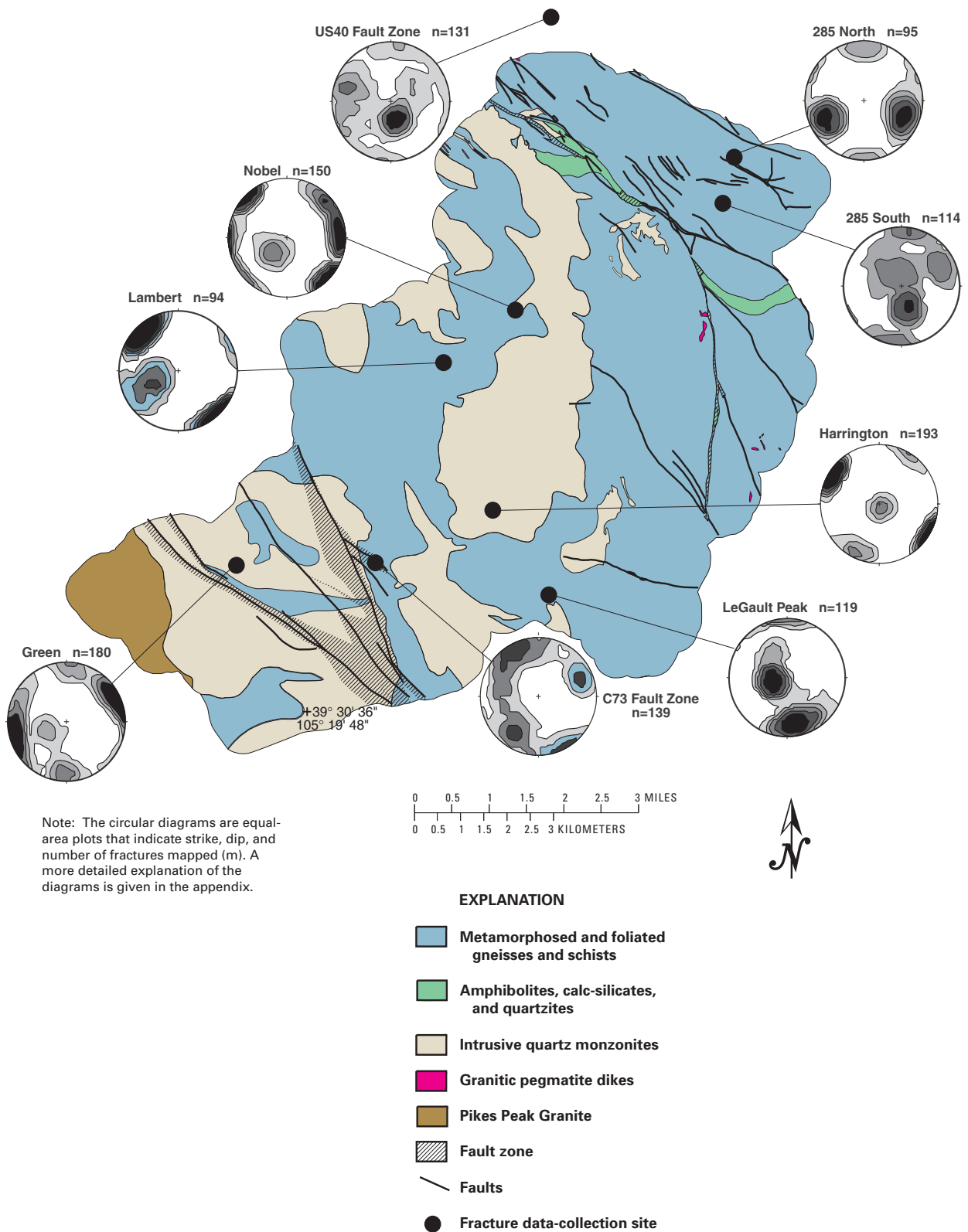


Figure 3. Simplified geologic map, locations of outcrops where fracture characteristics were measured or observed, and fracture-orientation data for measurements at each location.

Table 1. Individual rock types assigned to rock groups in the Turkey Creek watershed

[Individual rock types taken from the explanation in figure 2 are assigned to rock groups based on lithologic similarity, structural history, and geologic setting. The groups include (1) metamorphosed and foliated gneisses and schists; (1a) amphibolites, calc-silicates, and quartzites; (2) large-scale intrusive quartz monzonites found in plutons and consisting mostly of the Silver Plume Quartz Monzonite; (2a) Pikes Peak Granite and other granites; (2b) granitic pegmatites; and (3) major fault zones that cut all rock types. NP indicates rock types not present in the study area and Quaternary-age deposits have not been included. Y indicates Precambrian-age rocks that formed between 1.04 and 1.44 billion years ago, and X indicates rocks between 1.71 and 1.75 billion years old for this area. All other units are undated Precambrian-age rocks unless otherwise stated. The following is from Char, 2000, modified from Sheridan and others, 1972; Bryant and others, 1973; Scott, 1972; and Bryant, 1974]

Rock type name	Rock group assignment
Shonkinites	NP
Fountain Formation (Permian and Pennsylvanian-age sediments)	NP
Pikes Peak Granite	2a
Silver Plume Quartz Monzonite	2
Fine-grained porphyritic phase of Pikes Peak Granite	2a
Granitic rock	2a
Coarse-grained pegmatite	2b
Mafic granodiorite and quartz diorite	2
Gneissic granodiorite and quartz monzonite	1
Gneissic quartz monzonite	1
Migmatitic quartz-feldspathic gneiss	1
Migmatite	1
Amphibolite, quartzite, marble, and associated rocks	1a
Amphibolite	1a
Biotite gneiss and associated rocks	1
Sillimanitic biotite gneiss containing garnet-bearing layers, and cordierite-feldspar-rich gneiss	1
Interlayered hornblende and calc-silicate gneiss and amphibolite	1a
Feldspar-rich gneiss	1
Garnet-mica gneiss	1
Well-foliated, medium-grained biotite-quartz monzonitic or granitic gneiss	1
Felsic gneiss	1
Rutile-bearing sillimanite quartzite	1a
Fault zone	3

The Colorado Rocky Mountain Front Range has a long and complex geologic history and associated brittle deformation. There are at least three generations of brittle deformation associated with the Precambrian rock in the watershed: (1) early Paleozoic-age burial and late Paleozoic-age Ancestral Rocky Mountain uplift, (2) mid- to late Mesozoic-age burial and late Mesozoic-age to early Cenozoic-age Laramide uplift, and (3) late Cenozoic-age volcanism, uplift, and possible extension (for example, Sonnenberg and Bolyard, 1997). This protracted geologic history and the response of the various rock types to deformation led to the complex joint (fractures with no shearing motion along them) and fault patterns that are observed today. The Turkey Creek watershed

represents a relatively undeformed portion of the Front Range relative to areas to the north in the Colorado Mineral Belt (Tweto and Sims, 1963).

Quaternary-age alluvium in the Turkey Creek watershed is sparse and is present primarily along stream channels and in open areas locally known as parks (fig. 2). The dominant soil types (stony loams to rock outcrops) are generally thin (about 2 to 3 ft thick), have generally low water availability, have moderate to high permeability, and are on moderate to steep slopes (U.S. Department of Agriculture, 1980). In addition, locally derived, very near-surface, bedrock weathering may be hydraulically significant. Thicker zones of weathered bedrock exist predominantly where there are coarse-grained intrusive rocks,

especially overlying the Pikes Peak Granite. Significant areas of weathered bedrock also occur where there are metamorphic rocks that are dominantly composed of hornblende and a variety of amphiboles. Field observations and anecdotal information from water-well drillers indicate that weathered bedrock is rare to absent except in the southwestern part of the watershed where the Pikes Peak Granite crops out (fig. 2). Weathering probably extends to depths of about 10 ft or less and is nonuniformly distributed where the Pikes Peak Granite crops out and in particular where it has been glaciated.

Surficial deposits of alluvium and soils are thin and not present everywhere in the Turkey Creek watershed; although the surficial deposits contain water, most wells in the watershed are completed in the crystalline bedrock and most water used for domestic supply in the watershed is withdrawn from the crystalline bedrock. The crystalline bedrock has very low primary, or intergranular, porosity; rather, open space that may contain water in the crystalline rocks consists mostly of fractures and fracture networks. The fractured bedrock aquifer system in the Turkey Creek watershed is the fractures and fracture networks in the crystalline rocks.

DATA COLLECTION AND METHODS

Data used as part of this study are described in this section. Data collected in previous USGS studies and data compiled or collected by other agencies are referred to as “historical data,” and data collected as part of this study, beginning in 1998 and continuing through September 2001, are referred to as “contemporary data.” Some of the methods used in analyzing these data also are described in this section. Detailed descriptions of specialized methods used in developing estimates of fracture-network porosity, measurements of evapotranspiration, and characterization of spatial characteristics for some well-construction records are described in the Appendix. The preferred system of units for reporting in this report is the English inch-pound system; however, some data, such as those related to energy measures and rock fractures, are described in metric units as this is a standard and accepted practice.

Historical Data

Much data for the Turkey Creek watershed collected as part of previous studies or maintained by agencies other than the USGS were used in this study. These data provide some descriptions of historical climatologic, streamflow, ground-water level, and water-quality conditions in or around the watershed. The data also include well-construction records available from the Colorado State Engineer’s Office (SEO) and miscellaneous data available from the Jefferson County Planning and Zoning Department including summaries of U.S. Census Bureau information, projections of population growth, locations of occupied households, some historical land-use classifications, and digital orthophoto imagery.

The Colorado Climate Center, in cooperation with the National Weather Service, maintains climatologic records for many locations in Colorado (Colorado Climate Center, 2002). Records for precipitation and daily air temperature extremes from three stations—Bailey (station 50454), Cheesman (station 51528), and Elk Creek (station 52633)—were used as part of this study (fig. 1). In addition, a detailed precipitation record covering more than 40 years (1956–99) was available from John and Marguerite Schoonhoven of Flying J Ranch (RG12 in table 2). Several other intermittent and short-term records of snowfall and temperature were available from various sources.

Historical records include those collected previous to this study and consist of data from two stream gages on Turkey Creek in the vicinity of the present gage (06710992, fig. 4). A summary for time-series data indicating periods of record for stream gages and other data is presented in table 2. Some historical records, from the late 1980’s, of surface-water discharge, or streamflow, in the Turkey Creek watershed are available from the Automatic Data Processing System (ADAPS) part of the National Water Inventory System (NWIS) (Bartholoma, 1997). NWIS is a computer system established by the USGS to manage and provide some analytical capabilities for a wide variety of hydrologic information; ADAPS addresses continuous records of many hydrologic data, including surface-water records. Additional historical records of streamflow from the 1940’s and 1950’s are not included in the NWIS but have been compiled in publications (U.S. Geological Survey, 1942–53).

Table 2. List of sites with time-series records

[Note: primary identifier, U.S. Geological Survey (USGS) station identification number or National Weather Service (NWS) station number; identifier type refers to source for identifier (1 - USGS, 2 - Colorado Climate Center, 3 - State Engineers Office); Local identifier, local identifier used by this study; Location, latitude and longitude in nad27; Elevation, feet above NGVD29; Type, defines type of data collected at site (1 - total daily precipitation [a - tipping bucket, b - weighing bucket], 2 - daily minimum and maximum air temperature, 3 - mean daily discharge, 4 - soil moisture, 5 - solar radiation, 6 - evapotranspiration, 7 - daily mean diversion, 8 - intermittent or monthly depth-to-water measurements, 9 - mean daily depth to water); --, not applicable]

Identifier							
primary	type	local	Location	Elevation	Type	Period of record	Site name
DISCHARGE AND DIVERSIONS							
06710992	1	--	393703 1051324	6420	3	April 13, 2001 - continuing	Turkey Creek near Indian Hills
06710995	1	SWA01	393713 1051141	6040	3	April 1, 1998 - April 13, 2001	Turkey Creek at mouth of Canyon near Morrison
06711040	1	--	393827 1050934	5635	3	June 19, 1942 - September 30, 1953	Turkey Creek above Bear Creek Lake near Morrison
06711000	1	--	393809 1051003	--		April 25, 1986 - September 30, 1989	Turkey Creek near Morrison
393203105221600	1	STR-1	393203 1052216	9100	3	April 10, 2001 - August 1, 2001	North Turkey Creek upper tributary above Aspen Park
393210105205500	1	STR-2	393210 1052055	8435	3	April 10, 2001 - August 1, 2001	North Turkey Creek above Warhawk near Aspen Park
393141105200500	1	STR-3	393141 1052005	8350	3	April 17, 2001 - August 1, 2001	North Turkey Creek tributary above Aspen Park
393443105165800	1	STR-4	393443 1051658	7615	3	April 13, 2001 - August 1, 2001	North Turkey Creek tributary near Gartner Drive near Aspen Park
--	3	head 12	393714 1051155	6115	7	-- - --	Headgate Independent Highline # 12
--	3	head 27	393714 1051141	6015	7	-- - --	Headgate Bergen # 27
CLIMATOLOGIC							
393213105142100	1	RG1	393213 1051421	7460	1a	December 1, 1998 - September 30, 2001	RG1
393145105195900	1	RG2	393145 1051959	8250	1a	no record	RG2
393204105141700	1	RG3	393204 1051417	7900	1a	December 1, 1998 - September 30, 2001	RG3
393404105182701	1	RG4	393404 1051822	7820	1a	December 1, 1998 - September 30, 2001	RG4
393143105135600	1	RG5	393143 1051356	8480	1a	December 1, 1998 - September 30, 2001	RG5
393459105170300	1	RG6	393459 1051703	7560	1a	December 1, 1998 - September 30, 2001	RG6
393552105144201	1	RG7	393552 1051442	7480	1a	December 1, 1998 - September 30, 2001	RG7
393700105114500	1	RG8	393700 1051145	6040	1b,2	August 28, 1998 - September 30, 2001	RG8/AT1
393423105131000	1	RG9	393423 1051310	7160	1b	September 23, 1998 - September 30, 2001	RG9
393249105181900	1	RG10	393248 1051819	8240	1b	February 2, 1999 - September 30, 2001	RG10
393340105201500	1	RG11	393340 1052015	8180	1b	November 25, 1998 - November 23, 2001	RG11
--	1	RG12	393237 1051912	7980	1,2	January 1, 1956 - December 30, 1999	RG12
50454	1	RG13	392421 1052822	7730	11,2	August 1, 1948 - December 31, 1997	Bailey
51520	2	RG14	391313 1051640	6890	11,2	August 1, 1948 - June 30, 2000	Cheesman
52633	2	RG15	392953 1052000	8440	11,2	August 1, 1948 - September 30, 1951	Elk Creek
--	2	RG16	393227 1051925	8180	1a,2,4,5,6	February 3, 1999 - December 31, 2001	RG16/ ET Forest site/ ET Tower
--	2	RG17	393429 1051638	7770	1a,2,4,5,6	June 2, 2000 - December 31, 2001	RG17/ ET Meadow site
--	2	RG18	393429 1051638	7770	1b	December 6, 2000 - September 30, 2001	RG18/ ET Forest site
--	2	AT2	393104 1052109	9760	2	April 1, 2001 - September 30, 2001	Elk Creek Fire Station at Conifer Mountain
--	2	AT3	393304 1051621	8200	2	March 23, 2001 - September 30, 2001	North Meyer Ranch Park
--	2	AT4	393223 1051624	8200	2	March 23, 2001 - September 30, 2001	South Meyer Ranch Park
DEPTH TO WATER							
393821105161001	1	MH1	393820 1051612	7310	8	September 5, 1973 - February 14, 1983	MH1
					9	August 25, 1998 - continuing	
					9	May 23, 2001 - September 30, 2001	
393604105132100	1	MH2	393604 1051321	6900	8	November 4, 1998 - continuing	MH2
393513105181300	1	MH3	393513 1051813	7751	8	July 9, 1998 - continuing	MH3
393459105165701	1	MH4	393459 1051657	7672	8	December 3, 1998 - continuing	MH4
393350105184401	1	MH5	393350 1051844	7900	8	September 5, 1973 - February 14, 1983	MH5
					9	August 25, 1998 - continuing	
					9	May 23, 2001 - September 30, 2001	
393348105171400	1	MH6.1	393348 1051714	8375	8	December 3, 1998 - continuing	MH6.1
393344105171400	1	MH6.2	393344 1051714	8352	8	December 3, 1998 - continuing	MH6.2
393342105171500	1	MH6.3	393342 1051715	8340	8	December 3, 1998 - continuing	MH6.3
39333210515 800	1	MH7	393332 1051508	8337	8	December 3, 1998 - continuing	MH7
393301105150201	1	MH8	393301 1051532	8050	8	September 6, 1973 - February 14, 1983	MH8
					9	July 9, 1998 - continuing	
					9	May 23, 2001 - September 30, 2001	
393121105110600	1	MH9	393121 1051106	6720	8	September 6, 1973 - February 14, 1983	MH9
					9	August 25, 1998 - September 30, 2001	
392958105164601	1	MH10	392958 1051646	7950	8	September 6, 1973 - February 14, 1983	MH10
					9	August 25, 1998 - September 30, 2001	
393112105182100	1	MH11	393112 1051821	8477	8	June 18, 1998 - continuing	MH11
393143105195400	1	MH12	393143 1051954	8187	8	July 10, 1998 - continuing	MH12
393717105145300	1	MH13	393717 1051453	7279	8	May 11, 1999 - continuing	MH13

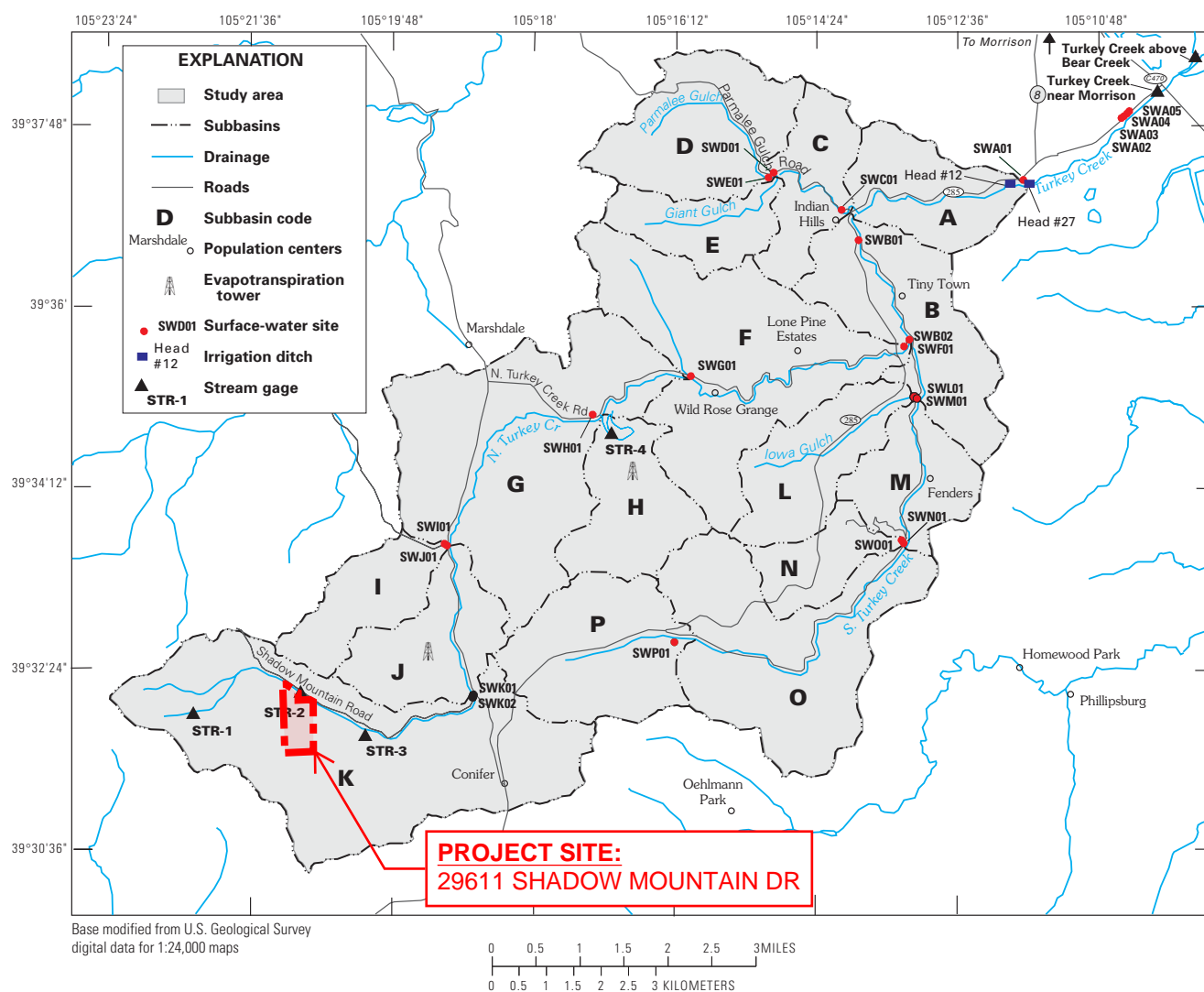


Figure 4. Locations of surface-water streamflow measurement and sampling sites, stream gages, and irrigation ditches.

Two stream gages on Turkey Creek were operated by the USGS at various times previous to this study. Station 06711040, Turkey Creek above Bear Creek Lake near Morrison, about 1.5 mi downstream from the present gage (station 06710992) (fig. 4), has data available from April 25, 1986, through September 30, 1989. Station 06711000, Turkey Creek near Morrison, about 1 mi downstream from the present gage, has data available from June 19, 1942, through September 30, 1953. Diversions from Turkey Creek upstream from these stations complicate streamflow records. Although streamflow records at these stations have an acceptable level of accuracy, they are not representative of stream regulation that occurs upstream from the gages. Regulation activity

typically consists of diversions. The water diverted from streams is not measured at the gages; consequently, the gage record is “low biased,” or consistently less than the sum of measured streamflow and the diversion, during times of diversion. Regulation also may include addition of water to streams. Records for diversions from the Independent Highline and Bergen ditches (fig. 4) are available from the SEO; other records from potential additional diversions or additions are not available.

The SEO is responsible for issuing permits for well construction in Colorado. As part of the permitting process, many well-construction details are obtained by the SEO and retained in their files. Many of these data, such as legal description, drillers’ logs,

and well-completion diagrams, are only available in paper format or scanned images of original paper copies. However, some data are available electronically as digital records. The SEO has about 3,300 digital well records with construction details on file for the Turkey Creek watershed. About 1,100 of those wells, referred to in this report as “permitted wells,” have defined locations that are shown in figure 5. The digital data describe reported well yield, total depth, and depth to water.

Water-quality data from previous studies were available for use in this study. Most of these data were collected in the 1970’s as part of the work by Hofstra and Hall (1975a) and Hall and others (1981). Bruce and McMahon (1997) also collected water-quality data

from a number of wells in Front Range settings, a few of which are in the watershed. In addition, Bruce and McMahon (1997) and Stevens and others (1997) collected water-quality data from wells completed in fractured rocks in other Front Range areas that can be compared to data collected during this study. All of these data include analyses for many water-quality properties and constituents addressed by this study as well as other constituents that are useful to this study. The locations for samples collected during previous studies in the Turkey Creek watershed are shown in figure 6. Univariate statistics for water-quality properties and constituents including major ions and some nutrients collected in previous studies are listed in table 3.

