



Staff Report for Hillside Review Approval

Weber County Planning Division

Synopsis

Application Information

Application Request: Consideration and action on an administrative application for final approval of the Nordic Valley Expansion Hillside Review

Type of Decision: Administrative

Applicant: Brandon Fessler

File Number: HSR 2020-04

Property Information

Approximate Address: 3567 Nordic Valley Way, Eden

Project Area: 1.48 Acres

Zoning: Forest Valley (FV-3) Zone

Existing Land Use: Residential

Proposed Land Use: Residential

Parcel ID: 22-029-0008; 22-029-0010

Township, Range, Section: T7N, R1E, Section 33

Adjacent Land Use

North:	Recreational	South:	Recreational
East:	Residential	West:	Residential

Staff Information

Report Presenter: Steve Burton
sburton@co.weber.ut.us
801-399-8766

Report Reviewer: RG

Applicable Ordinances

- Title 101 (General Provisions) Section 7 (Definitions)
- Title 108 (Standards) Chapter 14 (Hillside Development)
- Title 108 (Standards) Chapter 22 (Natural Hazard Areas)

Background and Summary

The applicant is requesting approval of a Hillside Review for the Nordic Valley trail expansion. The trail expansion includes new ski runs, lifts, and terminals on a parcel consisting of approximately 346 acres in Eden. The requirement for hillside review comes from a geologic reconnaissance review performed by GCS Geoscience, in which the geologist, Greg Schlenker, recommends the hillside review procedure due to slopes over 25%.

The County's Hillside Review procedures (LUC 108-14) outline the following submittal requirements for hillside review:

- a) Detailed engineering plans and profiles for retaining wall, cuts, filling and/or excavating of land.
- b) Site plan with contours.
- c) Cross sections of improvements.
- d) Retaining wall designs with engineers stamp (if applicable).
- e) Geotechnical report (site-specific for structures) and, if applicable, verification of compliance with the requirements of title 108, chapter 22 Natural Hazard Areas.
- f) Other studies and/or information deemed necessary by the members of the board.
- g) Utah pollution discharge elimination system (UPDES) permit with stormwater pollution prevention plan (SWPPP) shall be required at the time of application. Erosion control landscaping on cuts, fills and other locations, considered necessary by the review board, shall be provided in order to prevent erosion.
- h) A landscape plan as per section 108-14-10.

A site plan with contours is included as Exhibit B of this report. The applicant is not proposing landscaping, other than existing natural landscaping. The applicant has submitted a geologic hazards report (prepared by GCS Geoscience) and a geotechnical report (prepared by CMT Engineering Laboratories) for review. The applicant has also provided building elevations as part of the building permit submittal. The geotechnical and geologic hazards reports anticipate and provide recommendations regarding cuts and fills, as well as the placement of structures. The applicant will be required to comply with all recommendations outlined in the geotechnical and geologic hazards reports.

For this proposal, the hillside review board consists of the Weber Fire District, the Weber County Engineering Division, and the County Planning Division. The Weber County Building Official will review the applicable reports and plans as part of building permit review. The following are reviews of this project from the applicable review agencies:

Weber Fire District, October 2, 2020:

As long as everything is built to building department standards this is approved.

Review fee \$100.00

Weber County Engineering Division, October 15, 2020:

I have had a chance to review the plan(s) and have the following comment(s):

Follow the recommendations of the provided Geotechnical reports.

Planning Division Review

The Planning Division Staff has determined that, in compliance with review agency conditions, the requirements and standards provided by the Hillside Review Chapter have been met for the preparation of the site.

Planning Division Findings

After visiting the site and gathering input from the applicable County review agencies, the Planning Division Staff is recommending approval subject to the following conditions:

1. Development of the site must follow all recommendations outlined in the geologic hazards report and the geotechnical engineering study.
2. New runs that are cleared must be re-seeded with a seed mix approved by the forest service to help hold the soil in place. Re-seeded areas must be clear of noxious weeds (a condition of approval from the conditional use permit approval granted by the Planning Commission on March 3, 2020).