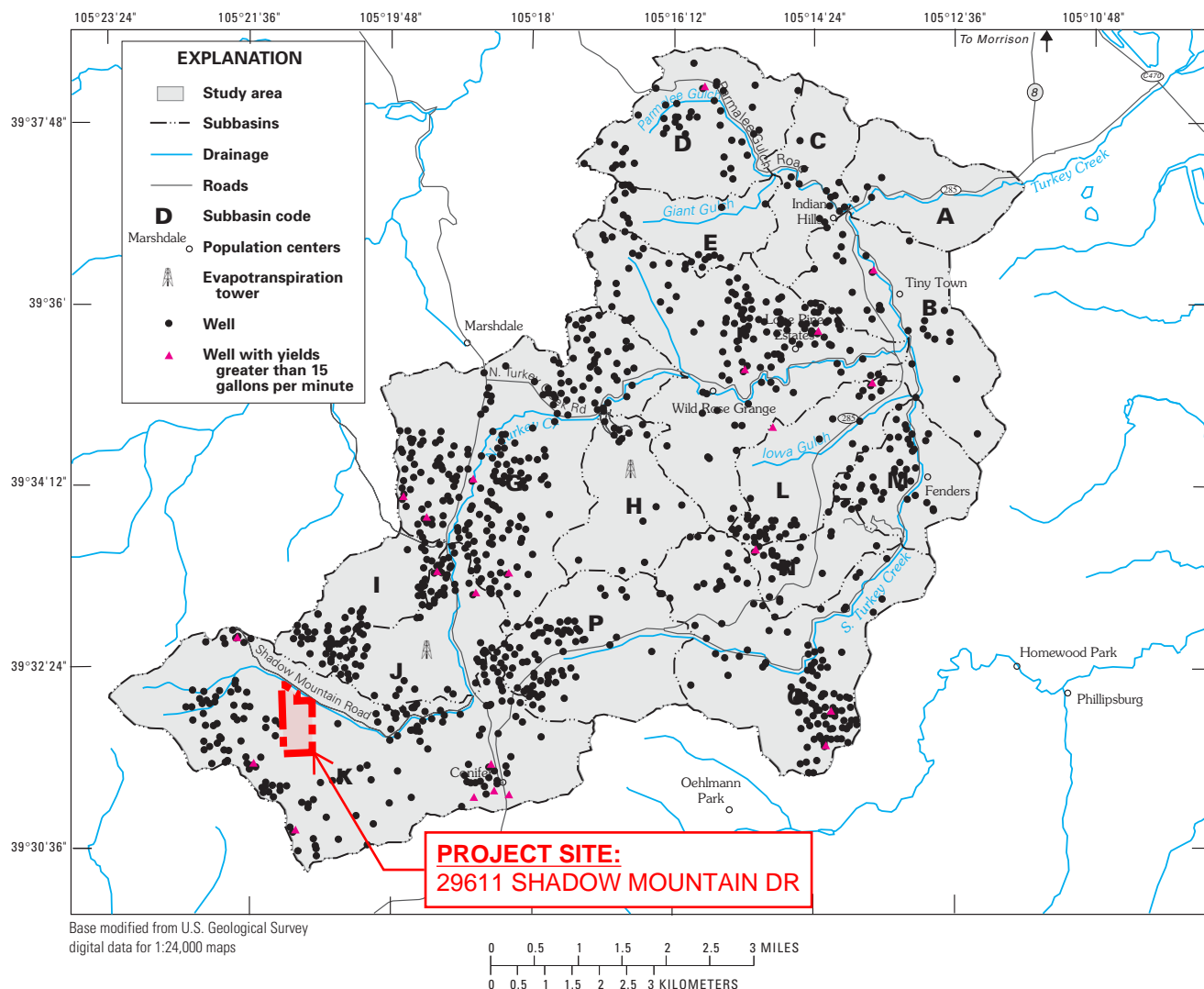


Figure 5. Locations of permitted wells from the State Engineers Office.



United States
Department of
Agriculture

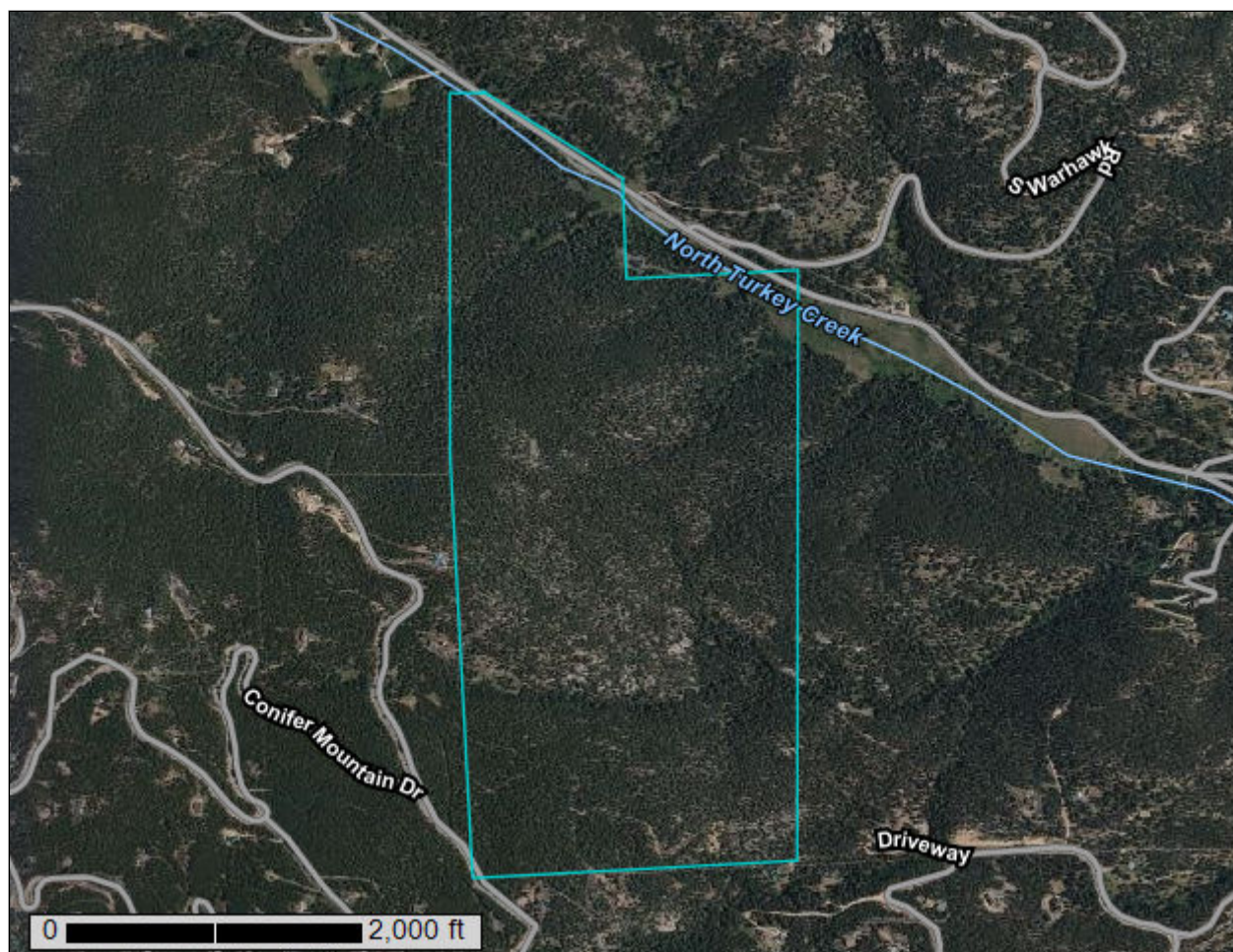
NRCS

Natural
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A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Golden Area, Colorado, Parts of Denver, Douglas, Jefferson, and Park Counties

Shadow Mountain Bike Park



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

Custom Soil Resource Report

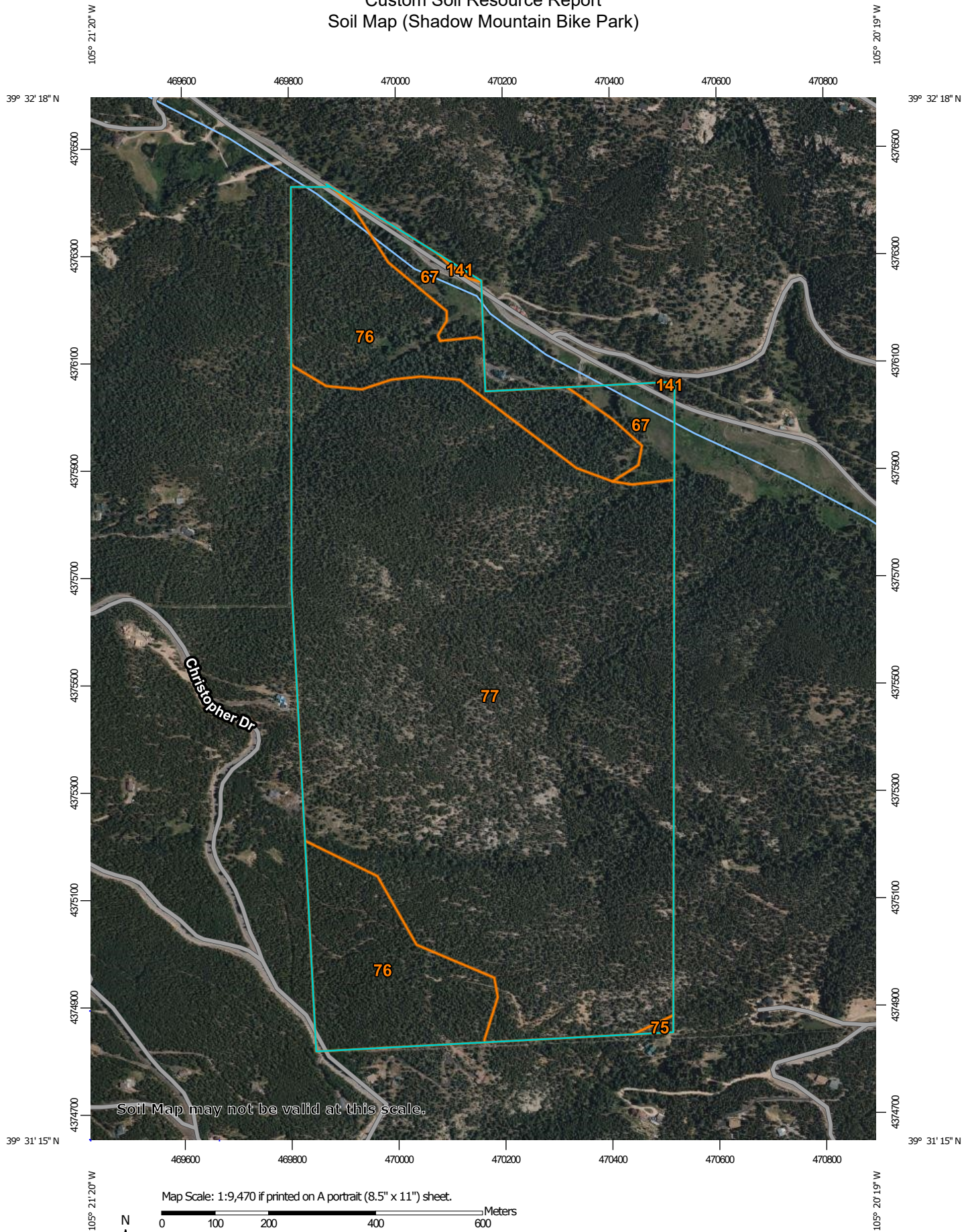
identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report

Soil Map (Shadow Mountain Bike Park)



Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils


 Soil Map Unit Polygons


 Soil Map Unit Lines


 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit


 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop


 Saline Spot

 Sandy Spot

 Severely Eroded Spot


 Sinkhole


 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals


Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Golden Area, Colorado, Parts of Denver, Douglas, Jefferson, and Park Counties
Survey Area Data: Version 16, Aug 31, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 1, 2020—Jul 2, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Shadow Mountain Bike Park)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
67	Kittredge-Earcree complex, 9 to 20 percent slopes	10.1	4.2%
75	Legault-Hiwan stony loamy sands, 5 to 15 percent slopes	0.3	0.1%
76	Legault-Hiwan stony loamy sands, 15 to 30 percent slopes	48.5	20.3%
77	Legault-Hiwan-Rock outcrop complex, 30 to 50 percent slopes	179.8	75.3%
141	Rogert, very stony-Herbman-Rock outcrop complex, 30 to 70 percent slopes	0.2	0.1%
Totals for Area of Interest		238.9	100.0%

Map Unit Descriptions (Shadow Mountain Bike Park)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a

given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Golden Area, Colorado, Parts of Denver, Douglas, Jefferson, and Park Counties

67—Kittredge-Earcree complex, 9 to 20 percent slopes

Map Unit Setting

National map unit symbol: jppt
Elevation: 7,600 to 9,500 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 41 to 43 degrees F
Frost-free period: 55 to 75 days
Farmland classification: Not prime farmland

Map Unit Composition

Kittredge and similar soils: 45 percent
Earcree and similar soils: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kittredge

Setting

Landform: Mountain slopes, terraces
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainbase, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium and/or colluvium derived from igneous and metamorphic rock

Typical profile

H1 - 0 to 8 inches: sandy loam
H2 - 8 to 29 inches: sandy clay loam
H3 - 29 to 60 inches: sandy loam

Properties and qualities

Slope: 9 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R048AY222CO - Loamy Park
Hydric soil rating: No

Description of Earcree

Setting

Landform: Alluvial fans

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Noncalcareous, gravelly and loamy alluvium and/or colluvium derived from igneous and metamorphic rock

Typical profile

H1 - 0 to 11 inches: gravelly sandy loam

H2 - 11 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 9 to 20 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: A

Ecological site: R048AY222CO - Loamy Park

Hydric soil rating: No

Minor Components

Cryofluvents

Percent of map unit: 3 percent

Landform: Flood plains

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: R048AY010UT - Wet Fresh Streambank (Willow)

Hydric soil rating: No

Urban land

Percent of map unit: 3 percent

Hydric soil rating: No

Rogert

Percent of map unit: 3 percent

Landform: Ridges

Landform position (two-dimensional): Summit, shoulder

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Convex

Across-slope shape: Convex

Ecological site: F048AY908CO - Mixed Conifer

Hydric soil rating: No

Troutdale

Percent of map unit: 3 percent
Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex, linear
Across-slope shape: Linear
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Venable

Percent of map unit: 3 percent
Landform: Terraces, flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R048AY241CO - Mountain Meadow
Hydric soil rating: Yes

75—Legault-Hiwan stony loamy sands, 5 to 15 percent slopes

Map Unit Setting

National map unit symbol: jpq3
Elevation: 7,600 to 10,000 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 41 to 43 degrees F
Frost-free period: 55 to 75 days
Farmland classification: Not prime farmland

Map Unit Composition

Legault and similar soils: 45 percent
Hiwan and similar soils: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Legault

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Linear, convex
Parent material: Acidic, gravelly, stony, and sandy residuum weathered from igneous and metamorphic rock

Typical profile

H1 - 0 to 2 inches: gravelly loamy sand
H2 - 2 to 14 inches: very gravelly loamy sand
H3 - 14 to 18 inches: weathered bedrock

Custom Soil Resource Report

Properties and qualities

Slope: 5 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 0.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Description of Hiwan

Setting

Landform: Mountain slopes, ridges
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Mountainflank, crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Acidic, stony, gravelly, and sandy residuum weathered from igneous and metamorphic rock

Typical profile

H1 - 0 to 1 inches: very gravelly loamy sand
H2 - 1 to 15 inches: very gravelly loamy sand
H3 - 15 to 19 inches: unweathered bedrock

Properties and qualities

Slope: 5 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 0.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Minor Components

Earcree

Percent of map unit: 3 percent
Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Grimstone

Percent of map unit: 3 percent
Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Peeler

Percent of map unit: 3 percent
Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: F048AY908CO - Mixed Conifer
Other vegetative classification: ABLA-PIEN/VASC (subalpine fir, Engelmann's spruce, grouse whortleberry) (null_6)
Hydric soil rating: No

Rock outcrop

Percent of map unit: 3 percent
Landform: Mountain slopes, ridges
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Free face, mountainflank, side slope, crest, free face
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Herbman

Percent of map unit: 2 percent
Landform: Mountain slopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Mountaintop, mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Urban land

Percent of map unit: 1 percent
Hydric soil rating: No

76—Legault-Hiwan stony loamy sands, 15 to 30 percent slopes

Map Unit Setting

National map unit symbol: jpq4
Elevation: 7,600 to 10,000 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 41 to 43 degrees F
Frost-free period: 55 to 75 days
Farmland classification: Not prime farmland

Map Unit Composition

Legault and similar soils: 45 percent
Hiwan and similar soils: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Legault

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Convex, linear
Parent material: Acidic, gravelly, stony, and sandy residuum weathered from igneous and metamorphic rock

Typical profile

H1 - 0 to 1 inches: gravelly loamy sand
H2 - 1 to 13 inches: very gravelly loamy sand
H3 - 13 to 17 inches: weathered bedrock

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 0.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Description of Hiwan

Setting

Landform: Mountain slopes, ridges

Landform position (two-dimensional): Shoulder, backslope, summit

Landform position (three-dimensional): Mountainflank, crest

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Acidic, stony, gravelly, and sandy residuum weathered from igneous and metamorphic rock

Typical profile

H1 - 0 to 1 inches: very gravelly loamy sand

H2 - 1 to 15 inches: very gravelly loamy sand

H3 - 15 to 19 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 30 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Very low (about 0.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: D

Ecological site: F048AY908CO - Mixed Conifer

Hydric soil rating: No

Minor Components

Grimstone

Percent of map unit: 3 percent

Landform: Mountain slopes

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Mountainflank

Down-slope shape: Convex, linear

Across-slope shape: Convex, linear

Ecological site: F048AY908CO - Mixed Conifer

Hydric soil rating: No

Rock outcrop

Percent of map unit: 3 percent

Landform: Mountain slopes, ridges

Landform position (two-dimensional): Shoulder, backslope, summit

Landform position (three-dimensional): Mountainflank, free face, side slope, crest, free face

Down-slope shape: Convex, linear

Across-slope shape: Convex, linear

Hydric soil rating: No

Peeler

Percent of map unit: 3 percent
Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: F048AY908CO - Mixed Conifer
Other vegetative classification: ABLA-PIEN/VASC (subalpine fir, Engelmann's spruce, grouse whortleberry) (null_6)
Hydric soil rating: No

Earcree

Percent of map unit: 3 percent
Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Herbman

Percent of map unit: 2 percent
Landform: Mountain slopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Mountaintop, mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Urban land

Percent of map unit: 1 percent
Hydric soil rating: No

77—Legault-Hiwan-Rock outcrop complex, 30 to 50 percent slopes

Map Unit Setting

National map unit symbol: jpq5
Elevation: 7,600 to 10,000 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 41 to 43 degrees F
Frost-free period: 55 to 75 days
Farmland classification: Not prime farmland

Map Unit Composition

Legault and similar soils: 35 percent
Hiwan and similar soils: 30 percent
Rock outcrop: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Legault

Setting

Landform: Ridges, mountain slopes

Landform position (three-dimensional): Mountainflank, crest

Down-slope shape: Convex, linear

Across-slope shape: Convex, linear

Parent material: Acidic, gravelly, stony, and sandy residuum weathered from igneous and metamorphic rock

Typical profile

H1 - 0 to 1 inches: gravelly loamy sand

H2 - 1 to 13 inches: very gravelly loamy sand

H3 - 13 to 17 inches: weathered bedrock

Properties and qualities

Slope: 30 to 50 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Very low (about 0.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: D

Ecological site: F048AY908CO - Mixed Conifer

Hydric soil rating: No

Description of Hiwan

Setting

Landform: Mountain slopes, ridges

Landform position (two-dimensional): Shoulder, backslope, summit

Landform position (three-dimensional): Mountainflank, crest

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Acidic, stony, gravelly, and sandy residuum weathered from igneous and metamorphic rock

Typical profile

H1 - 0 to 1 inches: very gravelly loamy sand

H2 - 1 to 15 inches: very gravelly loamy sand

H3 - 15 to 19 inches: unweathered bedrock

Properties and qualities

Slope: 30 to 50 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

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Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 0.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Mountain slopes, ridges
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Mountainflank, free face, side slope, crest, free face
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Igneous and metamorphic rock

Typical profile

H1 - 0 to 60 inches: unweathered bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Grimstone

Percent of map unit: 3 percent
Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Herbman

Percent of map unit: 3 percent
Landform: Mountain slopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Mountaintop, mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Rogert

Percent of map unit: 3 percent
Landform: Mountain slopes
Landform position (two-dimensional): Shoulder, backslope

Custom Soil Resource Report

Landform position (three-dimensional): Upper third of mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Peeler

Percent of map unit: 3 percent
Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: F048AY908CO - Mixed Conifer
Other vegetative classification: ABLA-PIEN/VASC (subalpine fir, Engelmann's spruce, grouse whortleberry) (null_6)
Hydric soil rating: No

Tolvar

Percent of map unit: 3 percent
Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

141—Rogert, very stony-Herbman-Rock outcrop complex, 30 to 70 percent slopes

Map Unit Setting

National map unit symbol: 2tz4y
Elevation: 7,590 to 10,000 feet
Mean annual precipitation: 17 to 23 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 25 to 75 days
Farmland classification: Not prime farmland

Map Unit Composition

Rogert, very stony, and similar soils: 45 percent
Herbman and similar soils: 30 percent
Rock outcrop: 15 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rogert, Very Stony

Setting

Landform: Ridges, mountain slopes

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Mountaintop, upper third of mountainflank

Down-slope shape: Linear, convex

Across-slope shape: Linear, convex

Parent material: Colluvium over residuum weathered from igneous and metamorphic rock

Typical profile

A - 0 to 8 inches: very cobbly sandy loam

C - 8 to 16 inches: very gravelly sandy loam

R - 16 to 79 inches: bedrock

Properties and qualities

Slope: 30 to 70 percent

Surface area covered with cobbles, stones or boulders: 2.0 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high
(0.01 to 0.57 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Very low (about 1.0 inches)

Interpretive groups

Land capability classification (irrigated): 7e

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: D

Ecological site: R048AY237CO - Stony Loam

Hydric soil rating: No

Description of Herberman

Setting

Landform: Mountain slopes, ridges

Landform position (two-dimensional): Summit, shoulder

Landform position (three-dimensional): Mountaintop, mountainflank, crest

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Colluvium over residuum weathered from igneous and metamorphic rock

Typical profile

A - 0 to 4 inches: very gravelly sandy loam

AC - 4 to 14 inches: very gravelly sandy loam

Cr - 14 to 79 inches: bedrock

Properties and qualities

Slope: 30 to 70 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high
(0.00 to 0.28 in/hr)

Custom Soil Resource Report

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: R048AY237CO - Stony Loam
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Mountain slopes, ridges
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Mountainflank, free face, side slope, crest, free face
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Rock outcrops, talus, and large boulders of igneous and metamorphic rock

Interpretive groups

Land capability classification (irrigated): 8
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Minor Components

Troutdale

Percent of map unit: 3 percent
Landform: Ridges, mountain slopes
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Mountainflank, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: R048AY228CO - Mountain Loam
Hydric soil rating: No

Kittredge

Percent of map unit: 3 percent
Landform: Alluvial fans, mountain slopes
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainbase
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R048AY228CO - Mountain Loam
Hydric soil rating: No

Sprucedale

Percent of map unit: 2 percent
Landform: Ridges, mountain slopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Mountaintop, mountainflank, side slope, crest

Custom Soil Resource Report

Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: R048AY228CO - Mountain Loam
Hydric soil rating: No

Pettingell

Percent of map unit: 2 percent
Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: R048AY237CO - Stony Loam
Hydric soil rating: No

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Custom Soil Resource Report

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Calculation of Peak Runoff using Rational Method	
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Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

Computed $t_c = t_i + t_t$

$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

$$\text{Regional } t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

$$\text{Selected } t_c = \max\{t_{\text{minimum}}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$$

	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =	0.85	1.19	1.39		1.93	2.20	

	a	b	c	$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$
Rainfall Intensity Equation Coefficients =	28.50	10.00	0.786	

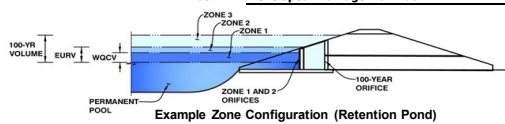
$$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$$

Q(cfs) = CIA

[illegible]

MHFD-Detention, Version 4.06 (July 2022)

Basin ID: Developed Drainage Plan Basin



Example Zone Configuration (Retention Pond)

Selected BMP Type =	EDB	
Watershed Area =	6.35	acres
Watershed Length =	700	ft
Watershed Length to Centroid =	350	ft
Watershed Slope =	0.060	ft/ft
Watershed Imperviousness =	40.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	65.0%	percent
Percentage Hydrologic Soil Groups C/D =	35.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths = User Input		

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Water Quality Capture Volume (WQCV) =	0.095	acre-feet
Excess Urban Runoff Volume (EURV) =	0.256	acre-feet
2-yr Runoff Volume ($P1 = 0.83$ in.) =	0.149	acre-feet
5-yr Runoff Volume ($P1 = 1.19$ in.) =	0.251	acre-feet
10-yr Runoff Volume ($P1 = 1.39$ in.) =	0.330	acre-feet
25-yr Runoff Volume ($P1 = 1.69$ in.) =	0.507	acre-feet
50-yr Runoff Volume ($P1 = 1.93$ in.) =	0.624	acre-feet
100-yr Runoff Volume ($P1 = 2.2$ in.) =	0.785	acre-feet
500-yr Runoff Volume ($P1 = 3.14$ in.) =	1.271	acre-feet
Approximate 2-yr Detention Volume =	0.143	acre-feet
Approximate 5-yr Detention Volume =	0.231	acre-feet
Approximate 10-yr Detention Volume =	0.297	acre-feet
Approximate 25-yr Detention Volume =	0.352	acre-feet
Approximate 50-yr Detention Volume =	0.374	acre-feet
Approximate 100-yr Detention Volume =	0.440	acre-feet

Zone 1 Volume (WQCV) =	0.095	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.161	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.184	acre-feet
Total Detention Basin Volume =	0.440	acre-feet
Initial Surge Volume (ISV) =	user	ft ³
Initial Surge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_T) =	user	ft
Slope of Trickle Channel (S_T) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio (R_{LW}) =	user	

Initial Surcharge Area (A_{SD})	=	user	ft ²
Surcharge Volume Length (L_{SV})	=	user	ft
Surcharge Volume Width (W_{SV})	=	user	ft
Depth of Basin Floor (H_{FLOOR})	=	user	ft
Length of Basin Floor (L_{FLOOR})	=	user	ft
Width of Basin Floor (W_{FLOOR})	=	user	ft
Area of Basin Floor (A_{FLOOR})	=	user	ft ²
Volume of Basin Floor (V_{FLOOR})	=	user	ft ³
Depth of Main Basin (H_{MAIN})	=	user	ft
Length of Main Basin (L_{MAIN})	=	user	ft
Width of Main Basin (W_{MAIN})	=	user	ft
Area of Main Basin (A_{MAIN})	=	user	ft ²
Volume of Main Basin (V_{MAIN})	=	user	ft ³
Calculated Total Basin Volume (V_{TBS})	=	user	acre-feet

Optional User Overrides

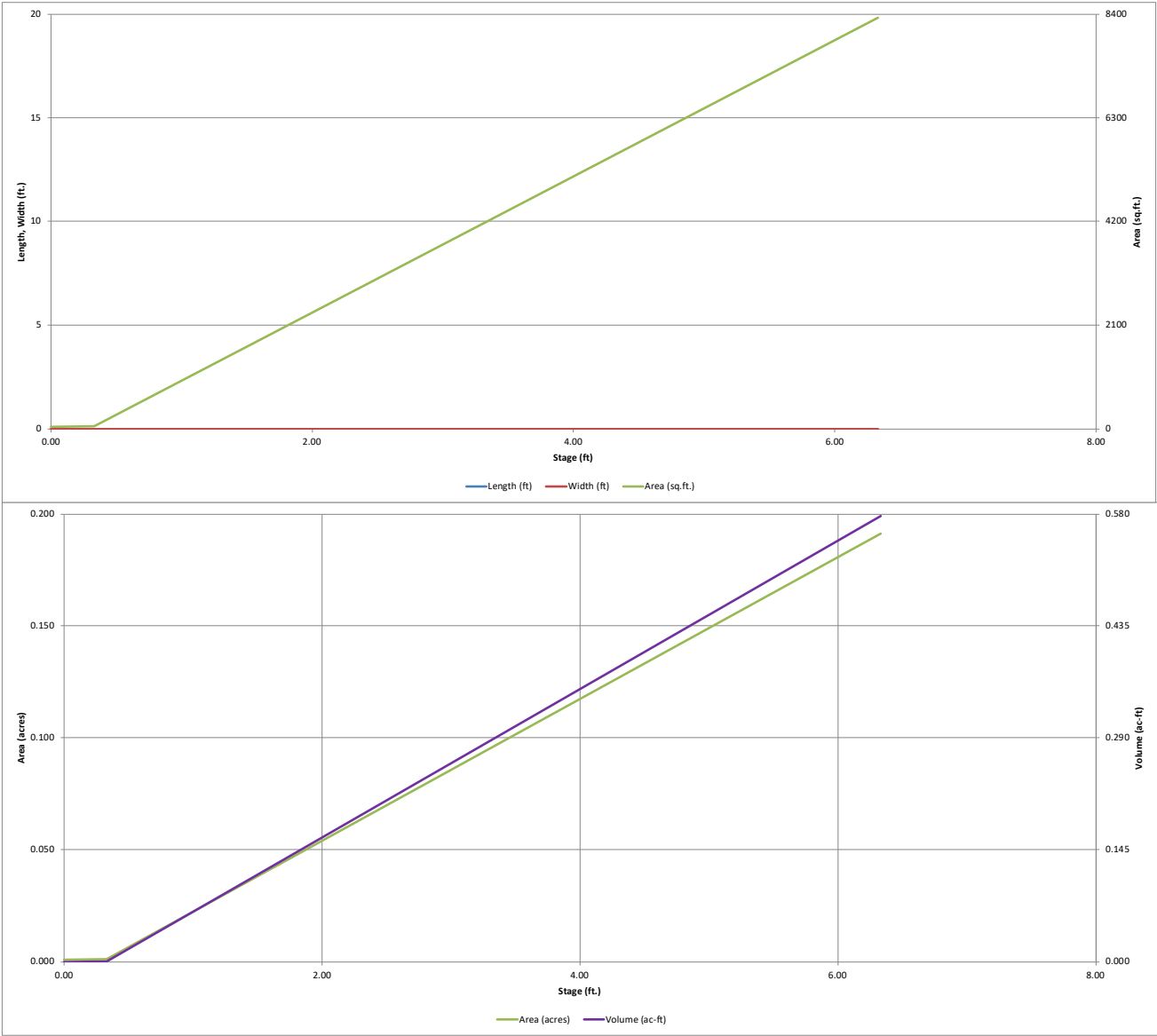
	acre-feet
	acre-feet
0.85	inches
1.19	inches
1.39	inches
	inches
1.93	inches
2.20	inches
	inches

Depth Increment =		f
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DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

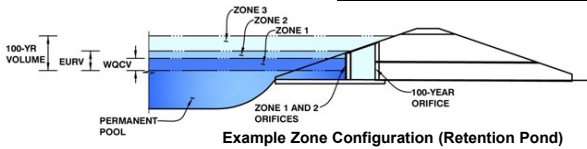


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-DETENTION, Version 4.06 (July 2022)

Project: Shadow Mountain Bike Park

Basin ID: Developed Drainage Plan Basin



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.75	0.095	Orifice Plate
Zone 2 (EURV)	4.32	0.161	Circular Orifice
Zone 3 (100-year)	5.56	0.184	Weir&Pipe (Restrict)
Total (all zones)		0.440	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth = N/A ft (distance below the filtration media surface)
Underdrain Orifice Diameter = N/A inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = N/A ft²
Underdrain Orifice Centroid = N/A feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = 2.75 ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = 11.00 inches
Orifice Plate: Orifice Area per Row = 0.37 sq. inches (diameter = 11/16 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row = 2.569E-03 ft²
Elliptical Half-Width = N/A feet
Elliptical Slot Centroid = N/A feet
Elliptical Slot Area = N/A ft²

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.92	1.83					
Orifice Area (sq. inches)	0.37	0.37	0.37					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice = 2.75 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = 4.32 ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = 2.17 inches

Calculated Parameters for Vertical Orifice

Vertical Orifice Area = 0.03 ft²
Vertical Orifice Centroid = 0.09 feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

Overflow Weir Front Edge Height, H_o = 4.32 ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = 3.00 feet
Overflow Weir Grate Slope = 4.00 H:V
Horiz. Length of Weir Sides = 4.00 feet
Overflow Grate Type = Close Mesh Grate
Debris Clogging % = 50%

Calculated Parameters for Overflow Weir

Height of Grate Upper Edge, H_u = 5.32 feet
Overflow Weir Slope Length = 4.12 feet
Grate Open Area / 100-yr Orifice Area = 16.33
Overflow Grate Open Area w/o Debris = 9.78 ft²
Overflow Grate Open Area w/ Debris = 4.89 ft²

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

Depth to Invert of Outlet Pipe = 2.50 ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = 18.00 inches
Restrictor Plate Height Above Pipe Invert = 6.70 inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Outlet Orifice Area = 0.60 ft²
Outlet Orifice Centroid = 0.33 feet
Half-Central Angle of Restrictor Plate on Pipe = 1.31 radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = 5.40 ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = 30.00 feet
Spillway End Slopes = 4.00 H:V
Freeboard above Max Water Surface = 0.60 feet

Calculated Parameters for Spillway

Spillway Design Flow Depth = 0.29 feet
Stage at Top of Freeboard = 6.29 feet
Basin Area at Top of Freeboard = 0.19 acres
Basin Volume at Top of Freeboard = 0.57 acre-ft

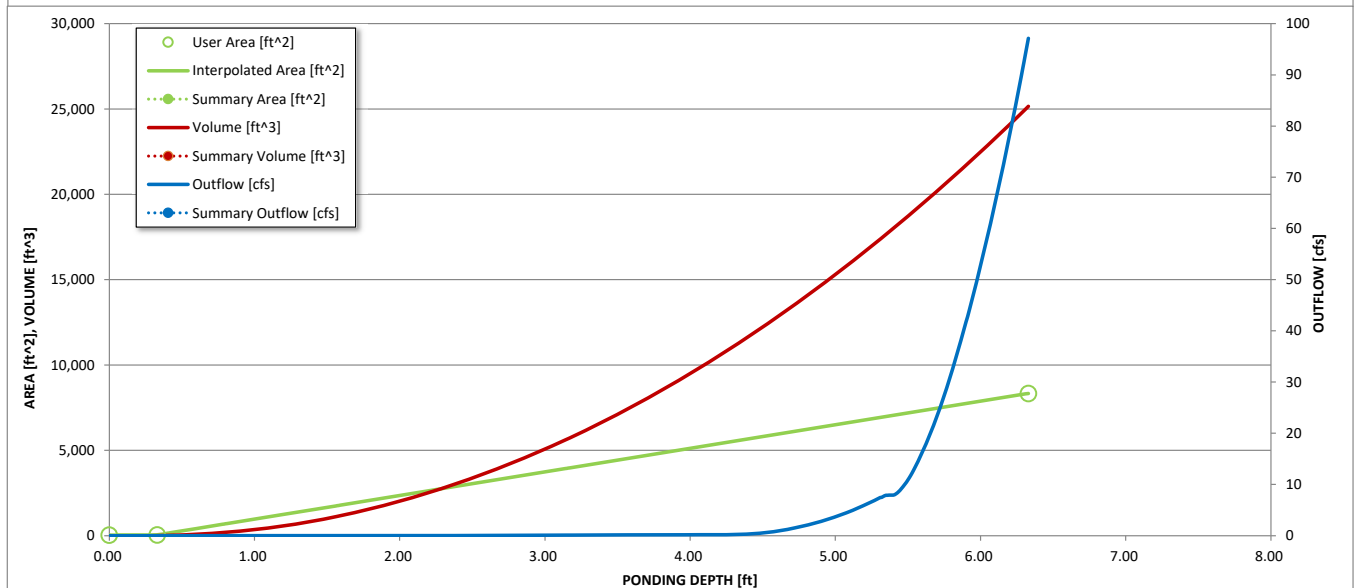
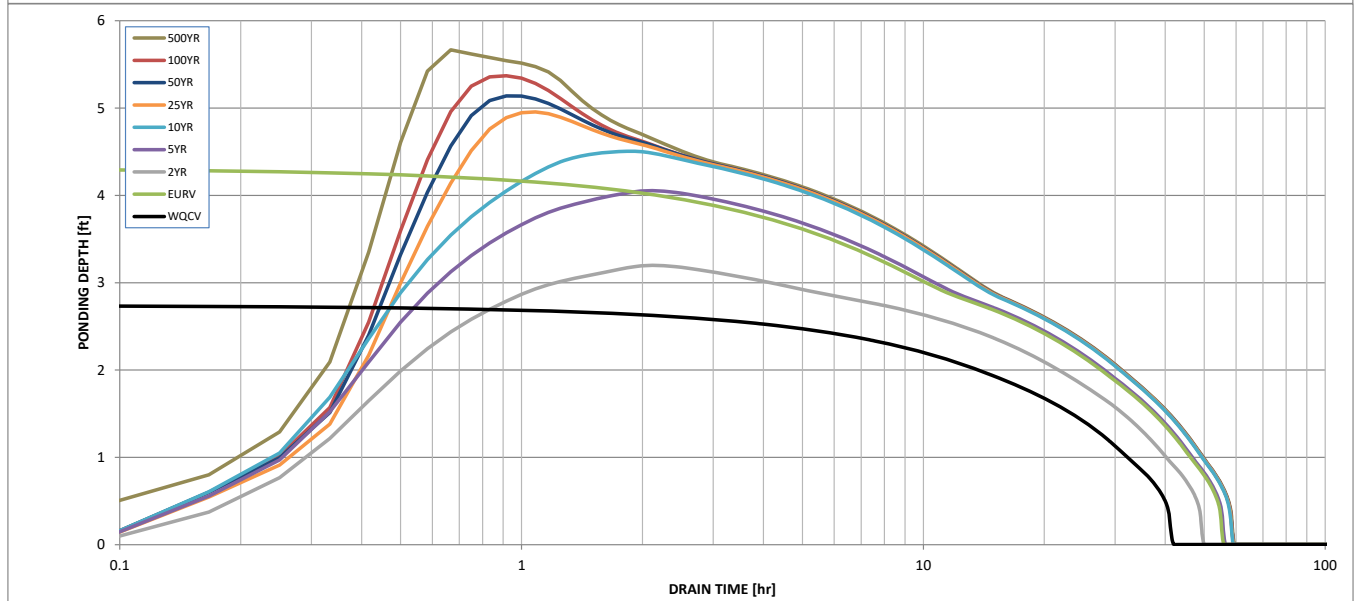
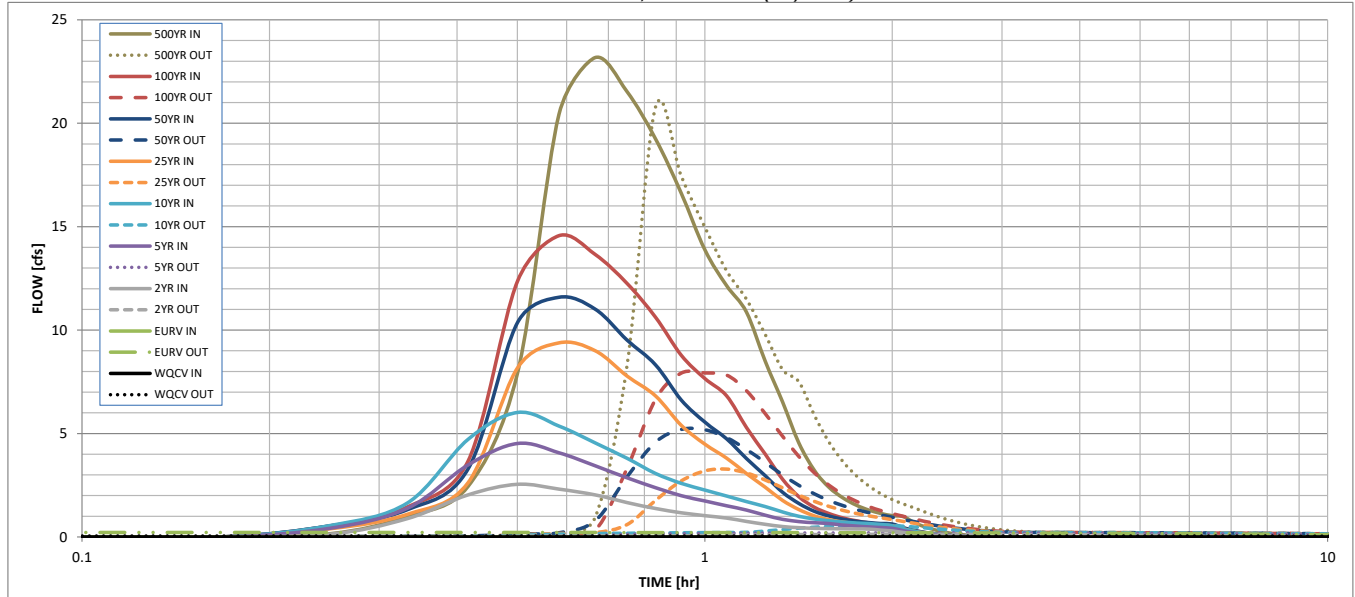
Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

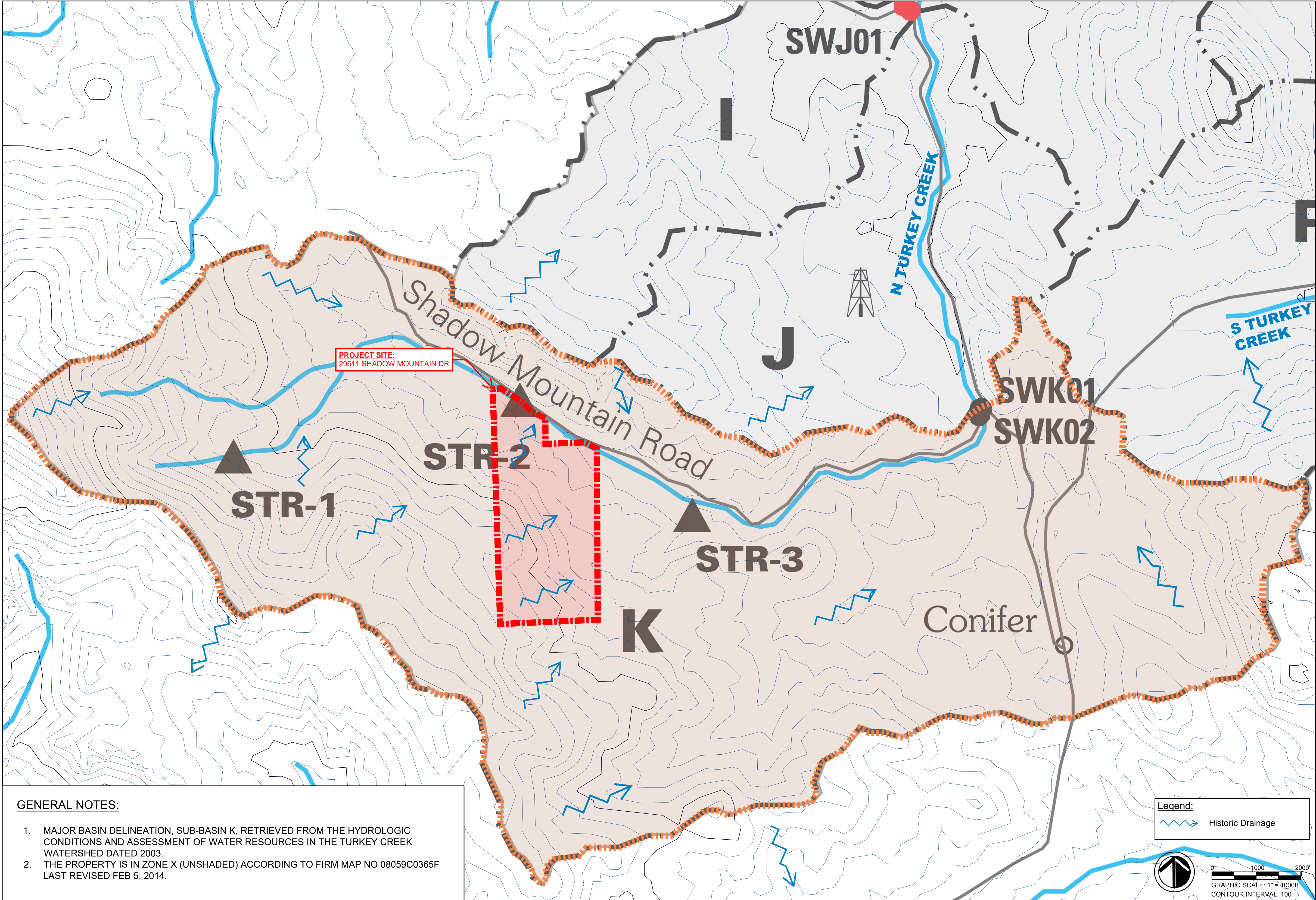
	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.85	1.19	1.39	1.69	1.93	2.20	3.14
One-Hour Rainfall Depth (in) =	0.095	0.256	0.149	0.251	0.330	0.507	0.624	0.785	1.271
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.149	0.251	0.330	0.507	0.624	0.785	1.271
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.1	0.9	1.9	4.9	6.5	8.5	14.8
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.01	0.14	0.30	0.77	1.02	1.35	2.34
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	2.5	4.5	6.0	9.4	11.6	14.6	23.2
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.1	0.2	0.6	3.3	5.2	7.9	20.8
Peak Inflow Q (cfs) =	N/A	N/A	0.2	0.2	0.3	0.7	0.8	0.9	1.4
Peak Outflow Q (cfs) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ratio Peak Outflow to Predevelopment Q =	Plate	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Structure Controlling Flow =	N/A	N/A	N/A	N/A	0.0	0.3	0.5	0.8	0.8
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Grate 2 (fps) =	38	47	44	47	48	45	43	41	34
Time to Drain 97% of Inflow Volume (hours) =	40	52	47	53	54	53	51	50	47
Time to Drain 99% of Inflow Volume (hours) =									
Maximum Ponding Depth (ft) =	2.74	4.32	3.20	4.05	4.50	4.96	5.14	5.37	5.67
Area at Maximum Ponding Depth (acres) =	0.08	0.13	0.09	0.12	0.13	0.15	0.15	0.16	0.17
Maximum Volume Stored (acre-ft) =	0.095	0.257	0.133	0.224	0.281	0.344	0.371	0.407	0.457

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			



GENERAL NOTES:

1. MAJOR BASIN DELINEATION, SUB-BASIN K, RETRIEVED FROM THE HYDROLOGIC CONDITIONS AND ASSESSMENT OF WATER RESOURCES IN THE TURKEY CREEK WATERSHED DATED 2003.
2. THE PROPERTY IS IN ZONE X (UNSHADED) ACCORDING TO FIRM MAP NO 08059C0365F LAST REVISED FEB 5, 2014.



323 West Main Street, Suite 202
Frisco, CO 80443
tel: 970.668.3398
www.segroup.com

**SHADOW MOUNTAIN
BIKE PARK**

CONIFER, COLORADO

Not For Construction

ISSUE

SCHEMATIC
DESIGN

RELEASE DATE

November 22

REVISIONS

PROJECT NO.