The recommendation for approval is based on the following findings:

1. The application was submitted and has been deemed complete.
2. The requirements and standards found in the Hillside Development Review Procedures and Standards Chapter have been met or will be met during the excavation and construction phase of proposed improvements.
3. The Hillside Review Board members reviewed the application individually and have provided their comments.
4. The applicant has met or will meet, as part of the building permit process and/or during the excavation and construction phase of the dwelling, the requirements, and conditions set forth by the Hillside Review Board.

Administrative Approval

Administrative approval of a Hillside Review for the Nordic Valley expansion (HSR 2020-04) is hereby granted based upon its compliance with the Weber County Land Use Code. This approval is subject to the requirements of applicable review agencies and is based on the findings listed in this staff report.

Date of Administrative Approval: 11/9/20


Rick Grover

Weber County Planning Director

Exhibits

- A. Application
- B. Site plan
- C. Geologic Reconnaissance
- D. Geotechnical Study

Area Map



Weber County Hillside Review Application

Application submittals will be accepted by appointment only. (801) 399-8791. 2380 Washington Blvd. Suite 240, Ogden, UT 84401

Date Submitted / Completed 9/28/20	Fees (Office Use)	Receipt Number (Office Use)	File Number (Office Use)
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Property Owner Contact Information

Name of Property Owner(s) Skyline Mountain Base		Mailing Address of Property Owner(s) 3567 Nordic Valley Way Eden, UT 84310	
Phone 801-745-3511	Fax		
Email Address bfessler@nordicvalley.ski		Preferred Method of Written Correspondence <input checked="" type="checkbox"/> Email <input type="checkbox"/> Fax <input type="checkbox"/> Mail	

Authorized Representative Contact Information

Name of Person Authorized to Represent the Property Owner(s) Brandon Fessler		Mailing Address of Authorized Person 3567 Nordic Valley Way Eden, UT 84310	
Phone 801-745-3511	Fax		
Email Address bfessler@nordicvalley,ski		Preferred Method of Written Correspondence <input checked="" type="checkbox"/> Email <input type="checkbox"/> Fax <input type="checkbox"/> Mail	