22089001

MADE BY

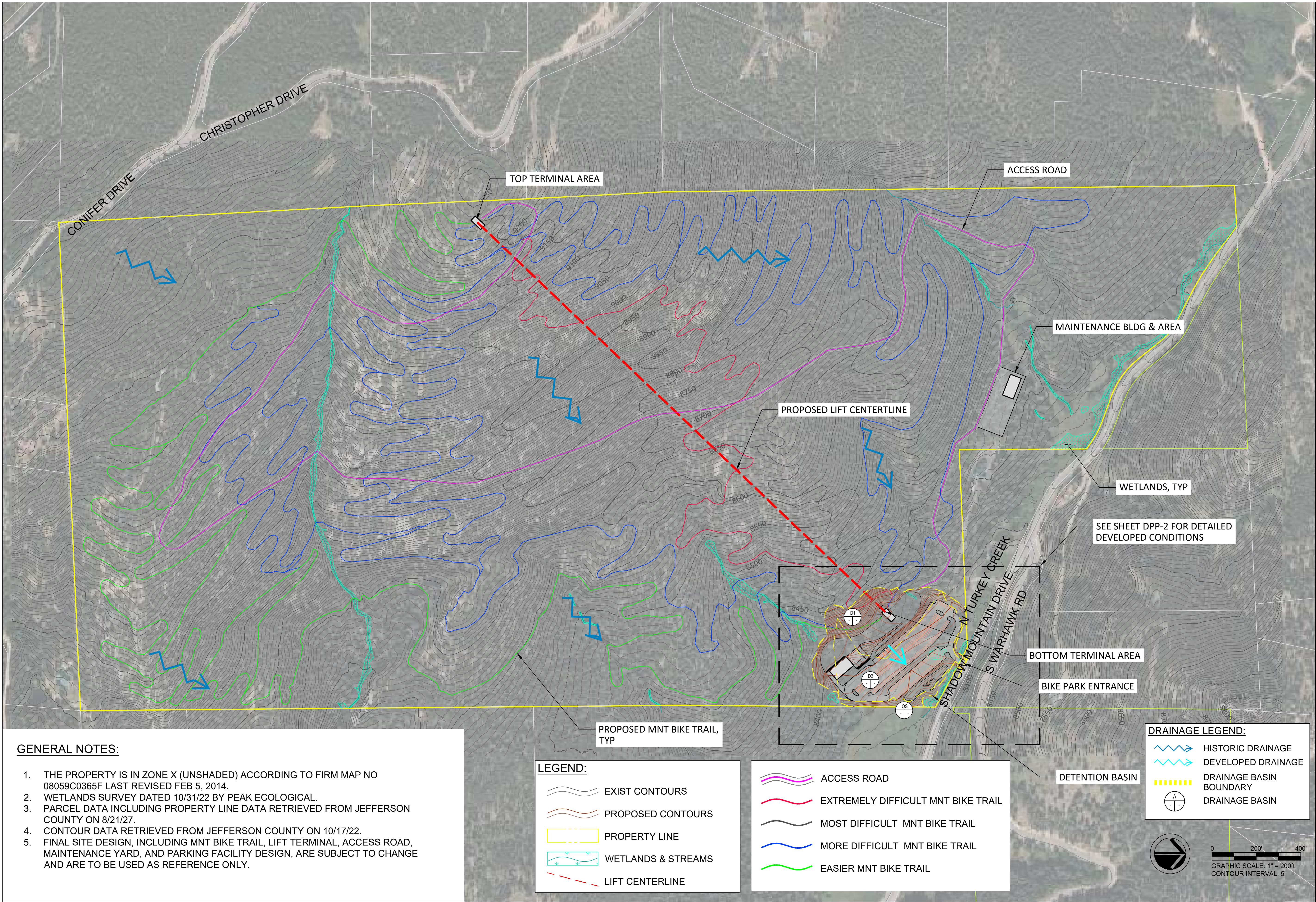
OD

REVIEWED BY

OD

**GENERAL
LOCATION MAP**

DPE



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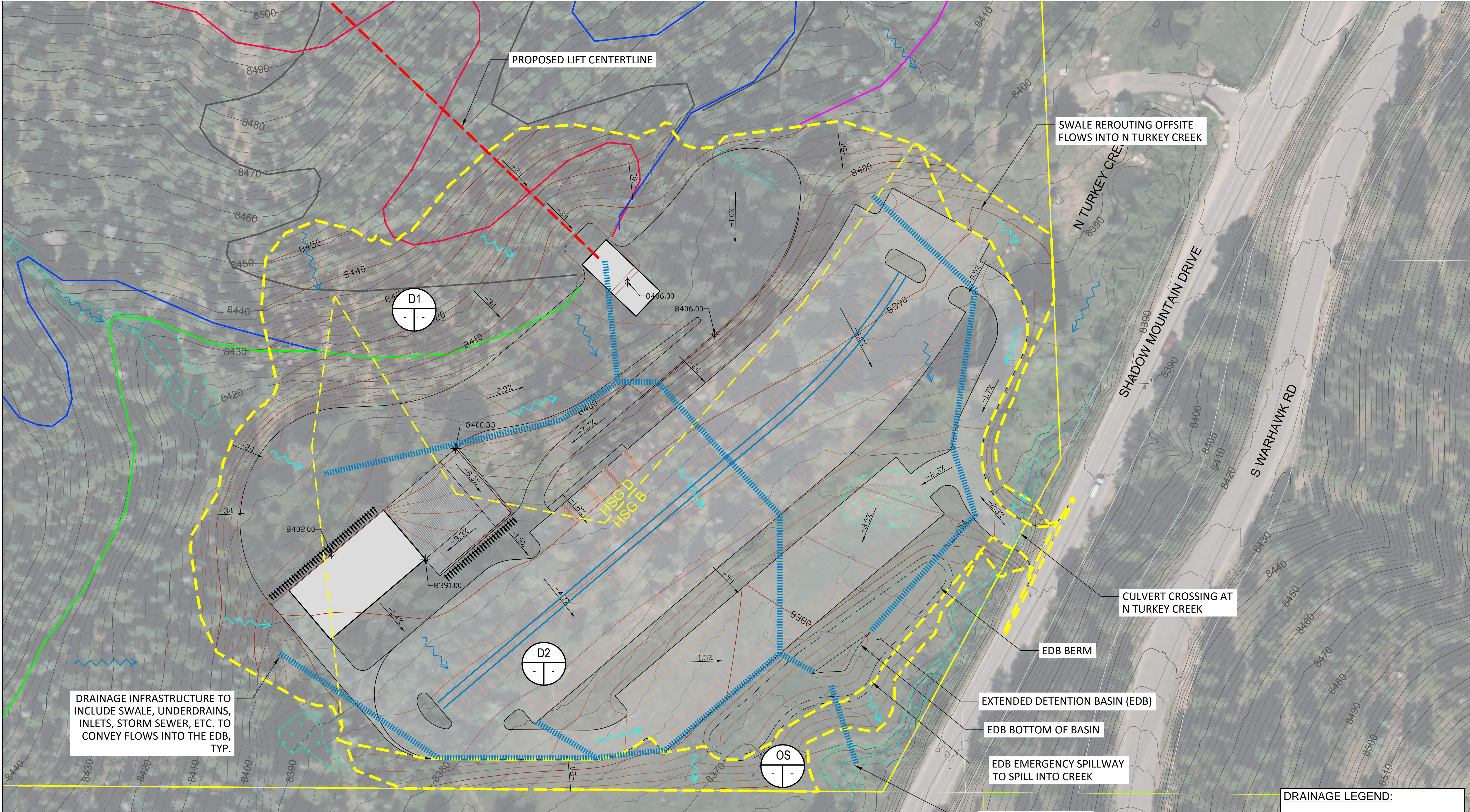
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REVIEWED BY

OD

DEVELOPED
DRAINAGE
CONDITIONS

DPP-1



GENERAL NOTES:

1. THE PROPERTY IS IN ZONE X (UNSHADED) ACCORDING TO FIRM MAP NO 08059C0365F LAST REVISED FEB 5, 2014.
2. WETLANDS SURVEY DATED 10/31/22 BY PEAK ECOLOGICAL.
3. PARCEL DATA INCLUDING PROPERTY LINE DATA RETRIEVED FROM JEFFERSON COUNTY ON 8/21/27.
4. CONTOUR DATA RETRIEVED FROM JEFFERSON COUNTY ON 10/17/22.
5. FINAL SITE DESIGN, INCLUDING MNT BIKE TRAIL, LIFT TERMINAL, ACCESS ROAD, MAINTENANCE YARD, AND PARKING FACILITY DESIGN, ARE SUBJECT TO CHANGE AND ARE TO BE USED AS REFERENCE ONLY.

LEGEND:

- EXIST CONTOURS
- PROPOSED CONTOURS
- PROPERTY LINE
- WETLANDS & STREAMS
- LIFT CENTERLINE

- ACCESS ROAD
- EXTREMELY DIFFICULT MNT BIKE TRAIL
- MOST DIFFICULT MNT BIKE TRAIL
- MORE DIFFICULT MNT BIKE TRAIL
- EASIER MNT BIKE TRAIL

DRAINAGE LEGEND:

- HISTORIC DRAINAGE
- DEVELOPED DRAINAGE
- PROPOSED DRAINAGE INFRASTRUCTURE
- DRAINAGE BASIN BOUNDARY
- DRAINAGE BASIN



0 40' 80'
GRAPHIC SCALE: 1" = 40ft
CONTOUR INTERVAL: 2'



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MADE BY
REVIEWED BY

22089001
OD
OD

**DEVELOPED
DRAINAGE
CONDITIONS**

DPP-2

PLANNING ENGINEERING MEMORANDUM

TO: Dylan Monke, Case Manager
FROM: Nathan Seymour, Planning Engineering
DATE: April 10, 2023
RE: 23-102980RZ; Special Use Application for Shadow Mountain Bike Park at 29611 Shadow Mountain Drive, Conifer CO 80433

Key Issues:

- **The Transportation Analysis will require updates as shown below.**
- **The Phase I Drainage Report will require minor updates.**

SPECIAL USE COMMENTS

1. Transportation:

- A full Transportation Impact Study will be required at time of SDP submittal. Follow requirements as outlined in Transportation Design and Construction Manual.
- This land use does not align with a trip generation code identified in the ITE 10th Edition. Provide greater justification for 1.5 turnover of vehicles per day using data collected from similar land uses.
- The County does not support the use of left turn acceleration lanes; these shall not be considered as a potential mitigation measure. Revise Table 1a, Table 1b, and any other places in the report which show a mitigated level of service.
- The County has preliminarily identified the intersections of 73/Barkley and 73/Shadow Mountain for installation of roundabouts. Given the significant impact of the development on these intersections (approximately 25% of the traffic through the intersections will be generated from the development), the County will be seeking contribution from the applicant for these public improvements.
- Provide a dedicated westbound left turn lane into the development. County regulations require a left turn lane at driveways on major collectors. Shadow Mountain Dr is currently classified as a collector, however the traffic volumes are in the range of a major collector (ADT of 2,000-8,000). Since the Shadow Mountain corridor is effectively functioning as a major collector, and the 85th percentile speed on Shadow Mountain is greater than 45mph, and a significant proportion of traffic on Shadow Mountain will now be westbound left turning traffic at the access point, provide a dedicated westbound left turn lane into the development.
- An eastbound right turn acceleration lane shall be evaluated in the Safety section of the forthcoming Transportation Impact Study required at time of SDP submittal. Right turn acceleration lanes may be required where necessary for public safety and traffic operations based upon site specific conditions.
- Provide justification for the 1% annual growth rate used for future traffic projections in 2025 and 2042.
- The value used for % Heavy Vehicles in the Synchro analysis is not reflective of actual expected conditions.

- i) The value used for PHF in the Synchro analysis does not match peak hour factor collected with traffic counts. Use the actual peak hour factors for analysis in existing scenarios; provide justification for peak hour factor used in projected future scenarios.
 - j) Provide explanation in the report for why the Saturday and Sunday PM periods were not analyzed.
 - k) Show the existing ADT on Figures 3b and 3c.
 - l) Provide a new Figure (or modify Figure 3a) so that the ADT used throughout the analysis is clear on the Figure.
 - m) Per the narrative, the applicant will work with the local Sheriff and/or Road and Bridge authority within the Right-of-Way to strictly enforce no parking along Shadow Mountain Drive. Please describe the type of work that the applicant is committing to provide.
 - n) Provide general explanation for the 0 value hourly counts for Shadow Mtn Drive west of Highway 73 on Tuesday, August 23, 2022 at 1:00 PM until Wednesday, August 24 at 1:00 PM. Provide justification for why this missing data does not affect the analysis and conclusions in the report.
 - o) The County collected traffic data in November 2022 at the same location as Site 1. The November ADT was 1,840, which is below the ADT that the applicant collected in August 2022. The County affirms that the applicant appropriately used traffic data for the season that would experience the highest background traffic volumes, in addition to the greatest impact from the development, and that this traffic report has therefore considered the peak traffic impacts to the area.
2. Phase I Drainage Report and Plan: Minor comments to the Phase I Drainage Report can be found attached on the Red Mark Print.

Comments to be addressed at time of **Site Development Plans Submittal include:**

- a) Please include and provide a detailed maintenance plan for all trails, maintenance roads etc.
 - a. With a trail width of 6-15', the runoff will be substantial. Details and calculations of temporary and permanent BMP's should be included in the Drainage Report and Construction Plans.
 - b) How are Detention and Water Quality requirements being addressed for impervious areas within the trail system/maintenance road area of the park? Can it be demonstrated that water quality is being addressed through infiltration measures?
 - c) The Jefferson County Floodprone area should be shown on the site plan. A floodplain permit will be required to be submitted for all work within the floodprone area. A Zone AE floodplain exists just downstream of this site. The engineer may consider utilizing the effective hydrology when sizing any proposed culverts or providing hydraulic modeling of the drainageway.
 - d) At time of SDP, you must demonstrate overall Stormwater control measure compliance with 13.3.4 of the Storm Drainage Design and Technical Criteria. Please include a table to assist with this analysis.
 - e) Unless relief is granted all areas which are expected to receive greater than 150 trips per day are required to be paved.
3. Official Development Plan (ODP) - Written Restrictions:
- a) The ODP should not specifically discuss construction materials such as dirt or gravel parking lots. Unless otherwise approved by P&Z, all parking lots and roads which see traffic exceeding 150 trips per day are required to be paved. May consider recycled asphalt. Surface treatments will be further defined at time of SDP.

OTHER CONSIDERATIONS

Subsequent process(es) required, and a the associated required documents

Future Requirements (prior to issuance of building permit)

1. Site Development Plan: The applicant needs to be aware that prior to the issuance of a building permit, a Site Development Plan Approval is required; please see the Zoning Resolution, Section 9 for more details on the requirements for the Site Development Plan.
2. Floodplain Development Permit: A Jefferson County Flood-prone area is located on the northern portion of the property along North Turkey Creek. Construction, including grading and/or access in this area will require a Floodplain Development Permit through Jefferson County Planning & Zoning. This should be submitted at the same time as the Site Development Plan.

CONCLUSION

These comments are based on the requirements of the Jefferson County Land Development Regulation (LDR), the Jefferson County Zoning Resolution (ZR), the Jefferson County Storm Drainage Design and Technical Criteria (SDD&TC) and the Jefferson County Transportation Design & Construction Manual (TD&CM). The comments are intended to make the applicant aware of regulatory requirements. Failure by Jefferson County Planning and Zoning to note any specific item does not relieve the applicant from conforming to all County regulations. Jefferson County Planning and Zoning reserves the right to modify these comments, request additional documentation, and or add appropriate additional comments.

If there are any questions, please contact Nathan Seymour at 303-271-8751.

NRS
Attachment/Enclosure
c: File

Dylan Monke

From: AUTOMAILER@JEFFCO.US
Sent: Monday, April 10, 2023 2:39 PM
To: Dylan Monke
Cc: EOBRIEN@JEFFCO.US
Subject: 23 102980 RZ - Agency Response

Case Number: 23 102980 RZ

Case Type: Rezoning

Case Name: Shadow Mountain Bike Park

Review: Open Space

Results: No Comment (no further review)

Review Comments:

Scheduled End Date: 04/07/2023

Reviewer: Elizabeth Stoner

Description: Special Use Application for Development of a day-use lift-served bike park as a Class III Commercial Recreation Facility.

LONG RANGE REVIEW MEMO

Date: May 5, 2023
 To: Dylan Monke
 From: Heather Gutherless, AICP
 Case number: 23-102980RZ (Special Use)
 Address/AIN: 61-163-00-001
 Purpose: Special Use application for Development of a day-use lift-served bike park as a Class III Commercial Recreation Facility.

Applicable Comprehensive Master Plan Sections

<u>Land Use</u>	<u>Physical Constraints</u>	<u>Community Resources</u>	<u>Infrastructure, Water & Services</u>	<u>Area Plan</u>
<u>All Development</u>	<u>General</u>	<u>Historic Resources</u>	<u>Transportation</u>	<u>North Plains</u>
<u>Business and Industry</u>	<u>Geologic Hazards</u>	<u>Visual Resources</u>	<u>Water and Wastewater</u>	<u>Central Plains</u>
<u>Housing</u>	<u>Floodplains</u>	<u>Air, Light, Odor, and Noise</u>	<u>Water Storage</u>	<u>South Plains</u>
<u>Mixed-Use</u>	<u>Wetlands</u>	<u>Open Space</u>	<u>Other Utilities</u>	<u>North Mountains</u>
<u>Community Uses</u>	<u>Wildfire</u>	<u>Recreation and Trails</u>	<u>Services</u>	<u>Central Mountains</u>
<u>Livestock</u>	<u>Radiation</u>	<u>Recreation and Tourism</u>	<u>Special Districts</u>	<u>Evergreen</u>
<u>Renewable & Alternative Energy</u>	<u>Landfills</u>			<u>Indian Hills</u>
<u>Extractive Resources</u>	<u>Mines</u>			<u>Conifer/285</u>
<u>Solid Wastes and Hazardous Materials</u>	<u>Wildlife & Vegetation</u>			
<u>Activity Centers</u>				
<u>Site Design</u>				

Key Issues:

- Land use, wildfire, wildlife, floodplain, light, noise, visual impacts.

Land Use

- The properties is located within the Conifer/285 Corridor Area Plan. The properties are within an area recommended for 1 dwelling unit per 10 acres.
- Since this is a Class III Commercial Recreation Facility, it would not fit into the definition of a Community Use. Therefore, the applicant needs to address the three factors outlined below to be considered when a new development is not consistent with the land use recommendations. The applicant did provide a separate document titled "Evaluation for Applications out of conformance with CMP Analysis", however, that document did not specifically address All Development, Policy 3.

a. How the impacts associated with the proposed land use(s) will be mitigated compared with the recommended Land Uses;

- The recommended land use is 1 du/10 acres. The proposed land use is a Class III Commercial Recreation Facility. Some potential impacts that should be evaluated include wetland areas, floodplains, wildfire, wildlife, visual, light, noise, traffic, water and wastewater.
- See appropriate sections below for additional evaluation on each of these items.
- The applicant's evaluation of this item is in the Sufficiency Response Letter. They compare the visual impact and water use to the recommended land use of 1 du/10 acres.
- **Staff continues to have concerns about how the impacts to wildfire, wildlife, wetlands, visual resources, light, and noise will be addressed.**

b. How the proposed land uses are compatible with the surrounding Land Use Recommendations and community character; and

- The applicant notes that the current land use recommendation map contains areas of open space adjacent to large lot residential uses. They also note that they are concentrating infrastructure near Shadow Mountain Drive, while buffering the visual impact and will disperse the trail system throughout the property to be shielded from Shadow Mountain Drive. They state that the project will benefit the residences in the area by providing opportunities for improved health and economic growth and that this would offset mountain bike users from other existing areas.
- Evaluation of Special Use criteria 1 is in the document provided by the applicant and that criteria also discusses compatibility with existing and allowable land uses in the surrounding area. The applicant's analysis states that the surrounding neighborhoods are single-family dwellings at a moderate to low density. The applicant states that they intent to mirror that dispersed development with limited infrastructure by concentrating infrastructure at the base area and dispersing the trail system throughout the property.
- **Staff agrees that open space uses and large lot residential uses are generally compatible. However, most open space parks offer more passive recreational activities, rather than active recreation that is being proposed at this location. While active recreation is also many times compatible with surrounding uses, impacts to adjacent neighbors, due to increased intensity of uses, still needs to be mitigated. Many of the items mentioned throughout the document would increase compatibility of this proposal with surrounding residential uses.**

c. What change of circumstance has occurred in the local area since the Land Use Recommendation was adopted.

- The applicant notes the increased growth of the front range area since 2010 and that this growth has increased the demand for professionally managed recreation outlets. They state that this growth surpassed the projections in the JCOS 2014-2019 Master Plan and therefore, increased demand was not clear during the original drafting of the CMP.
- Staff appreciates the applicant siting their references to the numbers used to justify the change of circumstance. However, we do not typically accept a change in population growth as a change of circumstance. We look for physical changes to the area, such as an expansion of a road that was not anticipated or a new land use in the area that received approval even though it was out of conformance with the Plan recommendations.
- The proposed access road is approximately 20-25 feet from the property line and there are trails approximately 18 -20 feet from the property line. The nearest home appears to be approximately 20 feet from the property line. Page 3 of the Proposed written restrictions document states that trails will be setback 30 feet from all property lines. Trails should be setback further from the property line to reduce impacts to adjacent neighbors. While setbacks are listed in the A-2 zone district for structures, there are not for setbacks for other amenities such as trails. This should be added to the proposed written restrictions. **We recommend meeting or exceeding the setbacks listed in A-2 for structures or developing a Non-disturbance area along the property boundaries that are adjacent to residences/agriculturally zoned properties.**
- Seasonal closure of facilities is proposed, but the park will still be open to people without lift or lodge access. Does the traffic study compare these two different scenarios? Also, seasonal closure seems a little misleading when the facility isn't entirely closed down. Will there be any staff on site? This definition should be revised. It references guests in the first sentence and visitors in the second sentence, are these one in the same or different?
- Other entertainment is mentioned in the cover letter? What does that mean? Is the bike park planning on sponsoring live music events? Staff needs to understand what those might be so that we can adequately evaluate their impacts.

Physical Constraints

Slopes

- There are several areas of slopes over 30% on the property. The applicant did provide a slope analysis and it appears that structures will be constructed in areas with less than 20% slope.

Floodplains/Wetlands

- There is a floodplain along North Turkey Creek. That floodplain should be delineated on the Special Use Graphic. The Physical Constraints section contains additional policies about floodplains. (CMP p. 34)
- Wetlands on the property are shown on the graphic. Those areas should be protected in the graphic and written restrictions. Written restrictions would be needed to explain situations where work would be completed in the wetland areas and what mitigation would occur. The CMP states that "Wildlife access to wetland should be protected and, where possible, enhanced." (CMP p. 35)

Wildfire

- Where not in a floodplain, this property appears to be within a High Wildfire Hazard Risk area. A Wildfire Risk Assessment was completed by The Ember Alliance. This report shows that evacuation times in the area may increase from 2.5 hours to 2.75 hours with additional traffic from the bike park and additional information about evacuation of this area. While the CMP does not have specific policies regarding evacuation, it does contain three policies related to access in the Wildfire section. Those discuss creating shaded fuel breaks and linking existing development to New Development to provide multiple access points. Roadway mitigation is an item addressed in the Wildfire Risk Assessment. This property would not provide any road connections to the developments to the south and west.
- The report contains recommendations for 4 treatment areas. **We recommend adding some of those recommendations to the written restrictions.** If this Special Use is approved, some of those recommendations will be addressed at the time of Site Development Plan. How the wildfire recommendations should be addressed is noted below. **The Special Use graphic should identify the 4 treatment areas graphically.**

- Basecamp:
 - Clearing as much area around the parking lot as possible, while keeping Aspen stands.
 - This should be addressed in the Special Use document. A non-disturbance area could be graphically shown around the Aspen stands and/or a written restriction could note that Aspen stands should be preserved. The Special Use document should contain a section about Landscaping to note that any landscape plans will be consistent with the recommendations of the Wildfire Risk Assessment
 - Prohibit wood fencing.
 - The Special Use document should prohibit wood fencing as noted on page 28 of the Wildfire Risk Assessment.
 - Which trees are to be removed would be addressed with the required SDP wildfire mitigation.
- Mountain Top:
 - Heavy clearing around top of lift, preserving Aspen stands and remove all junipers.
 - This should be covered with the SDP Wildfire Mitigation required.
- Central Trails:
 - Thinning
 - This would be required with the SDP.
- South End:
 - Patch cuts of lodgepole
 - This would be required with the SDP
 - Fencing of aspen to prevent browsing from animals.
 - **Note this in the Special Use.**
- There were several recommendations about signage, however, the County cannot dictate the content of signs, so this would need to be addressed by the applicant without County enforcement.
- Roadway mitigation would be covered by SDP.
- **As recommended by the Wildfire Risk Assessment, the parking lot should be setback of 300 feet from the property lines. (p. 35)**
- Slash mitigation would be covered by the SDP.
- The Elk Creek Fire Protection District's Community Wildfire Protection Plan (CWPP) should be followed.
 - Defensible Space is recommended by the CWPP and is a requirement for any new building permits in the County. Additionally, the applicant has submitted a Wildfire Risk Assessment that contains recommendations as noted above.
 - The CWPP recommends roadway management with maintenance plans. Roadway treatments on this property along Shadow Mountain Drive should be a part of the Wildfire Mitigation work that is completed with the SDP.
 - The site will be mitigated as outlined in the Wildfire Risk Assessment at the time of Site Development Plan, this should address the section of the CWPP that discusses Stand-level fuel treatments. (p. 52)
 - This area is within the Conifer Mountain plan unit. It is designated at an extreme relative risk. Measures will need to be taken to reduce that risk. Primary mitigation suggestions include Defensible Space, Create linked defensible space, landscape fuel treatments, home hardening and roadside mitigation. (p. 67) All of these mitigation suggestions can be addressed if the Special Use is approved and the project moves to the SDP process.

Wildlife

- The majority of the property is within a high wildlife quality habitat area, with portions of the property along the creek being maximum quality habitat areas, due to riparian habitat and wetlands. The Plan recommends avoiding maximum quality habitat areas and reducing impacts to high quality habitat areas.
 - The applicant submitted a Wildlife Report. It noted that Elk use the property year-round and that constant use of the bike park would decrease the value to elk and other wildlife.

- The Colorado Division of Parks and Wildlife has submitted comments on this proposal and note that the area is used by elk, deer and increasingly by moose. It is also used by mountain lions, bobcats, foxes and coyotes year round. They note that this parcel has important wildlife value and plays an important role in maintaining connectivity of wildlife habitat in an area that is becoming increasingly fragmented by a combination of infrastructure, traffic and growing recreational use.
- There should be restrictions added to address wildlife concerns. All fencing should be wildlife friendly and restricted to specific areas. Perimeter fencing should be prohibited. No lighting should shine into the wetland areas, which are maximum wildlife quality habitat areas. However, even this mitigation may not be enough to mitigate the impacts of this development to wildlife.

Community Resources

Historic Resources

- There are no historic resources identified on this property in the Historic Resources map.

Visual Resources

- Portions of this property, mainly in the southwest corner are highly visibility from the 285 Viewshed map and the County Hwy 73 Viewshed map. **Siting of any improvements in that area will need careful site design to minimize visual impacts.**
- Additionally, the community identified the meadow along Shadow Mountain Drive as a visual resource.
- The applicant did provide a Visual Analysis of the proposed development. It appears that the most visual impact to Shadow Mountain Drive will come from the lift, lodge and parking lot. Where is the day lodge in this analysis? It appears to be blocked by a tree at the particular vantage point used, what is the impact just east or west of that tree? Additionally, the site plan shows a multitude of trails going through the area and the vegetation plan discusses removing vegetation within 10-15 feet of the centerline of the trails. Please explain how this analysis adequately capture trail impacts. Also, we typically request 5 vantage points for a visual analysis. Additional analysis should be completed in coordination with the Case Manager.

Open Space and Trails

- The Conifer/285 Corridor Area Plan contains a section regarding Trails Development (p. 21-Conifer) Policies state:
 1. Trails should provide a link throughout the Plan area. Trail design should create trails that:
 - a. Vary in length, gradient and the nature experience;
 - This proposal would provide a different trail experience than in any other location of the County. It would also provide for beginner through advanced mountain biking terrain.
 - b. Link the community, provide wildlife corridors and serve as potential greenbelts;
 - The park won't link the community. **The first page of the Proposed Written Restrictions shows a map and several of the wetland areas are not built on. Those areas should be shown as no build or no disturb areas on the Special Use graphic. Language proposed for a recent rezoning with wetlands included a special use area for the meadow/wetland. The language for that area did allow trails and an access road with additional language. It stated that, "No development can occur in wetlands or wetlands 10 foot buffer except an access road between Light Lane and the site." It went on to state, "An access road may be constructed over the meadow area and wetland area but must have the least impact possible to serve the development in order to preserve meadow and wetland in its' natural state. The impact to the meadow and wetland for the access road is expected to be less than 5% of the meadow area."**

- There is one wetland area that appears to be built over by the parking area. What will be done to mitigate that wetland? There are also paths that go through wetland areas. How will those impacts be mitigated or lessened? We recommend changing the parking location.

c. Provide access for those with special needs and necessary conveyances, where appropriate;

- The chairlift will provide access to the mountain biking for those with special needs.

d. Traverse diverse landscapes;

- The landscapes on this property are relatively uniform, but there are different experiences at the north end vs the south end of the site. The paths on the property will provide access to the entire site. **How will the applicant ensure that bicyclists will not create their own paths in the sensitive wetland areas near Shadow Mountain drive?**

e. Provide turnouts and access to scenic views and vistas;

- **This proposal will provide scenic views and vistas from the top of the lift. Will there be turnout areas along the trails if people need to stop prior to getting to the bottom?**

f. Intersect to allow a choice of routes from a point of origination to various destinations; and

- There will be a variety of options from the top of the chairlift and there are choices on some of the proposed trails to take a different route. However, most trails are separated to avoid interactions between beginner and more advanced cyclists.

g. Avoid areas containing threatened, endangered, sensitive species, or fragile environments.

- There are no threatened or endangered species identified as existing or having potential habitat on this site. **The floodplain area along North Turkey Creek is a maximum quality wildlife habitat area. See item b. above for potential ways to address the wetlands and floodplain area.**

h. Restrict motorized activities to designated areas

- **A Class III Commercial Recreation Facility would allow for motorized activities throughout the site. Since the sound restrictions are not very restrictive, this could potentially allow for a motocross track. The noise impacts from that use would not be acceptable at this site.**

Air, Light, Odor and Noise

- The Community Resources section contains policies related to Air, Light, Odor and Noise and Recreation and Tourism that should be addressed.
- Plan policies discuss minimizing light impacts to protect the night sky, avoid pollution, and avoid light or Glare trespass on adjacent properties and Wildlife Habitat. (CMP p. 43)
- **The written restrictions allow lighting, but restrict exterior lighting to before 10 pm in Use Area B. Why is lighting in that Use Area necessary except for lighting required by insurance or regulations? No lighting in Use Area B would better mitigate impacts of the proposal.**
- Use Area A will need to meet the lighting standards in the Zoning Resolution. Use Area A also contains maximum quality wildlife habitat. Lighting will need to be directed away from the wetlands/floodplains areas and that should be a restriction in both Use Areas A and B.
- The Area Plan discourages internally illuminated signs. (Conifer p. 15) Sign lighting is not addressed in the proposed written restrictions. Signs should not be lit.

- Businesses are encouraged to turn off all non-essential lighting after business hours, leaving only the necessary lighting for site security. (Conifer p. 15) Again, lighting in Use Area B until 10 pm should be justified? Lighting in Use Area A should be reduced to security only after business hours.
- The Noise policies in the Comprehensive Master Plan discuss the potential noise impacts from hours of operation, mitigating the use of outdoor speakers, amplified music, and/or paging systems where residential uses could be impacted, minimizing noise to maximum/critical wildlife Habitat areas, ensuring noise is reviewed and, if necessary, mitigated and mitigating noise that is annoying, but does not exceed State noise standards. (CMP p. 44)
- What level of noise does the top of the chairlift produce? Will the motor be at the top of the chairlift or the bottom? Will it be electric or diesel? Please provide specs for the lift mechanical equipment so that we can determine whether additional restrictions are needed.
- The written restrictions state that the sound level shall adhere to the noise levels for Light Industrial uses. Those standards are 15 decibels higher than residential or park standards. Depending on the time of day, this may mean the difference between noise levels related to a conversation and noise levels related to busy traffic or an electric vacuum. This does not seem appropriate for this rural residential area. Residential noise standards should be met.
- As recommended by the Plan, hours of operation have been set. Those are sunrise to sunset, which seems appropriate given the type of use and that this is the restriction on Jefferson County Open Space parks.
- Will there be any outdoor speakers, amplified music, and/or paging systems? This should be addressed in the written restrictions.
- How will noise be mitigated to the wetlands/floodplain along Shadow Mountain Drive?
- The Conifer/285 Corridor Area Plan have additional noise policies related to minimizing noise, considering high noise levels incompatible unless mitigation can decrease the number of noise sources or how the noise is heard, and implementing hours of operation. (Conifer p. 15)
- Light Industrial noise standards do not seem compatible with this area.

Infrastructure, Water, & Services

Transportation

- The Comprehensive Master Plan discusses ensuring new development has adequate transportation infrastructure to serve it and mitigating negative impacts. Also, how transportation infrastructure and parking areas should balance safety, neighborhood character, and environmental impacts. (CMP p. 48)
- Additional policies in the Conifer/285 Corridor Area Plan discuss limiting roads to 2 through lanes with appropriate turning, acceleration and deceleration lanes and limiting improvements when they are expensive and would degrade the physical environment. (Conifer p. 29-30)
- The County's engineers had several comments on the Transportation Analysis provided with this application. Those comments should be addressed in the 2nd submittal.
- There is no proposed Bicycle infrastructure shown in the Bicycle Plan.

Water and Wastewater

- Comprehensive Master Plan policies discuss demonstrating water is adequate and available for the uses proposed, how new development should provide adequate water for firefighting services and how new development served by a well should also be served by a treatment system or facility in the same general area as withdrawal. A key provision in this section discusses how development should be at a scale density consistent with Locally Available Water Resources. Locally Available Water Resources are the surface and ground water that is physically in the watershed sub-basin where the development is occurring, not including water brought in from outside sources such as truck, pipeline, or other means. (CMP p. 49)
- The applicant provided Water supply cover letter and an engineering study for the water system improvements. The cover letter states that the water will be obtained in two phases. First, an exempt commercial well permit of 0.33 acre-ft per year would be requested. At the same time, the applicant will start the process for a water augmentation plan to supply the facility with 2 acre-ft per year for full build

out of the facility. Water will be used for both the facility and for fire sprinkler water. Since water would be coming from a well, it would be from a Locally Available Water Resource.

- The proposal is situated in the North Turkey Creek Basin of Jefferson County. The letter from the Division of Water Resources states that “the ability for the applicant to obtain well permit(s) and the allowed use(s) will be determined at the time the permit applications are submitted to and reviewed by the State Engineer’s Office”. With the Pre-application, we had asked if there were water rights available in this basin. It sounds like that would be determined once an application was submitted and reviewed.
- The cover letter discusses that a water storage tank will be constructed to provide for sprinkling of the lodge building. Water for this storage tank would not need to come from the well, but could be hauled in since it would not be used for the water consumed by the lodge.
- The CMP also discusses how in areas served by an individual or community well, emphasize low water demand uses. (CMP p. 49) This proposal is estimated to use 1,400 gallons per day on approximately 235 acres. Appendix C contains a table of Land Uses with Water Estimates. If this property were built out under the existing A-2 zoning, which has a 10 acre minimum lot size, it could potentially allow for up to 23 residences. According to the Land Uses with Water Estimates table, a single-family detached unit is estimated to use 300 gallons of water per day. That would mean that there could be a total water demand of 6,900 gallons of water per day if built out to the maximum under existing zoning.
- Sanitation will be provided by an onsite septic system. Where a property is served by well water, the Plan recommends an onsite wastewater treatment facility be used as well to facilitate water recharge. The comments from Jefferson County Public Health estimate that the proposed development would generate 1800 gallons of wastewater per day. That would make the application eligible for an OWTS permit through the County. If the average daily flow is 2,000 gallons per day or more, then a Site Approval process with the Colorado Department of Health and Environment (CDPHE) would be required.

Utilities and Services

- The power line along Shadow Mountain Drive is proposed to be buried, which would comply with the policies in the Plan and would reduce wildfire risk. Another power line would be utilized from the western boundary and would be an overhead line. The plan recommends locating utility lines underground, where practicable. (CMP p. 51) Please explain why this line is not also being buried. Due to regulations passed in October of last year, any above ground utility extensions will be required to have vegetation cleared within 10 feet of any new or existing power poles/towers.
- Elk Creek Fire Protection District had many comments on how the site should be designed and constructed. While many of these would not be reviewed until the time of Site Development Plan, it is good to know what those requirements would be. Additionally, there are some items that should be considered at the time of Special Use.
 - The Fire district talked about how an approved fire protection water supply capable of supplying the required fire flow for fire protection would be required. Would this require the installation of a cistern? If so, where would that be located and how would it impact the Special Use graphic?
 - Does the fire flow report need to be submitted now or with the SDP?

Design Guidelines

The Conifer/285 Corridor Area Plan contains many Design Guidelines on pages 33-48. Applicable policies are noted below.

Vistas, View Corridors & Scenic Areas

- Preserve view corridors for existing or future adjacent development.
 - We would like to see an updated visual analysis that has more vantage points and views of the lodge without a tree directly in front of it.
- In transition areas between lower and higher density uses, ensure that more intense uses are not visually obtrusive to adjacent lower density uses.
 - Comments about setbacks noted above should be addressed.

- Prevent silhouette of structures on ridgelines.
 - **It appears from the visual analysis that the top of the lift will not be right at the top of the ridge. However, additional vantage points will help to determine its visual impact.**
- Avoid outdoor lighting within view corridors or on prominent ridges.
 - **Outdoor lighting in Use Area B will be turned off after 10 pm. See above for further restrictions on lighting recommended around the wetland areas.**

Parking

- Screen or obscure views of parking lots from adjacent public areas or unrelated land uses and on-site users.
 - The County's landscaping standards will require a certain amount of landscaping around the parking lot areas and within the parking lot itself. **It appears that not all of the landscaping standards would be met in the conceptual site plan.**
- Minimize parking areas (impervious surfaces) and their expansiveness.
 - Two different areas of parking have been created with a landscape separation in the conceptual site plan. **The landscaping standards in the zoning resolution will a certain amount of landscaping around the parking lot areas and within the parking lot itself to break up the expansiveness of the parking lot.**
- Orient building to site amenities. Separate parking from these areas.
 - The building and site amenities are adjacent to each other with the parking being between the amenities and Shadow Mountain Drive.

Signs

- Minimize the size and number of signs to avoid visually confusing roadway entrances or streetscapes. It goes on to state minimums of one sign per project per major road frontage and one sign per building, which lists all tenants.
 - The standards for signs are not modified, so the Zoning Resolution sign standards for Agricultural Districts. Those standards would only allow one ground sign along the road, but would allow more wall signs, with a total of 200 square feet of sign area. **Signs should be limited to one sign per building.**
- Integrate signs into overall landscape and building design, carrying out a consistent graphic theme.
 - **Something about this could be added to the special use document.**
- Minimize negative visual impact of signs on adjacent areas. This guidelines goes on to states that signs should be no closer than 50 feet from adjacent neighbors, to limit signs to one per building and to limit size of a project sign to 64 square feet.
 - **These items could be added to the special use document.**

Fencing & Screening

- **There are several policies regarding fencing. It is unclear what fencing will be needed at this time to determine which policies apply. At a minimum fencing should be wildlife-friendly.**

Entrances

- Limit the number of entrances to commercial developments.
 - It is our understanding that only one entrance is proposed.

Air, Odor, Light & Noise

- Integrate light design into overall project design and architecture.
 - **This is not addressed.**
- Minimize visual intrusiveness of lighting.
 - **The special use document restricts exterior lighting in Use Area B after 10 pm. There were some additional suggestions above in the Community Resources section of this memo.**
- Minimize light falling on areas not used for activity. Areas not in use or after hours should be lighted only for essential safety requirements.
 - See comment above.
- Minimize the impact of people-generated noise or more quiet residential and recreation areas to a level that does not exceed normal noise levels of those adjacent uses. It goes on to recommend a

minimum distance of 100' between a project's active recreation areas and existing off-site residential structures.

- **Setbacks of the lift should be specified as well as trails and maintenance roads from the property lines.**
- Protect or preserve areas valued for the absence of man-made noise.
 - **See comments above.**

Wildlife & Vegetation

- Landscape with indigenous species, where possible.
- Landscape to mimic natural systems.
 - If this special use is approved, these two guidelines would be evaluated at the time of Site Development Plan.
- Thin forests to allow light and water, etc. to filter downward to increase forest vigor and restore understory vegetation (ground cover) which increase visual and environmental quality (erosion and sediment, runoff, growth, etc.).
 - A Wildfire Risk Assessment was created for this project. Additional suggestions based on this report were noted above under the Physical Constraints section of this memo. If the special use is approved, any work would be required prior to construction on the site.
- Prevent habitat deterioration where critical wildlife areas exist. Enhance available habitat.
- Maintain the natural wildlife "carrying capacity" of sites that have moderate or high wildlife significance. Improve the carrying capacity of some sites to offset the loss of habitat in developed areas.
 - Wildlife habitat is a concern with this proposal. See comments above under the Physical Constraints section of this memo.
- Maintain natural vegetation ecosystems adjacent to and within bodies of water, streams, other watercourses, and within associated wetlands.
 - Protection of wetlands is a concern with this proposal. See comments above under the Physical Constraints section of this memo.
- Maintain wildlife movement corridors of a size and character that ensure their continued use.
 - Wildlife habitat is a concern with this proposal. See comments above under the Physical Constraints section of this memo.

Open Space(s) & Recreation

- Create attractive planting areas at building-land interface.
 - If this special use is approved, this guideline would be evaluated at the time of Site Development Plan.
- Prevent damage to vegetation along major roadways.
 - **Staff is recommending additional protection of the wetlands and stream corridor along Shadow Mountain Drive.**
- Avoid using exotic plant species unless: They blend with the intended character of the overall design; no native species can be used as a substitute; they are for special effect or focus.
- Create visual diversity and interest through selection of plant materials. Plant materials should achieve a visual and aesthetic balance between newly planted and existing vegetation as to character, form, size, and color.
- Design public areas to be safe and secure.
 - If this special use is approved, the design of the buildings and site would be evaluated at the time of Site Development Plan.

Circulation

- Minimize visual scarring of road cuts, or disruption of scenic areas (e.g., meadows).
 - **The visual analysis should adequately capture the impacts of the trails and maintenance road.**
- Preserve or create a rural image, even in more intensely developed areas
- Access from parking lot to buildings, etc., should be convenient and safe.
- Concentrate pedestrian circulation around site amenities.
- Minimize the distance pedestrians must walk between buildings or activity.

- If this special use is approved, the design of the buildings and site would be evaluated at the time of Site Development Plan.
- Design pedestrian/bikeways and roadways that create attractive, pleasant and safe features for users of the facilities and residents of adjacent property.
 - This facility would create an off-road facility for bicyclists.

Energy

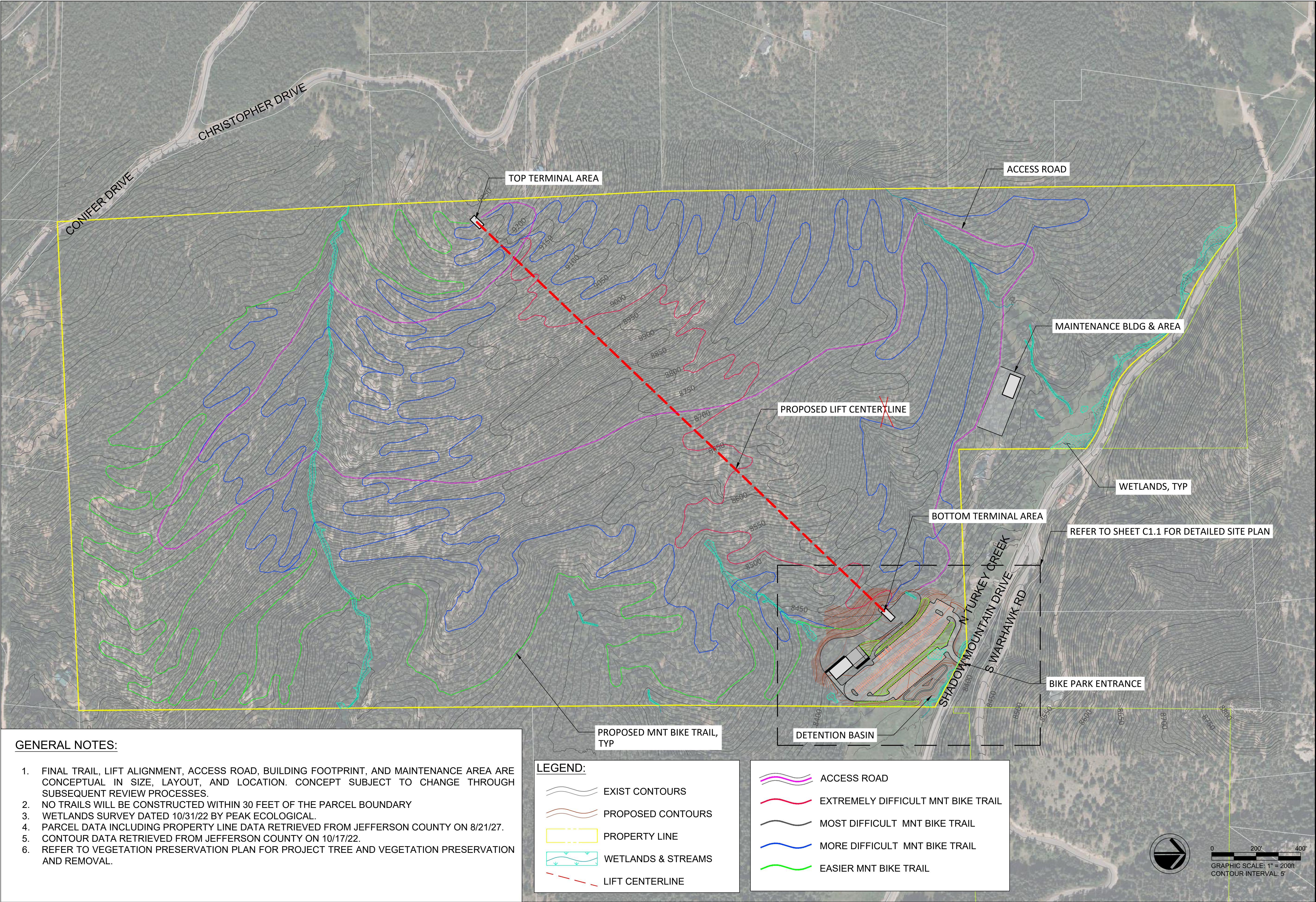
- Minimize negative visual impact of propane tanks.
 - If this special use is approved, any mechanical equipment would be required to be screened.

Privacy

- Maximize privacy, including visual and auditory, between new developments and existing residential areas.
- Maintain and enhance property values.
 - See comments throughout this memo regarding increased setbacks.

Architectural Design Guidelines:

- Orient, design, and construct structures that are people oriented and facilitate interaction.
- Buildings should be small and clustered, scaled to respect topography, views and vegetation
- Balance the proportional relationship of the form of building to size of the lot/parcel.
- Structures should avoid overpowering the site and be sensitive to the natural landscape's variety and diversity.
- Use the massive elements of the building to express depth, substance, and strength, rather than only surface veneer, i.e., exposed timber, structural beams, solid rock, walls, etc.
- Create interesting, diverse, stimulating streets and walls that create varied experiences for people and respond to the landscape in an informal and organic way
- Use sculptures, fountains/water features, wood carvings, awnings and canopies, balconies, patios and terraces, flags and banners, umbrellas, the annual colors of flowers and trees (i.e., Aspen), accent lighting, painted wall graphics, etc., in detailing projects.
- Create pedestrian amenities that complement surrounding site conditions.
- Minimize negative visual impact of exposed foundations.
 - Several of these items could be added into the special use document, others will be addressed by existing regulations if this special use is approved and the project moves forward to the Site Development Plan process.
 - **A Class III recreation facility does not have a size limit. A maximum size should be added to the special use document.**



SHADOW MOUNTAIN

BIKE PARK

CONIFER, COLORADO

Not For Construction

ISSUE

SCHEMATIC
DESIGN

RELEASE DATE

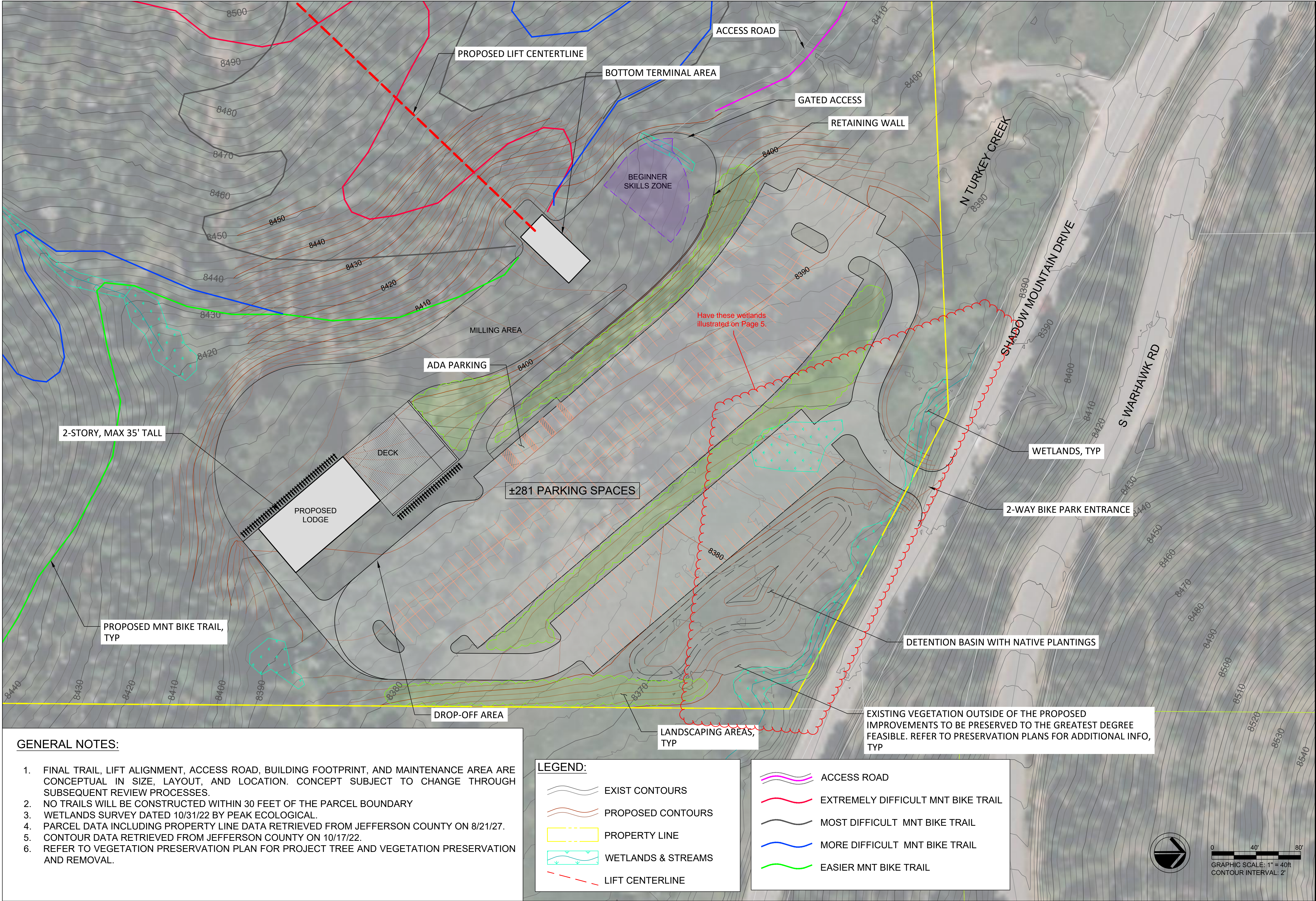
November 22

REVISIONS

PROJECT NO. 22089001
MADE BY OD
REVIEWED BY OD

**OVERALL SITE
PLAN**

C1.0



**SHADOW MOUNTAIN
BIKE PARK**
CONIFER, COLORADO

Not For Construction

ISSUE
SCHEMATIC
DESIGN

RELEASE DATE
November 22

REVISIONS

PROJECT NO. 22089001
MADE BY OD
REVIEWED BY OD

**DETAILED SITE
PLAN**

C1.1

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~~*The information contained in this document is to be integrated into the Special Use Document.~~

Please add a title to this document such as, "Shadow Mountain Special Use" or other.