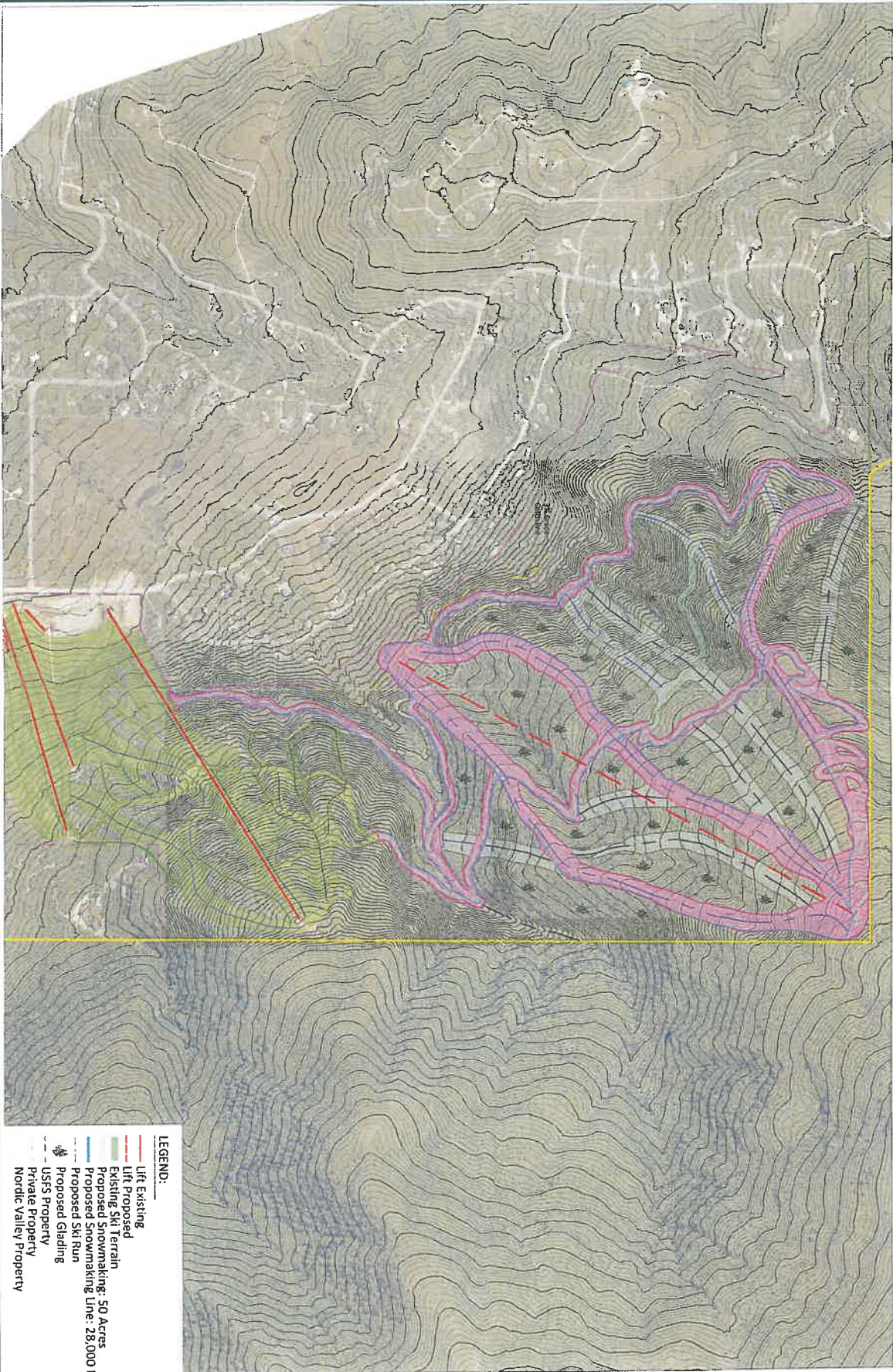
Property Information

Project Name Nordic Valley Expansion	Current Zoning FV-3, O-1
Approximate Address 3567 Nordic Valley Way Eden, UT 84310	Land Serial Number(s) 22-029-0010

Subdivision Name / Lot Number(s)
Nordic Valley

Project Narrative

Nordic Valley would like to expand its lift network to include an additional aerial lift along with trails and snowmaking that will allow guests to access more moderate terrain on the eastern portion of the mountain. This entails concrete at the lifts top and bottom terminals as well as for the towers on the lift line.