LAND USE AREAS:

33?

Subject to the intent identified in Section __, the primary uses permitted within the property are described and limited as follows:

CLASS III COMMERCIAL RECREATION FACILITY: A facility for the purpose of sports and recreational activities, excepting therefrom any activity that involves the use of non-domestic animals and/or firearms, which is operated or owned by a commercial enterprise and open to the general public or members for a fee in return for the provision of some recreational activity, and including all uses related to the operation thereof, which may include stand-alone food and beverage for purchase and sale from independent vendors, retail items for purchase and sale, items for rental, and bike patrol and emergency services.

PARKING: Parking area accessory to and for the benefit of the Class III Commercial Recreation Facility use.

DAY LODGE: An indoor facility for the purpose of supporting the Class III Commercial Recreation Facility use, which may include: pre-made food and beverage for purchase and sale, retail items for purchase and sale, items for rental, administrative offices, bike patrol and emergency services, and other services and relief areas related to supporting guests.

TRAINING AREA: An outdoor area for the purpose of training bike skills, which may include: structures, jumps, ramps, and obstacles, paths made of dirt, gravel, or other natural materials, and other mechanisms for the purpose of learning or practicing bike skills.

CHAIRLIFT: All infrastructure required for the operation, maintenance, and support of the Lift structure, including but not limited to terminals, towers, lines, poles, chairs, electrical equipment, and other related components.

TRAILS: Trails constructed for use by cyclists and, in some case, individuals on foot or other non-motorized means of transportation. All trails will be setback 30 feet from all property lines.

USE AREA B ACCESS ROAD(S): Road(s) constructed of dirt, gravel, or a similar material for ingress and egress to and from Use Areas A and B.

MAINTENANCE FACILITIES: Operational, maintenance, and administrative services and facilities associated with the Class III Commercial Recreation Facility use.

The following table identifies the permitted uses within each of the two land use areas identified on the "Land Use Map" on this sheet.

"Other Entertainment" mentioned in the Cover Letter should be described here and/or in Written Restrictions, Page 6.

~~*The information contained in this document is to be integrated into the Special Use Document.~~

Table 1: Land Use Areas		
Area	Acres	Permitted Uses
A	6	Class III Commercial Recreation Facility; Parking, Day Lodge, Training Area, Chairlift Infrastructure; Permitted Uses in the A-2 Zone District
B	229.3	Class III Commercial Recreation Facility; Trails, Chairlift Infrastructure, Use Area B Access Roads, Maintenance Facilities; Permitted Uses in the A-2 Zone District

~~**STANDARD FLEXIBILITY STATEMENT**~~

~~The Land Use Map is intended to depict general site configuration.~~

Any adjustments to A-2 setbacks proposed?
Staff would suggest proposing greater setbacks for trail construction. 30-foot from property lines is listed elsewhere, should be formalized here.

Any Parking Ratio proposed?

The maximum width of the proposed lift clear cut should be limited in the Written Restrictions or otherwise illustrated in the Visual Analysis at maximum potential (e.g. 200-ft from lift centerline or other maximum or justify why broader width is not required to be shown in Visual Analysis.)

Wildfire Assessment recommends "heavy clearing" in this area. Visual Analysis shall be updated to indicate what this would look like after mitigation and construction.

The County Comprehensive Master Plan discourages development of and wildland access to existing wetlands.

These areas should be shown as protected areas or provide mitigation.

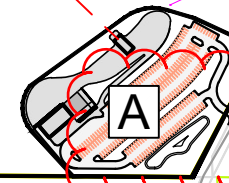
Is there a reason the northern existing access wasn't considered to avoid the wetlands on-site?

Wildfire plan recommends 300-foot setback for parking lot areas. Is there a reason this cannot be met?

B

What is this?

Parking lot, lodge and other details not required here. Use Areas shouldn't show parking lot, buildings or access trails.



The wildfire report recommends protection of existing Aspen stands as they are fire-resistant. Staff recommends illustrating these areas be shown as "Non-Disturbance Areas" on this graphic to conform with the County's Comprehensive Master Plan Wildfire (Pg. 36.).

Shadow Mountain Bike Park

~~LAND USE MAP~~ Exhibit A

0 150 300 600 ft.
DATE: JANUARY 2023



Reformat for 2nd Referral, large scale
24" x 36" ODP document including
Graphic, Written restrictions and
definitions proposed.

SHADOW MOUNTAIN BIKE PARK

Special Use Case # ~~20-127140 PA~~

23-102980 RZ

- A. **Intent.** The purpose of this Special Use is to permit a Class III Commercial Recreation Facility use on the subject property, which is zoned Agricultural-Two (A-2).
- B. **Written Restrictions.** All the uses and standards of the Agricultural Two Zone District (A-2) and other applicable sections of the Zoning Resolution shall apply to the property further described in the legal description provided in _____, with the following modifications:
1. Permitted Uses
 - a. Primary
 - i. Class III Commercial Recreation Facility and related uses, excluding therefrom any activity which includes the use of firearms and/or non-domestic animals; ~~all Permitted Uses in the A-2 Zone District~~
 - b. Accessory.
 - i. Day lodge; parking; maintenance facilities; ~~and all Permitted Uses in the A-2 Zone District~~
 2. Written Restrictions.
 - a. Guest Hours of Operation. The Shadow Mountain Bike Park will be open to guests no earlier than sunrise and no later than sunset.
 - b. Seasonal Closure. The Shadow Mountain Bike Park will be closed to guests from December 1 through March 1 (the "**Seasonal Closure**"). During the Seasonal Closure, the Shadow Mountain Bike Park may be open to visitors, but visitors will be unable to use the Lift and unable to access the Lodge.
 - c. Infrastructure Height. All chairlift infrastructure (including terminals and towers) will not exceed 35 feet in height.
 - d. Sound. Sound levels shall adhere to maximum permissible noise levels for Light Industrial uses, pursuant to CRS § 25-12-103, as amended.
 - e. Lighting. No exterior lighting will be permitted in Use Area B after 10:00 pm, ~~except for lighting required by insurance and/or local, state, and federal regulations.~~
 - f. Fires. Outdoor fires using wood or charcoal for fuel are prohibited. All outdoor fires of any type are prohibited in Use Area B.
 - g. Trash Management. Only wildlife-proof trash, recycling and composting containers will be used on the Property.

APPROVED FOR RECORDING:

Is any fencing proposed for this property? Any
fencing should be Wildlife friendly

This Special Use Document, titled Shadow Mountain Bike Park, was approved the _____ day of _____ 2023, by the Board of County Commissioners, of the County of Jefferson, State of Colorado and is approved for recording.

The owner of the property, at the time of approval was: State of Colorado

~~*The information contained in this document is to be integrated into the Special Use Document.~~

By: Jefferson County Planning and Zoning Director

Signature: _____

Date: _____



CONCEPT MASTER PLAN

January 2023

 **SE GROUP**

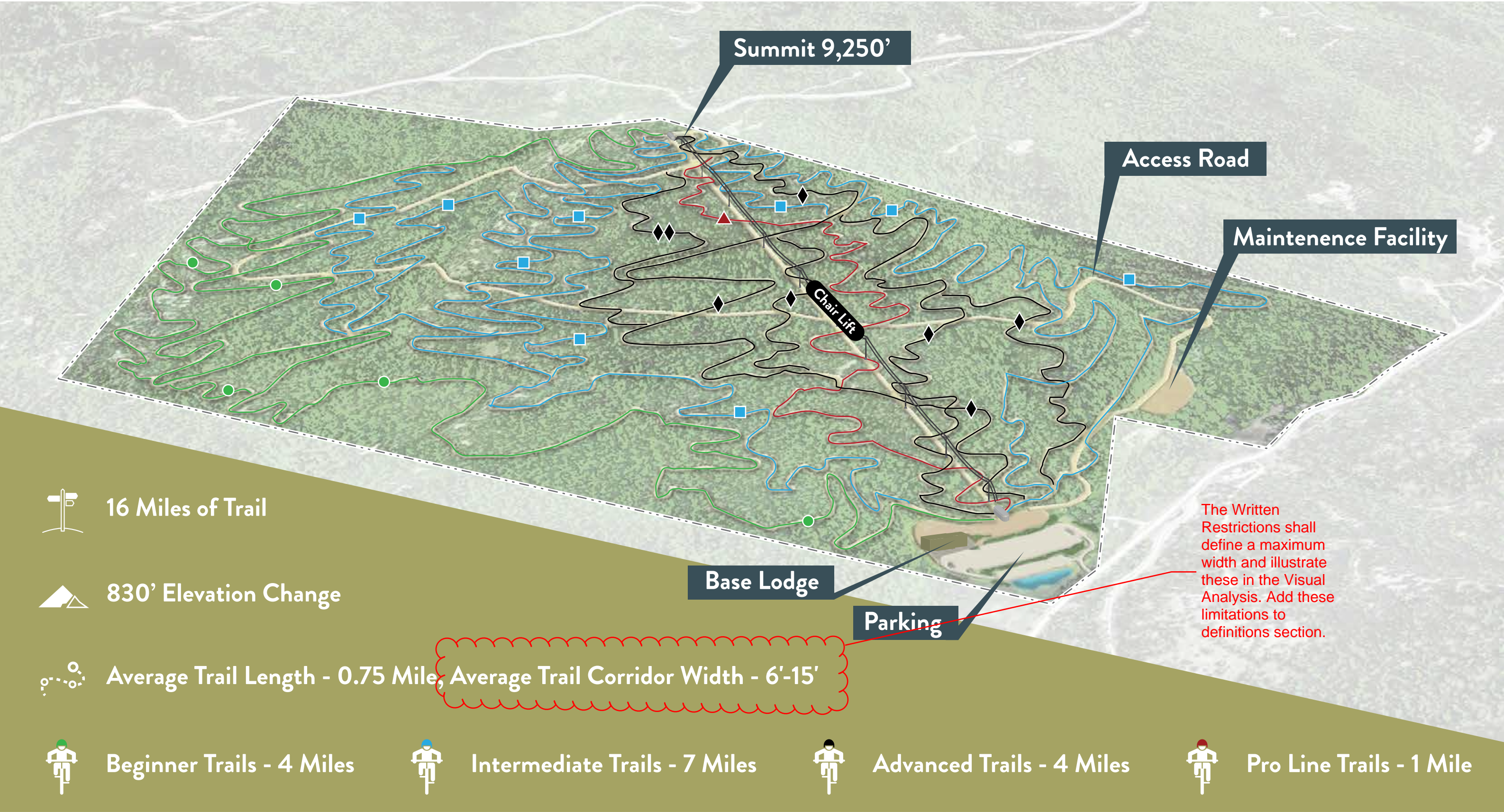
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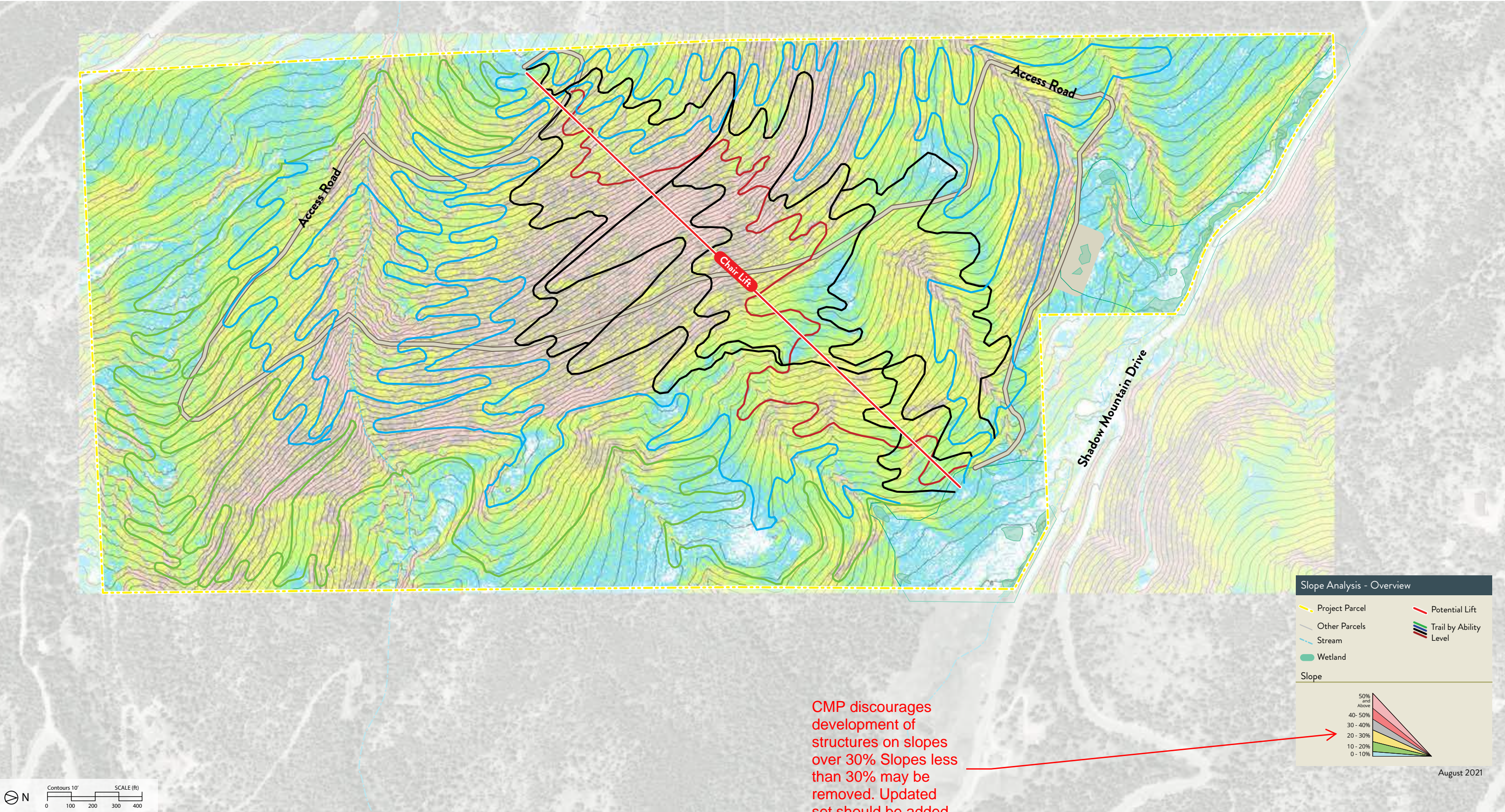
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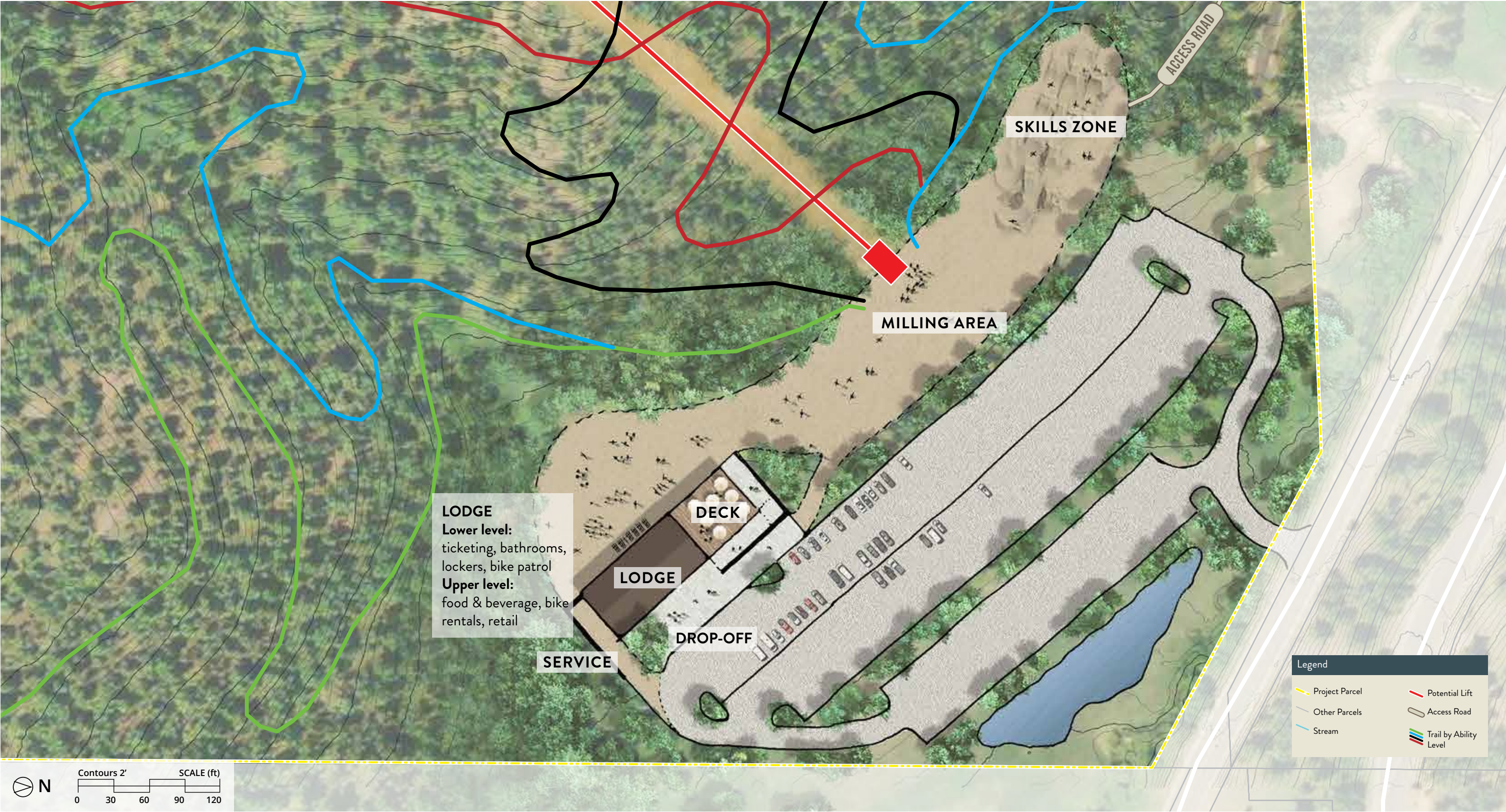


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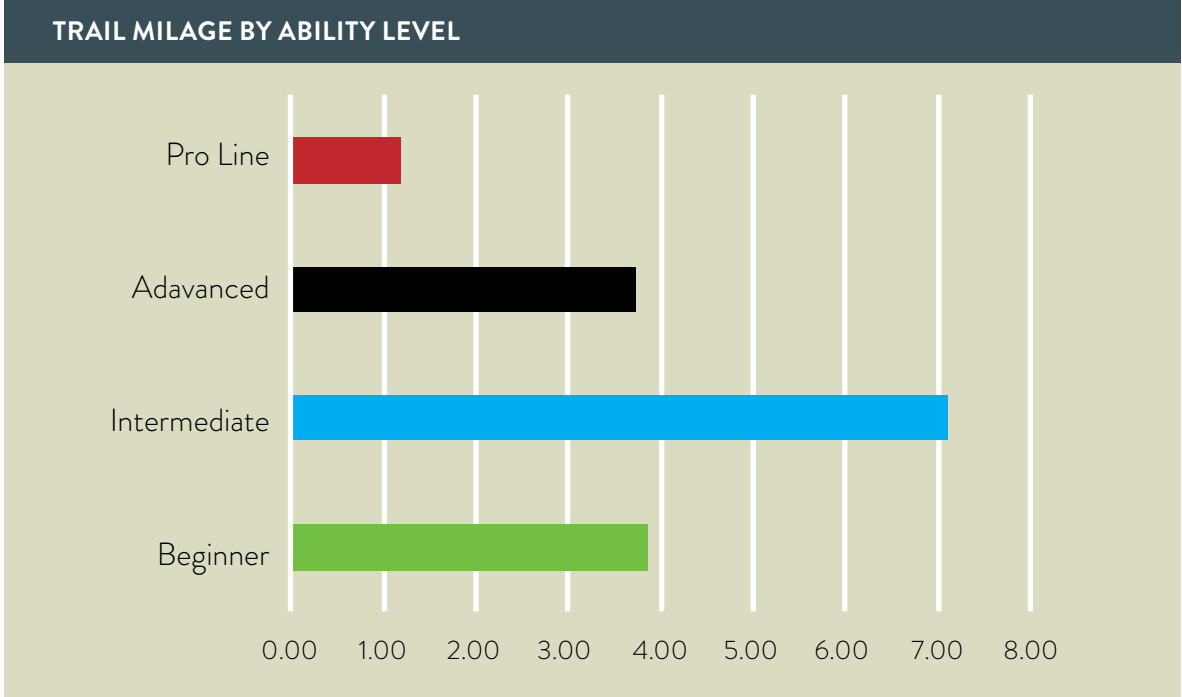