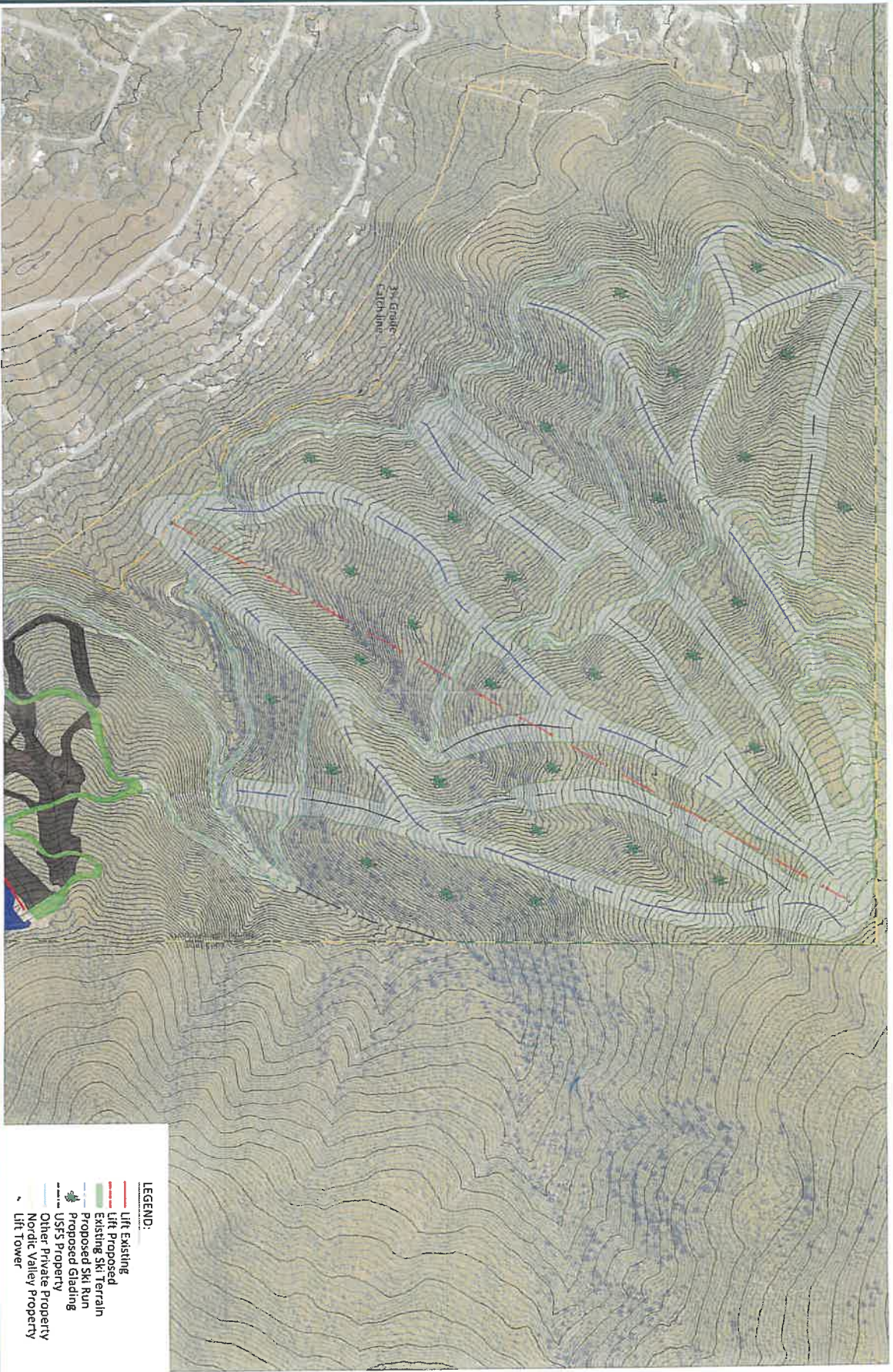
- LEGEND:**
- Lift Existing
 - Lift Proposed
 - Existing Ski Terrain
 - Proposed Snowmaking: 50 Acres
 - Proposed Snowmaking Line: 28,000 L.F.
 - Proposed Ski Run
 - Proposed Glading
 - USFS Property
 - Private Property
 - Nordic Valley Property

NORDIC VALLEY

SE GROUP
THE OFFICE OF DESIGN
WWW.SEGROUP.COM

EXPANSION SNOWMAKING CONCEPT | **NORDIC VALLEY**

August 2019
DRAWING SCALE: 1" = 200'
DATE: 08/20/19



NORDIC VALLEY

SE GROUP
www.segroup.com

EXPANSION CONCEPT | NORDIC VALLEY

August 2010
NORDIC VALLEY
CONCEPT PLAN

GCS Geoscience

**Report Professional Geologist Site
Reconnaissance and Review
Proposed Lift 5 and Snowmaking Expansion
Parcel #22-029-0010
Nordic Valley Ski Resort, 3567 Nordic Valley Way
Eden, Weber County, Utah**