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CONCEPT TRAIL INFORMATION

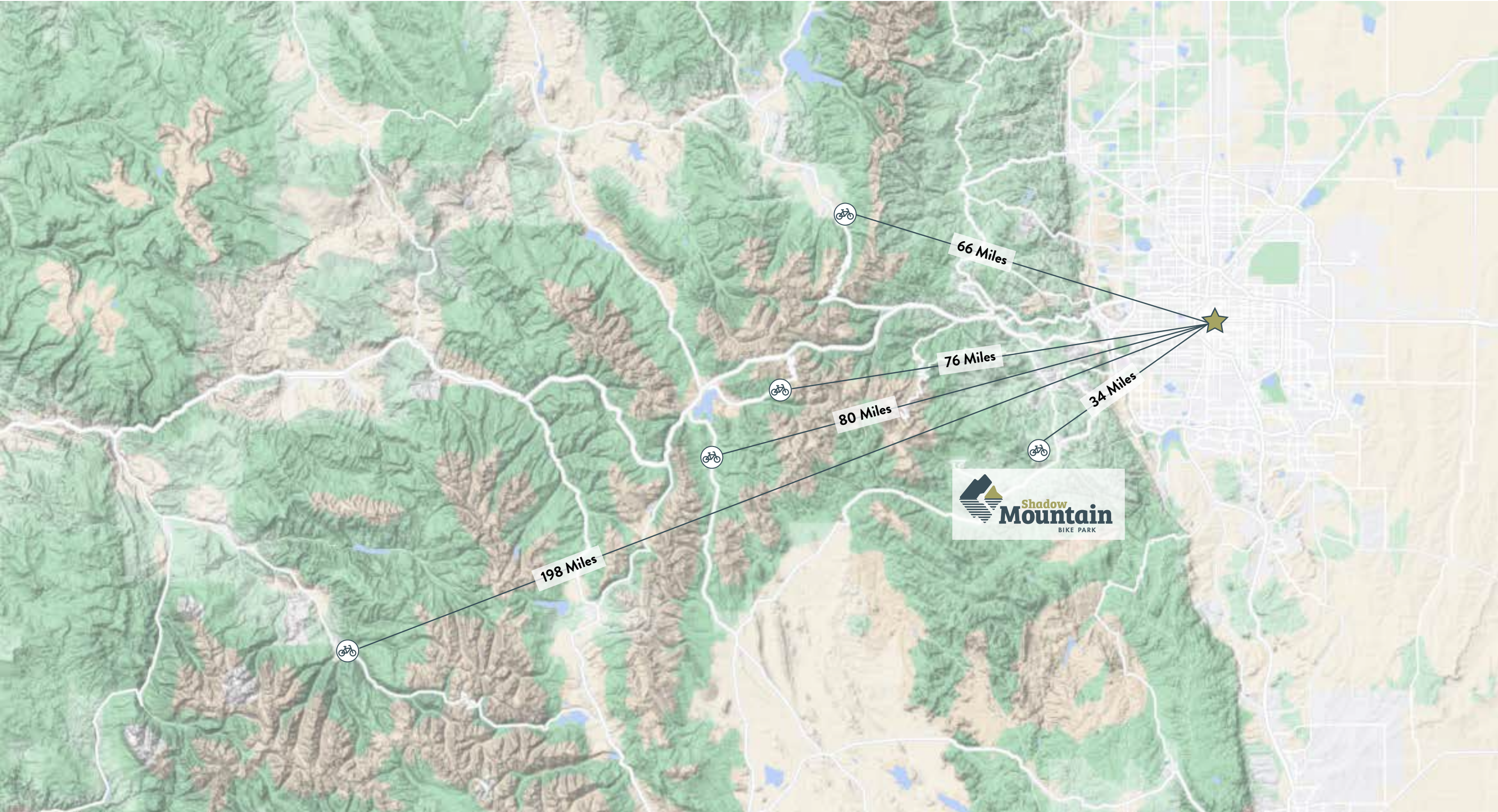
TRAIL	ABILITY LEVEL	FREERIDE/TECHNICAL	LENGTH FEET	LENGTH MILES
1	●	Freeride	16,258.10	3.08
2	●	Freeride	3,593.62	0.68
3	●	Freeride	582.00	0.11
4	■	Freeride	3,322.59	0.63
5	■	Technical	3,128.34	0.59
6	■	Freeride	11,016.89	2.09
7	■	Technical	4,703.06	0.89
8	◆	Technical	2,605.43	0.49
9	▲	Freeride	1,407.41	0.27
10	■	Freeride	1,807.06	0.34
11	◆◆	Freeride	7,416.11	1.40
12	■	Freeride	2,130.34	0.40
13	◆	Freeride	2,025.30	0.38
14	▲	Freeride	2,671.71	0.51
15	◆	Technical	3,786.62	0.72
16	■	Freeride	7,527.59	1.43
17	◆	Freeride	2,647.62	0.50
18	◆	Technical	1,212.43	0.23
19	▲	Freeride	2,127.25	0.40
20	■	Technical	3,929.99	0.74
Total:			83,899.46	15.89



CAPACITY

Chairlift Capacity = 790 riders/day

Parking Capacity (+/- 290 spaces) = 750 riders/peak day



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MEMO

TO: Dylan Monke
Jefferson County Planning and Zoning Division

FROM: Tracy Volkman
Jefferson County Environmental Health Services Division

DATE: March 22, 2023

SUBJECT: Case #23-102980 RZ
Shadow Mountain Bike Park
Philip Bouchard
61-163-00-001

The applicant has met the public health requirements for the proposed rezoning of this property.

PROPOSAL SUMMARY

Special Use Application for Development of a day-use lift-served bike park as a Class III Commercial Recreation Facility.

COMMENTS

Jefferson County Public Health (JCPH) provided comments regarding this proposal on November 18, 2020 and on June 1, 2022. We have reviewed the documents submitted by the applicant for this rezoning process and have the following comments:

The applicant must submit the following documents or take the following actions prior to a ruling on the proposed rezoning of this property. NOTE: Items marked with a “✓” indicate that the document has been submitted or action has been taken. **Please read entire document for requirements and information. Please note additional documentation may be required. Failure to provide required documentation may delay the planning process.**

REZONING REQUIREMENTS (Well and OWTS requirements)

✓	Date Reviewed	Required Documentation/Actions	Refer to Sections
✓	03/21/2023	Submit an Onsite Wastewater Report (Form 6001) in accordance with the LDR Section 22.B.2. Include an engineer evaluation to determine the gallons per day that will be generated at maximum occupancy and full build-out of the development and determine if an Onsite Wastewater Treatment System can be installed on the property.	Wastewater
✓	03/21/2023	Submit a notarized Environmental Questionnaire and Disclosure Statement in accordance with the Jefferson County Zoning Resolution and Land Development Regulation (LDR) Section 30.	Environmental Site Assessment

WATER

The Jefferson County Zoning Resolution (Section 9 C.21) and the Land Development Regulation (LDR) Section 21.B.2.a (1) requires proof of legal water, such documentation may include, but is not limited to, a copy of the well permit or water court decree. The Colorado Division of Water Resources (CDWR) is the governing authority for wells. As such, the applicant should contact the Colorado Division of Water Resources at 303.866.3581 who will determine if the applicant has a legal right to the water supply.

Please note that the well(s) will serve as a drinking water supply that serves a population of at least 25 people per day for at least 60 days per year and is not a non-transient, non-community water system or a community water system. As such, the water supply would meet the definition of a transient, non-community water system as defined in the Colorado Primary Drinking Water Regulations. **Please contact the Water Quality Control Division, Colorado Department of Public Health and Environment (CDPHE) at 303.692.3500 for a PWSID number and or permit as required as this well water supply will be regulated by the CDPHE, Water Quality Control Division.**

JCPH advises all parties to note that the long-term dependability of any water supply in Colorado, be it surface water, ground water, or a combination of surface water and ground water, cannot be guaranteed. All ground water and surface water supplies are subject to fluctuations in precipitation. During periods of drought, it will be necessary to carefully manage all uses of water so that the basic water supply needs for human health can be met.

WASTEWATER

The applicant submitted a partially completed Onsite Wastewater Report (Form 6001) in accordance with LDR Section 22.B.2. (a). The second page of the form was not provided as required. However, an Engineering Study for Shadow Mountain Bike Park Concept Master Plan Wastewater System Improvements prepared by Stantec dated November 2022 Project No. 181711248 was provided for review. This study calculated that the average day usage is estimated to be 1120 gallons per day (gpd).

Using Appendix A, Estimated Daily Wastewater Flow, of the current Jefferson County Onsite Wastewater Regulations, we estimate that approximately 1,800 gpd of wastewater will be generated per day. See following table:

Estimated Daily Wastewater Flow Per Day

Use	# of persons per day	Gallons per person per Day (gpd) per JCPH OWTS Regulations	Total Gallons of Wastewater Per Day
Employees	20	15	300
Guests	300	5	1500
Total			1800

Prior to installing an onsite wastewater treatment system (OWTS) the applicant must receive a permit from Jefferson County Public Health. The applicant must submit an OWTS application, associated documents, and applicable fees to this Department for an approved permit to install the OWTS. Contact Mitchell Brown at 303.271.5767 or mlbrown@jeffco.us for more information on this process.

If there are multiple onsite wastewater treatment systems, the systems will need to be evaluated under Colorado Department of Public Health and Environment (CDPHE) Policy 6. Please contact Mitchell Brown at mlbrown@jeffco.us or at 303.271.5767 for more information on this process.

Onsite wastewater treatment systems with an average daily flow of 2,000 gallons per day or more per property must comply with the Colorado Water Control Act, Article 8, Title 25 of the Colorado Revised Statutes, and Regulations adopted by the Colorado Water Quality Control Commission. Site approval from the Colorado Department of Public Health and Environment is required. Jefferson County Public Health will provide review and comment to the Colorado Department of Public Health and Environment on the site application.

ENVIRONMENTAL ASSESSMENT

JCPH has reviewed the Environmental Questionnaire and Disclosure Statement. The applicant checked "No" on all categories of environmental concern on the cover sheet. From this information, it does not appear that any recognized environmental conditions exist which would negatively impact the property.

REGULATED FACILITIES

The applicant has indicated on their application that they will allow Food Trucks at this site for retail food service for guests. Each Food Truck must have a valid Colorado Retail Food Establishment License for Mobile Units. Licenses issued by the City and County of Denver are not valid outside of Denver. If the Food Truck holds only a Denver County retail food service license, they must obtain a Colorado Retail Food Service License. Contact Duane Dominguez at 303.271.5745 or ddoming@co.jefferson.co.us for more information on licensing requirements for food trucks to operate in Jefferson County.

MAINTENANCE FACILITIES

Above ground storage fuel tanks with total tank capacity of 660 to 40,000 gallons are regulated by the Colorado Department of Labor and Employment, Division of Oil and Public Safety. They may also be regulated by the local fire department. Above ground storage tanks should also have secondary containment systems to prevent leakage of fuel or chemicals onto the ground. If underground piping for fuel is associated with the above ground storage tank, this may also be regulated by CDLE. Contact the CDLE, Division of Oil and Public Safety at 303.318.8500 and the jurisdictional fire department for registration, permitting, inspection and monitoring requirements.

Hazardous materials (oil, maintenance equipment fluids, etc.) or industrial waste that is generated from this operation cannot be disposed of into the onsite wastewater treatment system(s). Onsite disposal is prohibited. Any waste of this type must be recycled or disposed of at the proper waste disposal site, in accordance with local, state, and federal regulations.

Any waste materials generated from repair operations must be properly contained and stored on the site prior to transporting to an approved recycling or disposal facility. On site disposal of any

such materials is prohibited. Sufficient control measures to prevent any spillage from impacting the area should be in place.

AIR

Land development projects that are greater or equal to 25 contiguous acres and/or 6 months in duration typically require the submission of an Air Pollutant Emission Notice (APEN) and may require an air permit. Furthermore, Regulation No. 1 of the Colorado Air Quality Control Commission requires the developer to follow a Fugitive Dust Control Plan to mitigate dust problems during demolition, land clearing and construction activities. This department will investigate any reports of fugitive dust emissions from the project site. If confirmed, a notice of violation will be issued with appropriate enforcement action taken by the State.

NOISE

The Colorado Revised Statutes (Sections 25-12-101 through 108) stipulate commercial areas must comply with the following maximum noise levels 25 feet from the property lines:

- 60dB(A) from 7:00 a.m. to 7:00 p.m.
- 55dB(A) at all other times.

NOTE: These case comments are based solely upon the submitted application package. They are intended to make the applicant aware of regulatory requirements. Failure by Jefferson County Public Health to note any specific item does not relieve the applicant from conforming to all County regulations. Jefferson County Public Health reserves the right to modify these comments, request additional documentation, and or add appropriate additional comments.

Dylan Monke

From: AUTOMAILER@JEFFCO.US
Sent: Friday, March 24, 2023 10:16 AM
To: Dylan Monke
Cc: Keith Dean
Subject: 23 102980 RZ - Agency Response

Case Number: 23 102980 RZ

Case Type: Rezoning

Case Name: Shadow Mountain Bike Park

Review: Road & Bridge

Results: Comments Sent (request re-review)

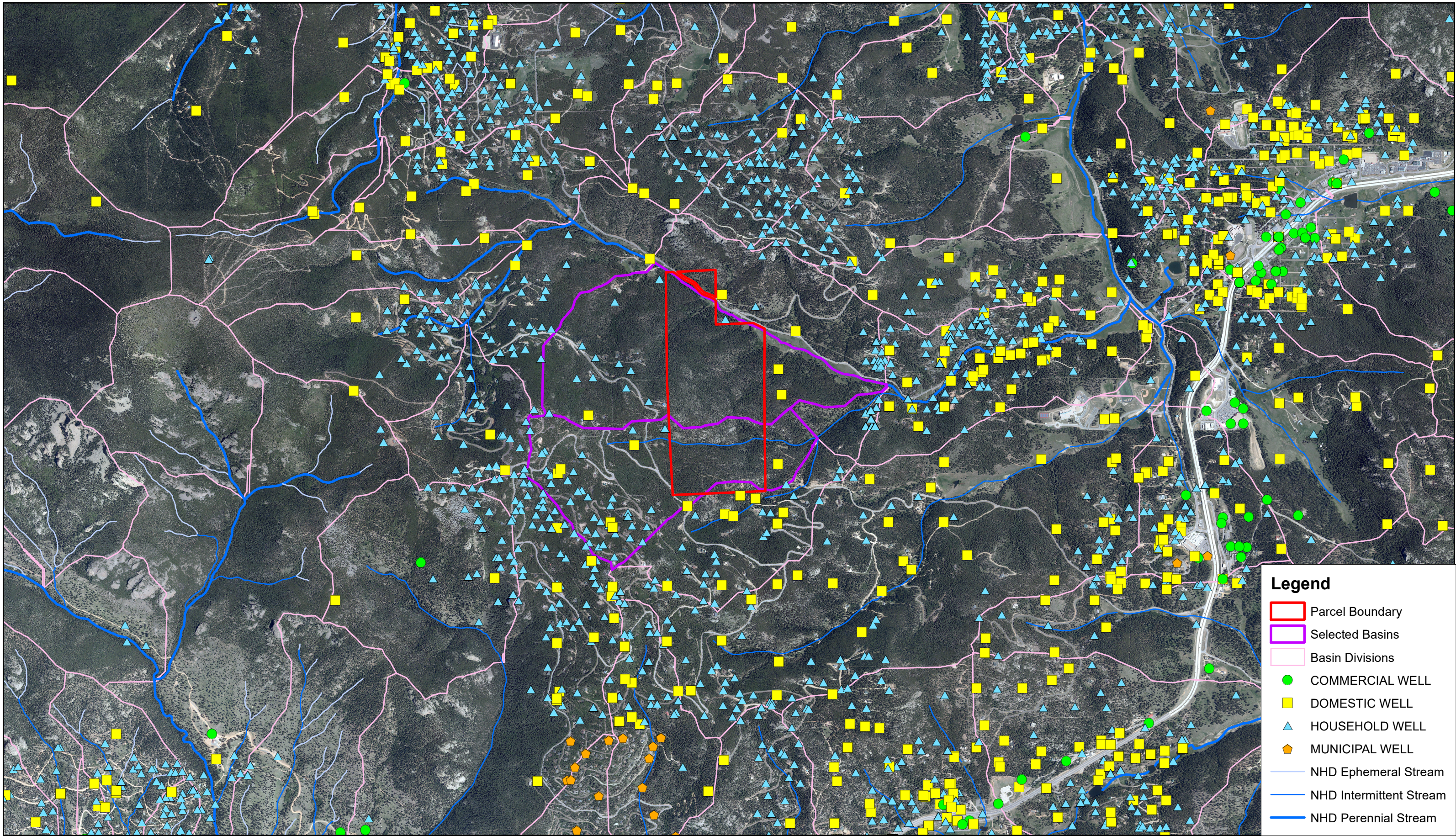
Review Comments:

Road and Bridge has no issues with the rezoning. However the traffic study does not include the impact it will have on the intersections of CR 73 and Pleasant Park Road or Barkley Road and the on and off ramp of Hwy 285(Conifer Road, S. Wolf Street, Main Street, Aspen Road). This will affect these intersections and improvements will need to be made to handle the influx in traffic.

Scheduled End Date: 04/07/2023

Reviewer: Keith Dean

Description: Special Use Application for Development of a day-use lift-served bike park as a Class III Commercial Recreation Facility.



Legend

-  Parcel Boundary
-  Selected Basins
-  Basin Divisions
-  COMMERCIAL WELL
-  DOMESTIC WELL
-  HOUSEHOLD WELL
-  MUNICIPAL WELL
-  NHD Ephemeral Stream
-  NHD Intermittent Stream
-  NHD Perennial Stream

Dylan Monke

From: Justin Gutierrez <JGutierrez@Summitutilitiesinc.com>
Sent: Monday, March 20, 2023 8:48 AM
To: Dylan Monke
Subject: --{EXTERNAL}-- RE: [EXTERNAL EMAIL] 23-102980RZ - ELECTRONIC REFERRAL - EXTERNAL - Rezoning

This Message Is From an External Sender

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Report Suspicious

Good morning Dylan,

The Shadow Mountain Bike Park, 80433 is located in Colorado Natural Gas service territory. There are gas lines and appurtenances in surrounding roadway R.O.W.s and service lines and meter sets to surrounding homes. However, Colorado Natural Gas does not have any assets in the property and has no objections to the Rezoning for Shadow Mountain Bike Park, 80433.

Please call 811 prior to digging!

Thanks,

Justin Gutierrez
Engineer
Summit Utilities, Inc.
jgutierrez@SummitUtilitiesInc.com
Office: (720) 981-2123 [x1187]

From: AUTOMAILER@JEFFCO.US <AUTOMAILER@JEFFCO.US>
Sent: Friday, March 17, 2023 2:39 PM
To: KIEL.G.DOWNING@USACE.ARMY.MIL; MARK.LAMB@STATE.CO.US; Justin Gutierrez <JGutierrez@Summitutilitiesinc.com>; GREG.OCHIS@STATE.CO.US; ASUMMERS@DRCOG.ORG; GCHIAPELLA@DRCOG.ORG; CDPHE_LOCALREFERRAL@STATE.CO.US; SARAH.BRUCKER@STATE.CO.US; JOANNA.WILLIAMS@STATE.CO.US; BRADLEY.SHEEHAN@STATE.CO.US; DAVID.DIXON@STATE.CO.US; ALFONZO_MARTINEZ@CABLE.COMCAST.COM; PLATREVIEW@LUMEN.COM; MATT.PISCOPO@COLOSTATE.EDU; RPARKER@ELKCREEKFIRE.ORG; JWARE@ELKCREEKFIRE.ORG; PLATREFERRAL@UNITEDPOWER.COM; DONNA.L.GEORGE@XCELENERGY.COM
Cc: DMONKE@JEFFCO.US; MSCHUSTE@JEFFCO.US; KMILLER@JEFFCO.US
Subject: [EXTERNAL EMAIL] 23-102980RZ - ELECTRONIC REFERRAL - EXTERNAL - Rezoning



ELECTRONIC REFERRAL

This e-mail is to inform you that the application referenced below is now beginning the 1st Referral. Please review and provide comments on the referral documents found in the [Current Referral Documents](#) sub-folder. Comments should be submitted electronically to the Case Manager by the due date below.

Case Number: 23-102980 RZ

Case Type: Rezoning

Address: Shadow Mountain Bike Park, 80433

Description: Special Use Application for Development of a day-use lift-served bike park as a Class III Commercial Recreation Facility.

Case Manager: Dylan Monke

Case Manager Contact Information: dmonke@co.jefferson.co.us 303-271-8718

Comments Due: 03/24/2023

If you have any questions related to the processing of this application, please contact the Case Manager.

If you received this message in error, please do not read, copy, or share it. Instead, please notify the sender immediately and permanently delete all copies in your possession.

P&Z REFERRAL T&E RESPONSE

To: Dylan Monke

Case #: 23-102980 RZ

Case Name, Address, or PIN:

From: Transportation & Engineering

Due Date: March 24, 2023

Shadow Mountain Bike Park

Amanda Attempt Result & Attachments:

☐ Comments Sent (no further review)

☒ Comments Sent (request re-review)

☐ No Comment (no further review)

Drainage

☐ T&E is currently working on a project in the area. See attached information.

☐ No concerns.

☐ Other Notes:

Right-of-Way / Roadway Corridor Expansion Projects

☒ Corridor Projects / ROW

☐ Land owner will need to refund the county \$ _____ for ROW purchased in _____ for
This amount **must** be paid before plat is recorded and / or plans are approved and released for construction.

☐ Documentation attached in AMANDA. ☐ Documentation to follow.

☐ Additional ROW needed for upcoming T&E project. Plan sheet attached with required width / area.

☐ Fee-in-lieu of adjacent roadway construction preferred, due to planned construction by the county. Please have the applicant submit a cost estimate.

☒ No Concerns.

☐ Other Notes:

Traffic Operations / Transportation Planning

☒ Transportation Planning

☒ Transportation Engineering

	Included in referral	Reviewed	
		No	Yes
Traffic Study	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Signage & Striping Plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Traffic Signal Plans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Trails or Sidewalks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Street / Road Plans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☐ No Concerns.

☐ Other Notes:

A full Transportation Impact Study will be required at time of SDP submittal. Follow requirements as outlined in Transportation Design and Construction Manual.

This land use does not align with a trip generation code identified in the ITE 10th Edition. Provide greater justification for 1.5 turnover of vehicles per day using data collected from similar land uses.

Additional Comments

☒ **Name:** Transportation & Engineering

Comments:

The County does not support the use of left turn acceleration lanes; these shall not be considered as a potential mitigation measure. Revise Table 1a, Table 1b, and any other places in the report which show a mitigated level of service.

The County has preliminarily identified the intersections of 73/Barkley and 73/Shadow Mountain for installation of roundabouts. Given the significant impact of the development on these intersections (approximately 25% of the traffic through the intersections will be generated from the development), the County will be seeking contribution from the applicant for these public improvements.

Provide a dedicated westbound left turn lane into the development. County regulations require a left turn lane at driveways on major collectors. Shadow Mountain Dr is currently classified as a collector, however the traffic volumes are in the range of a major collector (ADT of 2,000-8,000). Since the Shadow Mountain corridor is effectively functioning as a major collector, and the 85th percentile speed on Shadow Mountain is greater than 45mph, and a significant proportion of traffic on Shadow Mountain will now be westbound left turning traffic at the access point, provide a dedicated westbound left turn lane into the development.

An eastbound right turn acceleration lane shall be evaluated in the Safety section of the forthcoming Transportation Impact Study required at time of SDP submittal. Right turn acceleration lanes may be required where necessary for public safety and traffic operations based upon site specific conditions.

Provide justification for the 1% annual growth rate used for future traffic projections in 2025 and 2042.

The value used for % Heavy Vehicles in the Synchro analysis is not reflective of actual expected conditions.

The value used for PHF in the Synchro analysis does not match peak hour factor collected with traffic counts. Use the actual peak hour factors for analysis in existing scenarios; provide justification for peak hour factor used in projected future scenarios.

Provide explanation in the report for why the Saturday and Sunday PM periods were not analyzed.

Show the existing ADT on Figures 3b and 3c.

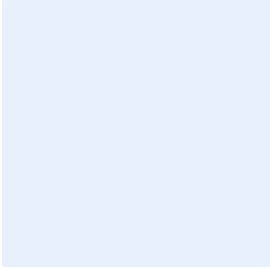
Provide a new Figure (or modify Figure 3a) so that the ADT used throughout the analysis is clear on the Figure.

Per the narrative, the applicant will work with the local Sheriff and/or Road and Bridge authority within the Right-of-Way to strictly enforce no parking along Shadow Mountain Drive. Please describe the type of work that the applicant is committing to provide.

Provide general explanation for the 0 value hourly counts for Shadow Mtn Drive west of Highway 73 on Tuesday, August 23, 2022 at 1:00 PM until Wednesday, August 24 at 1:00 PM. Provide justification for why this missing data does not affect the analysis and conclusions in the report.

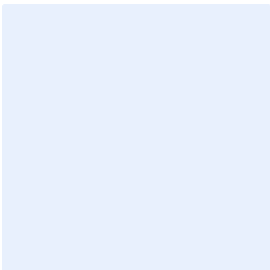
The County collected traffic data in November 2022 at the same location as Site 1. The November ADT was 1,840, which is below the ADT that the applicant collected in August 2022. The County affirms that the applicant

appropriately used traffic data for the season that would experience the highest background traffic volumes, in addition to the greatest impact from the development, and that this traffic report has therefore considered the peak traffic impacts to the area.



☐ **Name:**

Comments:



Dylan Monke

From: United Power Plat Referral <platreferral@UnitedPower.com>
Sent: Monday, March 20, 2023 1:52 PM
To: Dylan Monke
Subject: --{EXTERNAL}-- FW: 23-102980RZ - ELECTRONIC REFERRAL - EXTERNAL - Rezoning

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[Report Suspicious](#)

Good afternoon,

Thank you for inviting United Power, Inc. to review and comment on **Case Referral 23-102980RZ– Shadow Mountain Bike Park, 80433 – Rezoning**.