For:

Mountain Capital Partners
PO Box 17000
Durango, Colorado
81302

By:

GCS Geoscience
554 South 7700 East Street
Huntsville, Utah 84317

April 2, 2020
GCS File No: 2020.11

April 2, 2020
File No: 2020.11

Mountain Capital Partners
PO Box 17000
Durango, Colorado
81302

ATTN: Gloryann Linch

Subject: Report
Professional Geologist Site Reconnaissance and Review
Proposed Lift 5 and Snowmaking Expansion, Parcel #22-029-0010
Nordic Valley Ski Resort
3567 Nordic Valley Way
Eden, Weber County, Utah

INTRODUCTION

In response to your request, GCS Geoscience (GCS) has prepared this Professional Geologist site reconnaissance review for the above referenced improvements for the proposed expansion parcel at Nordic Valley Resort. The expansion parcel consists of a 346.78-acre property that is to become part of the existing Nordic Valley Resort in Weber County, Utah, as shown on attached Figure 1. Figure 2 provides aerial coverage of the site and detail of the current (2014) layout of the site vicinity.

The parcel is generally open and undeveloped ground at this time. The adjacent properties to the north have been developed for lift-served skiing, and comprise the current operating Nordic Valley Ski Resort. The subject parcel and surrounding properties are zoned by Weber County as Open Space Zone O-1, and Forest Valley FV-3 land-use zones. It is our understanding that the subject parcel is currently in review for Conditional Use permitting for this proposed use with Weber County.

It is our understanding that resort is proposing to increase skiable area by expanding snowmaking and its lift network onto the subject parcel. The proposed Lift 5 is an aerial lift that will span approximately 4000 feet as shown on Figure 2, and will lift skiers approximately 1375 feet in elevation. The proposed snowmaking will include approximately 28,000 lineal feet of supply line and cover roughly 50 acres of skiable terrain, as shown on Figure 2.

Because the proposed improvements appear to be located in part on a hillslope area in the vicinity of mapped landslide hazards, marginal soils, and/or FEMA floodplain areas, Weber County is requesting that a geological site reconnaissance be performed to assess whether all or parts of the site are exposed to the hazards that are included in the Weber County Code, Section 108-22 Natural Hazard Areas. These hazards include, but are not limited to: Surface-Fault Ruptures, Landslide, Tectonic Subsidence, Rock Fall, Debris Flows, Liquefaction Areas, Flood, or other Hazardous Areas.

The purpose of this **Professional Geologist Site Reconnaissance Review** is to evaluate if the proposed improvements are outside or within areas identified as Natural Hazards Overlay District, and if within a hazard area, to recommend appropriate additional studies that comply with the purpose and intent of the Weber County Natural Hazards Area guidelines and standards in order to be permitted for Conditional Use by Weber County. Because the proposed expansion, and expansion construction is likely to involve or overlap with geologically hazardous areas, and areas of slopes greater than 25-percent; the reporting and documentation to be provided by the studies herein will be used to guide Civil Engineering and Geotechnical engineering design for Hillside Review studies; as specified in Chapter 108-14 Hillside Development Review Procedures and Standards for hillside terrain and environmentally sensitive areas by the Weber County Code (2020).

LITERATURE AND RESOURCE REVIEW

To evaluate the potential exposure of sites to geological hazards that impact sites or site improvements, Weber County has compiled a series of Geographic Information Systems (GIS) data mapping layers of geological hazard related information. These data may be queried on-line using the Weber County Geo-Gizmo web server application at:

<http://www.co.weber.ut.us/gis/maps/gizmo/>.