Unfortunately, this is outside our service territory and we are unable to comment.

Sincerely,



[\[unitedpower.com\]](https://www.unitedpower.com)



[\[facebook.com\]](https://www.facebook.com)



[\[twitter.com\]](https://www.twitter.com)



[\[linkedin.com\]](https://www.linkedin.com)



[\[youtube.com\]](https://www.youtube.com)



[\[instagram.com\]](https://www.instagram.com)

Zayda Vargas

Right of Way Administrative Assistant

Office: 303-637-1389 | zvargas@unitedpower.com

Working Hours: Monday-Friday 8:00-4:30

United Power | www.unitedpower.com

[\[unitedpower.com\]](https://www.unitedpower.com)

500 Cooperative Way Brighton, CO 80603

*Powering Lives, Powering Change, Powering the Future—
The Cooperative Way*

From: AUTOMAILER@JEFFCO.US <AUTOMAILER@JEFFCO.US>

Sent: Friday, March 17, 2023 2:39 PM

To: KIEL.G.DOWNING@USACE.ARMY.MIL; MARK.LAMB@STATE.CO.US; JGUTIERREZ@SUMMITUTILITIESINC.COM;
GREG.OCHIS@STATE.CO.US; ASUMMERS@DRCOG.ORG; GCHIAPELLA@DRCOG.ORG;
CDPHE_LOCALREFERRAL@STATE.CO.US; SARAH.BRUCKER@STATE.CO.US; JOANNA.WILLIAMS@STATE.CO.US;
BRADLEY.SHEEHAN@STATE.CO.US; DAVID.DIXON@STATE.CO.US; ALFONZO_MARTINEZ@CABLE.COMCAST.COM;
PLATREVIEW@LUMEN.COM; MATT.PISCOPO@COLOSTATE.EDU; RPARKER@ELKCREEKFIRE.ORG;
JWARE@ELKCREEKFIRE.ORG; United Power Plat Referral <platreferral@UnitedPower.com>;
DONNA.L.GEORGE@XCELENERGY.COM

Cc: DMONKE@JEFFCO.US; MSCHUSTE@JEFFCO.US; KMILLER@JEFFCO.US

Subject: 23-102980RZ - ELECTRONIC REFERRAL - EXTERNAL - Rezoning

CAUTION: This email originated from outside of United Power. Do not click links or open attachments unless you recognize the sender and know the content is safe.

ELECTRONIC REFERRAL

This e-mail is to inform you that the application referenced below is now beginning the 1st Referral. Please review and provide comments on the referral documents found in the [Current Referral Documents](#) sub-folder. Comments should be submitted electronically to the Case Manager by the due date below.

Case Number: 23-102980 RZ

Case Type: Rezoning

Address: Shadow Mountain Bike Park, 80433

Description: Special Use Application for Development of a day-use lift-served bike park as a Class III Commercial Recreation Facility.

Case Manager: Dylan Monke

Case Manager Contact Information: dmonke@co.jefferson.co.us 303-271-8718

Comments Due: **03/24/2023**

If you have any questions related to the processing of this application, please contact the Case Manager.

Disclaimer

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Visual Analysis

of proposed projects at
Shadow Mountain Bike Park

November 2022

Prepared for:



Shadow Mountain Bike Park

Prepared by:



SE Group
PO Box 2729
Frisco, CO 80443

and

Perkins&Will

Introduction

This visual analysis includes a summary of visual resource management guidelines, a description of the existing visual conditions in the project area, and an analysis of impacts associated with implementation of the proposed project. The analysis also includes mitigation measures designed to minimize or avoid impacts to visual resources.

The proposed project is the development of a lift-served bike park on Shadow Mountain Drive in Conifer, Colorado. The project would require tree clearing and grading to construct a base area that includes parking spaces for up to 300 cars, a guest services facility, and the top and bottom terminals of a chairlift, as well as tree clearing along the lift corridor, bike trails, and service road.

Local Guidelines

Local guidelines for the visual resource include the Conifer/285 Corridor Area Plan and the Jefferson County Zoning Resolution.

Community Plan Compliance

The Jefferson County 2020 Comprehensive Master Plan was originally adopted by the Planning Commission in 2010 and updated in 2020. It includes eight area plans that provide more specific guidance when considering rezoning, special use, or site approval. The Conifer/285 Corridor Area Plan applies to the proposed project area and its direction for the visual resource is provided below.

The perception of open space is enhanced by unrestricted views.

The visual resources of the Conifer/285 Corridor Area are among its most important values. Views of the area's beauty attract people to the community and provide pleasure to its residents. These resources should be protected.

1. *Visually sensitive areas, and landscapes that have special qualities, (e.g. major rock outcrops, mountain meadows, steep slopes, ridgelines and peaks) should be treated as environmentally sensitive areas, and New Development in these areas should only be allowed if visual impacts can be adequately mitigated.*
2. *Visual impacts of New Developments in mountain meadows cannot be adequately mitigated through planting trees.*
3. *If a mountain meadow is discovered on a property, which is not already designated on the Plan Recommendation maps, development should be placed outside of mountain meadows. Buildings may be placed at the edge of meadows within the trees; however, the following items should be taken into consideration for this to occur. Density recommendations should not change.*
 - a. *Using the natural topography to minimize the visual impacts of the buildings, as much as practicable.*
 - b. *Constructing only open-style fencing in the meadow area.*
 - c. *Minimize disturbance in the 'wet' portion of the meadow, if such an area exists.*
4. *In addition, the following should be included in the architectural design.*
 - a. *Using colors that help the structures blend into the natural surroundings.*
 - b. *Using more than one building material. One of the materials used should be stone, faux stone, cultured stone, or timbers.*

- c. *Minimize the impact of other non-building structures on the meadow, such as driveways, septic systems and detention areas.*
5. *Structures, roads and utilities should be designed so they do not visually dominate the landscape. Techniques that should be considered include:*
 - a. *Structures should be below the ridgeline, and natural materials and colors should be used;*
 - b. *Roads should be constructed parallel to contours, rather than a bold cut on a hillside; and*
6. *Development within activity centers should be designed to achieve a visually cohesive appearance by using natural materials and colors compatible with the mountain backdrop of the area.*¹

A-2 Zoning

The proposed project would be located on a parcel zoned as Agricultural-Two, or A-2. There are no specific guidelines for the visual resource, however, there are guidelines for building heights and other parameters. They are the following:²

Districts	Building Height	Lot Size (see a & b below)
A-1	35 ft.	5 Acre (217,800 s.f.)
A-2	35 ft.	10 Acre (435,600 s.f.)
A-35	35 ft.	35 Acre (1,524,600 s.f.)

Existing Conditions

The existing parcel is undeveloped. It is characterized by slopes from 5 to 25 percent with some steeper areas of rock outcrops. Vegetation consists of mixed conifer, aspen forest, lodgepole pine, agricultural and rocky meadows, as well and some riparian areas and wetlands.³ Most of the proposed development would occur in a meadow area that was previously cleared of vegetation for agricultural purposes. The area has not been identified by the Conifer/285 Corridor Area Plan as a mountain meadow.

Two viewpoints were selected for analysis in order to simulate the visual impacts of the proposed project. These include a viewpoint along Shadow Mountain Drive, looking directly at the proposed base area development and lift corridor, and a viewpoint from South Warhawk Road from which the lift corridor would likely be visible. These viewpoints were selected because the local community was concerned about modifications to the visual resource from these particular areas and because they are the most frequented areas with direct views of the proposed project area. Many other viewpoints along Shadow Mountain Drive and South Warhawk Road were considered, however, visibility of proposed projects from most other viewpoints considered would be minimal to none. Refer to Figure 1 for a map of the viewpoints included in this analysis.

Shadow Mountain Drive passes through the parcel and is on the northwestern edge of the proposed parcel for development. This is the main viewpoint from which visitors to the area can see the parcel

¹ Conifer/285 Corridor Area Plan, updated 2020

² Jefferson County Zoning Resolution, 2020 Edition, Section 33

³ Shadow Mountain Bike Park Vegetation Assessment, prepared for this application.

(refer to Figure 2). Most viewers currently see the parcel along an approximately 0.75-mile stretch of road while driving along Shadow Mountain Drive. When driving the posted speed limit of 30 miles per hour, there is an approximately 90 second window in which the project area is visible. In its existing condition, the only built structures on the parcel are a wooden fence and metal posts close to the road, where a stream crosses.

South Warhawk Road stems from Shadow Mountain Drive and travels uphill, across from the project parcel to the northeast. Most visitors in this area are residents. While driving, there are short windows where the trees break and reveal the higher elevation areas within the parcel (refer to Figure 4). This window of visibility only lasts a couple seconds at a time. In its existing condition, the only built structures in view are houses on the mountain side and communications infrastructure along the ridgeline.

Additionally, there are some private residences bordering the project area that have direct views of the parcel. Adjacent residences include homes on the other side of Shadow Mountain Drive, as well as homes directly adjacent to the parcel. Most viewers at these locations are likely local residents in their homes or on their property. The duration of their view likely lasts anywhere between a couple seconds and several minutes, depending on what they are doing.

Proposed Conditions

Development of the proposed project would introduce developed bike park infrastructure and trails into an area that currently exists in a near natural state. The project would result in modest additions to a largely undeveloped landscape when viewed from both critical viewpoints.

As illustrated in the visual simulations, the proposed base area and parking facilities would be prominent in the foreground of viewpoint 1 and the chairlift and lift corridor would be prominent in the middleground of viewpoint 2. The service road and bike trails would have negligible visual impacts as they would be shielded by existing vegetation from most views in the analysis area.

As illustrated in Figure 3, implementation of the proposed project would introduce recreation infrastructure to the largely undeveloped landscape along Shadow Mountain Drive. Visual impacts would be most severe in the foreground, where the proposed parking facility, base area facility, and chairlift/terminal would be viewed by members of the public driving down the road. Given the topography, vegetation, and winding nature of Shadow Mountain Drive, it is anticipated that the proposed base area would only be visible for approximately 90 seconds over a 0.75-mile segment of the road. Project-specific design criteria and best management practices would be utilized to minimize or avoid visual impacts from this viewpoint.

As illustrated in Figure 5, implementation of the proposed project would introduce recreation infrastructure to the largely undeveloped landscape viewed from South Warhawk Road. Visual impacts would be evident in the middleground, where the proposed chairlift, top terminal, and lift corridor would be visible for members of the public driving down the road. Given the topography, vegetation, and winding nature of South Warhawk Road, it is anticipated that the proposed chairlift infrastructure would occasionally become visible in short windows where the trees break and reveal the higher elevation areas within the parcel. These views are not anticipated to last more than a couple of seconds, and project-specific design criteria and best management practices would be utilized to minimize or

avoid these impacts. While the proposed projects would introduce recreation infrastructure to the mountainside, with adherence to PDC, the proposed projects would remain visually subordinate to the visual strength of the characteristic landscape.

It is likely that the residences in the area would also experience the visual impacts of the proposed project. These are the areas from which the views would last the longest. The two residences closest to the project parcel (one across from the parcel and one bordered by the project parcel along Shadow Mountain Drive) would have the most direct views of the proposed base area development. The character of their views would change from largely undeveloped to developed.

Mitigation Measures

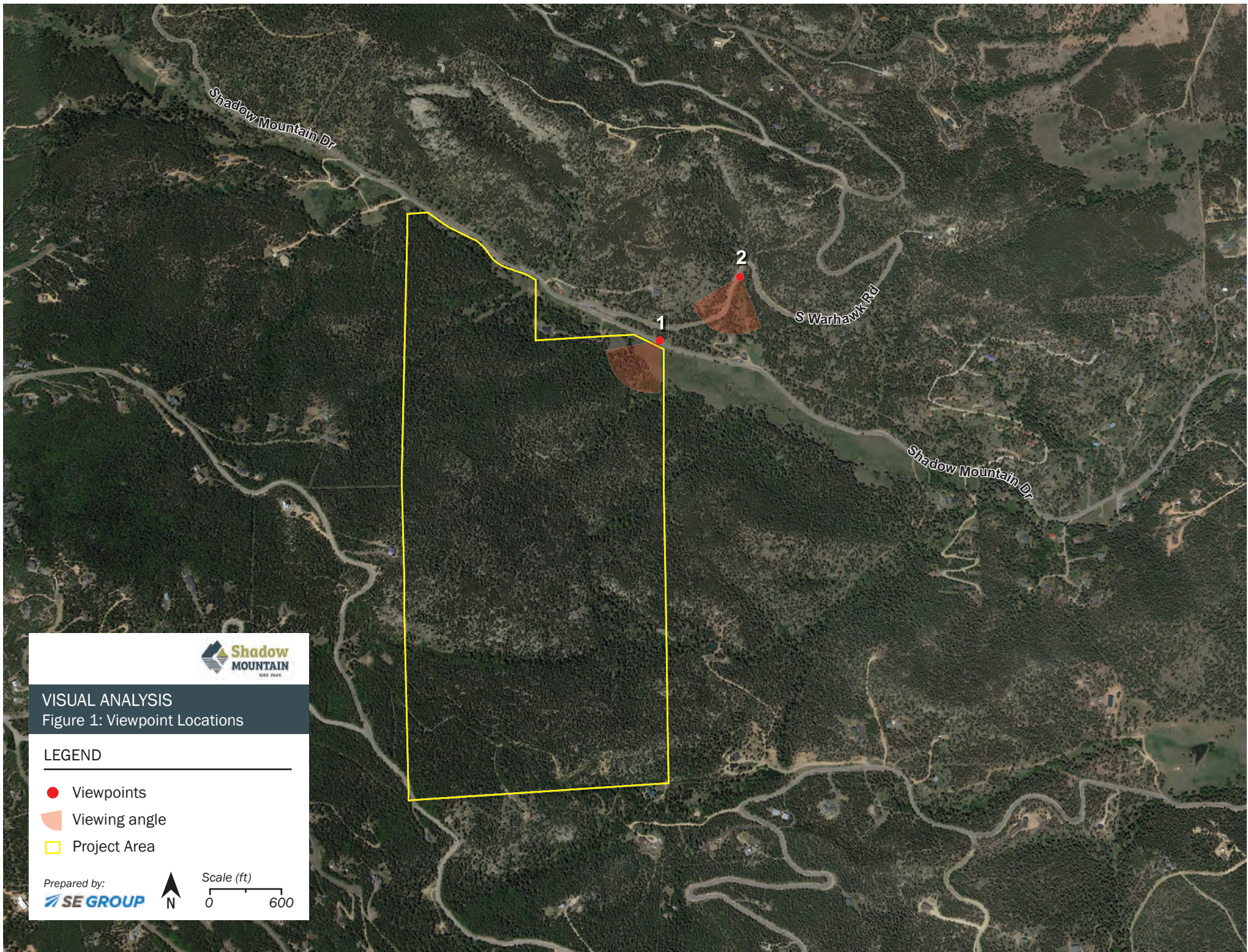
As demonstrated in Figure 3, vegetation would be planted and clustered along the edge of the parking lots strategically to screen the base area facility, lift terminal, and bike park activity. While these are not considered mitigation according to the Conifer/285 Corridor Area Plan, they would provide screening of the development for drivers along Shadow Mountain Drive and for the nearby residences.

The planned base area facility would also follow design criteria to mitigate its presence in the viewshed of Shadow Mountain Drive. The building would be nestled into the hillside, minimizing vertically into the majority of the facades. Maximum building height is currently designed at 32'6", compliant with the A-2 building height limit of 35'. The roof planes would be sloped to match the grade of the hillside and 'replace' the hillside that was removed, so one's eye naturally connects the rooflines into the mountainside. Although an exact material palette has not been selected at this point, the building facades will be comprised of natural materials and tones of grey, brown, and black. Utilizing wood, stone, concrete, and steel allows the building to blend into the shadows and trunk lines of the forest surrounding it.

Viewshed Analysis

The viewshed of the proposed project is displayed in Figure 6. This viewshed was analyzed from the highest point within the parcel, from the proposed top lift terminal. As described in the figure, the viewshed displays a 10km (approximately 6.22 mile) radius, where green indicates areas from which the viewpoint would be visible.

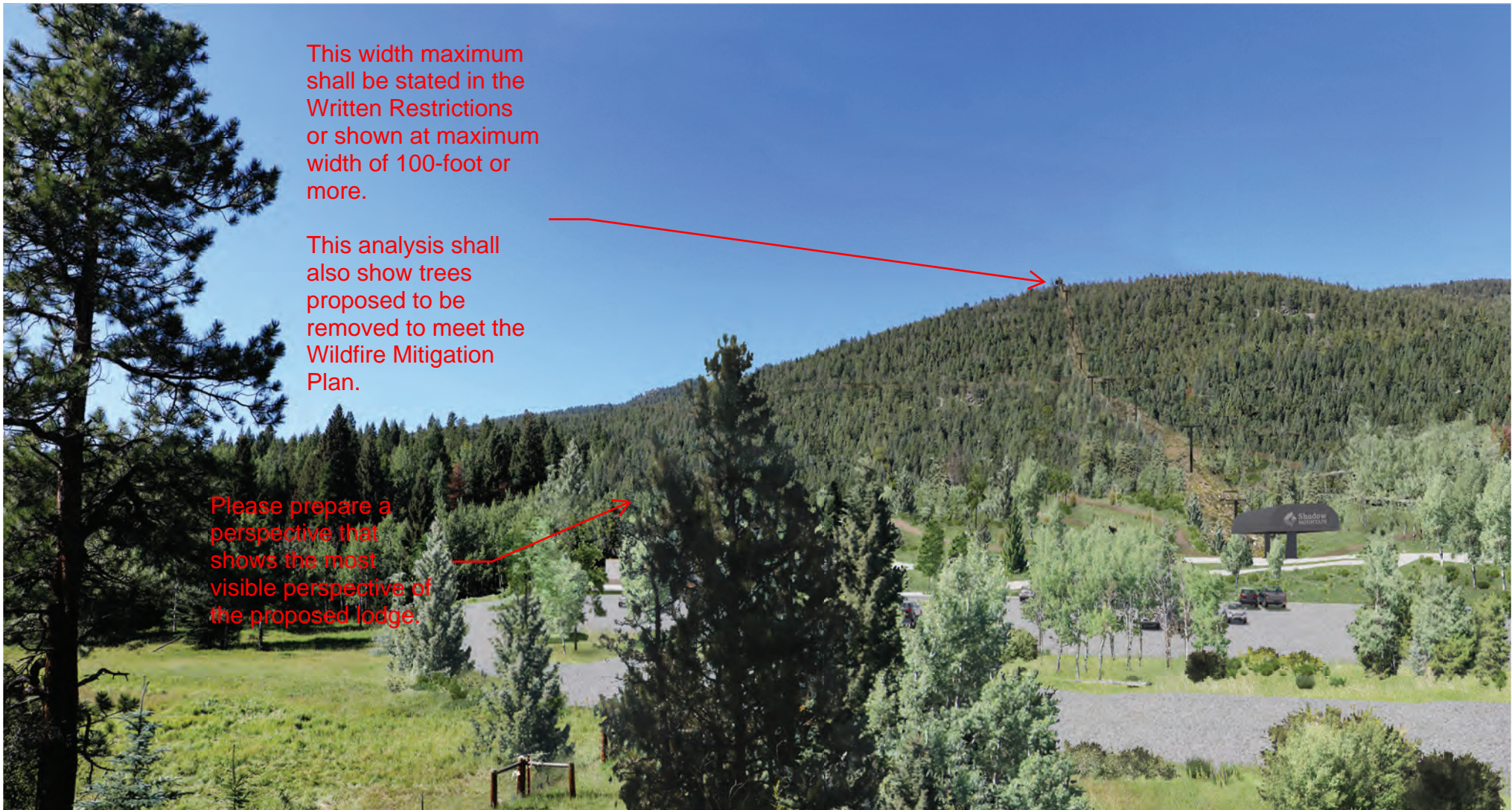
The viewshed from this point is primarily visible north and west of the project area. It is likely that the areas further away would have trouble seeing a lift terminal given the presence of vegetation and the scale of it from a distance. This being said, it is likely that the viewshed areas that would be most highly impacted are those closest to the project area.





VISUAL ANALYSIS
Figure 2: Viewpoint 1
Shadow Mountain Drive
Existing Conditions





VISUAL ANALYSIS
Figure 3: Viewpoint 1
Shadow Mountain Drive
Proposed Conditions





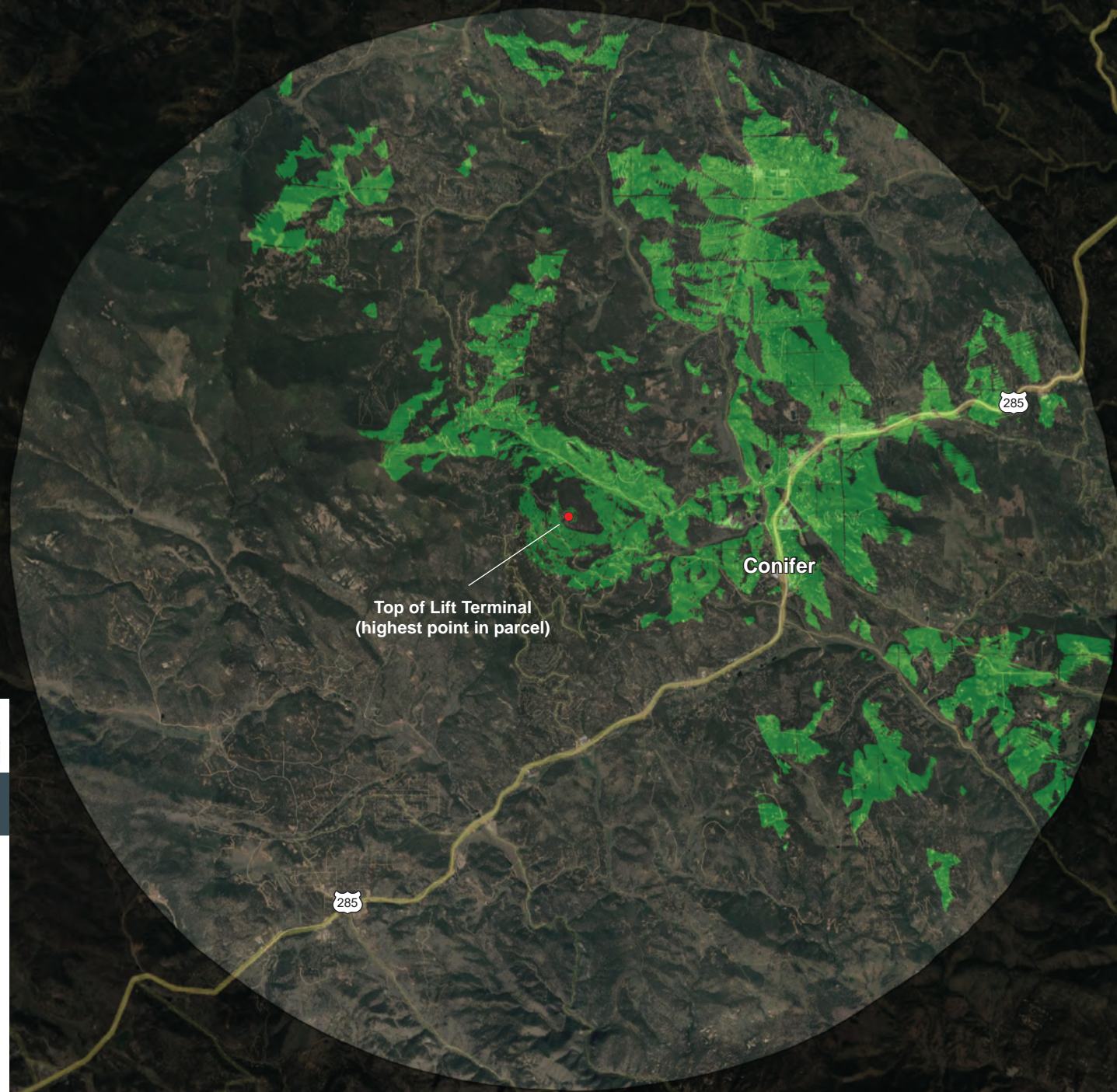
VISUAL ANALYSIS
Figure 4: Viewpoint 2
South Warhawk Road
Existing Conditions





VISUAL ANALYSIS
Figure 5: Viewpoint 2
South Warhawk Road
Proposed Conditions





VISUAL ANALYSIS

Figure 6: Viewshed from top lift terminal

LEGEND

- Top lift terminal
- Viewshed areas

Notes:

Viewshed is shown within a 10km radius.

Viewshed calculations are approximate and do not account for vegetation and other obstructions.

Prepared by:



Scale
0 1 mi