Using the Geo-Gizmo application, under the Engineering Layers category, is listed geological hazard related layers that may be toggled on and off to determine potential hazards exposure to sites in the county. These mapping layers include the following categories; *Quake Epicenters, FEMA Flood Zone Line, FEMA Base Flood Elevation, Wasatch Faults, Landslide Scarps, Geologic Faults, Faults, Quaternary Faults, FEMA Flood Zone, FEMA LOMR, Engineering Problems; Liquefaction Potential, Landslide, FEMA Letters of Map Change, and FEMA Flood Zones*. These layers have been compiled from the respective agencies including the Federal Emergency Management Agency (FEMA), the Utah Geological Survey (UGS), and the U.S. Geological Survey (USGS). These mapping layers consist of regional compilation hazards data but are not

compiled at scales that are necessarily applicable for site specific usage and planning. When hazard layer data on the Geo-Gizmo are found to interact with Permit Applicant site improvement locations, Weber County Engineers and Planners will request that the Permit Applicant have a Professional Geologist Site Reconnaissance Review, such as presented herein, conducted for the site.

In addition to the Geo-Gizmo site screening, the Weber County Engineers and Planners rely on recently published UGS geological mapping (Coogan and King, 2016), that includes much of Weber County for determining if a site is located upon a potentially hazardous geological mapping unit, thus requiring a geological reconnaissance. This mapping may be viewed on-line at:

<https://weber.maps.arcgis.com/apps/webappviewer/index.html?id=bd557ebafc0e4ed58471342bb03fdac5>

Our preliminary review of the Geo-Gizmo web server indicated that the expansion parcel was partially overlapped with area classified as Landslide layer, however our review of the Weber County Geologic Map indicated that the property is located upon a geological mapping units designated as **Qms**, **Qms?(Zpu)**, and **Qms(ZYp)** which are mass movement deposits considered potentially hazardous because of indications of past landslide movement; and **Qafy** and **Qmdf** units which are younger alluvial fan and debris flow deposits that are considered potentially hazardous because of the potential for debris flow/debris flood processes on these areas, thus requiring this reconnaissance and review.

Our site specific review consisted of a GIS data integration effort that included:

1. Reviews of previous mapping and literature pertaining to site and regional geology including and Sorensen and Crittenden (1979), Mulvey (1992), USGS and UGS (2016), Elliott and Harty (2010), King and McDonald (2014), and Coogan and King (2016).
2. An analysis of vertical and stereoscopic aerial photography for the site including a 1947 1:20,000 stereoscopic sequence, 2012 5.0 inch digital HRO coverage, and 2014 1.0 meter digital NAIP coverage of the site.
3. A GIS analysis using the QGIS® GIS platform to geoprocess and analyze merged 2011 1.0 meter and 2018 0.5 meter LiDAR digital elevation data made available for the site by the Utah Automated Geographic Reference Center (AGRC). The GIS analysis included using the QGIS® platform Geospatial Data Abstraction

Library (GDAL, 2013) Contour; the GRASS® (Geographic Resources Analysis Support System, 2013) r.slope and r.shaded.relief modules.

For the best site-specific documentation for this review we relied on geologic mapping by Coogan and King (2016), which provided the most up-to-date rendering of geological mapping for the site location. Supporting documentation by King and McDonald (2014), and Sorensen and Crittenden (1979) was also used to support this review. The geological mapping for this review is provided on Figure 3, Geologic Mapping. Topographic, slope, and elevation data for this review was supported through the aforementioned LiDAR analysis which is presented on Figure 4, LiDAR Analysis.

REVIEW FINDINGS

The site is located in Ogden Valley on the eastern flank of Lewis Peak. The valley is a northwest trending fault bounded graben structure, with the Wasatch Range comprising the western flank of the valley and the Bear River Range the eastern flank (Avery, 1995). Topographically the site is located on valley margin slopes positioned between Lewis Peak on the west and floodplains of the North Fork of the Ogden River on the east. The expansion parcel is located on gentle to steep valley margin slopes that buttress Lewis Peak which rises to 8031 feet, approximately 2.6 miles southwest of the site. The surface of the site is located upon a valley margin slopes formed on Precambrian and Paleozoic rocks that have been incised and eroded by past alluvial processes, that have oversteepened slopes insomuch as to cause mass movement of susceptible slopes. Two established drainages flow generally southwest to northeast across the parcel area, with Pole Canyon on the southern margin of the site, and Pine Creek located on the northern part of the site, as shown on Figure 2.

The expansion parcel is located upon generally northeastern sloping ground with elevations ranging from 5576 feet on the northeast side of the site, to 7126 feet on the southwest side of the site, as shown on Figure 4. Slope surfaces on the expansion parcel range from near-level to steep, in excess of 30 percent, across much of the site.

Geological Mapping:

Figure 3 shows the location of the site relative to GIS overlays including geological mapping drawn from Coogan and King (2016). A summary of the geological mapping of the site vicinity, as paraphrased from Coogan and King (2016), is provided as follows:

Qmdf - Debris- and mud-flow deposits (Holocene and upper and middle? Pleistocene) – Very poorly sorted, clay- to boulder-sized material in unstratified deposits characterized by rubbly surface and debris-flow levees with channels, lobes, and mounding...

Qafy, Qaf, Qaf2 - Alluvial-fan deposits (Holocene and Pleistocene) – Mostly sand, silt, and gravel that is poorly bedded and poorly...variably consolidated; includes debris flows, particularly in drainages and at drainage mouths (fan heads)...with unit Qafy being the younger, and Qaf2 the older, and Qaf fans being undivided in age determination...

Qac - Alluvium and colluvium (Holocene and Pleistocene) – Unsorted to variably sorted gravel, sand, silt, and clay in variable proportions; includes stream and fan alluvium, colluvium, and, locally, mass-movement deposits...

Qms - Landslide deposits (Holocene and upper and middle? Pleistocene) – Poorly sorted clay- to boulder sized material; includes slides, slumps, and locally flows and floods...

Qafb, Qafp - Lake Bonneville-age alluvial-fan deposits (upper Pleistocene) – ...**Qafb** and **Qafp** fans typically contain well-rounded, recycled Lake Bonneville gravel and sand and are moderately well sorted...

Qms(Tn) – Qms?(Tn) - Block landslide and possible block landslide deposits (upper and middle? Pleistocene) – Mapped where nearly intact block composed of Norwood Formation (**Tn**) is visible in landslide...

Qms?(Zpu) - Block landslide and possible block landslide deposits (upper and middle? Pleistocene) – Jumbled mass of formation, Formation of Perry Canyon bedrock; Upper member (**Zpu**) with blocks...

Qms(ZYp) - Qms?(ZYp) - Block landslide and possible block landslide deposits (upper and middle? Pleistocene) – Jumbled mass of formation of Perry Canyon (**ZYp**) with blocks...

Tn - Norwood Formation (lower Oligocene and upper Eocene) – Typically light-gray to light-brown altered tuff (claystone), altered tuffaceous siltstone and sandstone, and conglomerate...

Zpu - Formation of Perry Canyon bedrock; Upper member (Neoproterozoic) – Olive drab to gray, thin-bedded slate to argillite to phyllite to micaceous meta-siltstone to meta-graywacke to meta-sandstone in variable proportions such that unit looks like both the “greywacke-sandstone” and “mudstone”...This unit is prone to slope failures...

Zpd - Formation of Perry Canyon bedrock; Diamictite member (Neoproterozoic) – Tan to gray weathering, gray to dark-gray meta-diamictite containing pebble to boulder-sized quartzite and granitoid (quartzo-feldspathic gneiss) clasts in dark-gray sandy (up to granule size) to micaceous argillite matrix...

Zmcg - Maple Canyon Formation bedrock; Lower unit (green arkose) member (Neoproterozoic) – Grayish-green, fine-grained arkosic (feldspathic) meta-sandstone and sandy argillite (meta-graywacke), with local quartzite lenses...is prone to slope failures...

Zarx - Argillite of lower member of Maple Canyon Formation or upper member of Formation of Perry Canyon (Proterozoic) – Greenish-gray argillite to meta-graywacke...This unit is prone to slope failures...

In summary the surface of the site is located upon older Precambrian and Paleozoic rocks that were thrust from west to east roughly 80 million of years ago as part of what is called the Willard Thrust (Sorensen and Crittenden, 1979). Approximately 20 to 30 million years ago the thrust rocks were locally covered by Tertiary volcanic deposits locally known as the Norwood Formation. Since the deposition of the Norwood Formation, orogenic mountain building processes have been occurring, resulting in the erosion and deposition of Quaternary age deposits on the surface vicinity during the past 1.6 million years. Most recently, in the past 19,000 to 15,000 years, ancient Lake Bonneville inundated parts of Ogden Valley leaving lake bed soil deposits, and adjusting the grade of alluvial soil deposition in the valley during and after the period of lake inundation (Currey and Oviatt, 1985). Since the regression of the ancient lake, stream erosion and incision of the mountain slopes has oversteepened slopes resulting in the mass movement, landsliding, of susceptible slopes on and in the vicinity of the expansion parcel.

Site Specific Geology:

Figure 3 indicates the expansion parcel is located upon the following geological sequence of rocks and deposits:

1. Older thrust-faulted and folded Neoproterozoic rock units of **Zarx**, **Zmcg?**, **Zmcc?**, **Zpd**, and **Zpu** of the Willard thrust sheet that appear to be inclined to the northeast.
2. Block landslide deposits of **Qms(ZYp)**, **Qms?(ZYp)**, and **Qms(Zpu)** of the formation of Perry Canyon rocks that overlie the Neoproterozoic rocks. On the

basis of the morphostratigraphic position of bounding and overlying younger **Qac**, **Qmdf**, and **Qms** deposits, we believe the time of movement for the **Qms(ZYp)**, **Qms?(ZYp)**, and **Qms(Zpu)** deposits at the site to be no more recent than upper Pleistocene age.

3. Covering in part the sloping areas over the older Neoproterozoic rocks and the Block Landslide deposits, are Holocene to middle? Pleistocene age landslide slump and creep deposits classified as **Qms**. The **Qms** deposits are the most recently active mass movement features on the site.
4. On the southeast and east margins of the site along the Pole Canyon and Pine Creek drainageways, alluvial deposits of **Qafb**, **Qafy**, and **Qmdf** have been deposited, with the **Qafy** and **Qmdf** deposits comprising the most recently active deposits on the site.

Geologic Hazards

The identified geologic hazards mapping units for the expansion parcel area are presented on Figure 5, Geologic Hazards Overlay Map. The hazard areas identified through this reconnaissance study should generally be studied in greater detail relative to specific affects and effects of the proposed project improvements to better define hazard margins, probabilities, and exposure detail relative to the proposed improvements. The units are broken down in to three hazard classifications and the basis of processes and morphology. The hazard classifications on Figure 5 are as follows:

- Alluvial fan and debris flow process hazards, which include active stream-flow, and floodplain areas, and potential and past active debris flow areas on the site. These include areas mapped as **Qafy**, and **Qmdf** on Figure 3, and are believed to have been subject to these processes as recently as Holocene time, between 12,000 years before present (ybp) to the present.
- Mass movement, slump, soil creep hazards, these include shallow and rotational landslide units, and areas where slope creep processes are likely. These include areas mapped as **Qms** on Figure 3, that are believed to have moved as recently as Holocene time, between 12,000 ybp to the present.
- Mass movement, block failures, these include likely deeper-seated landslide features where large intact bedrock blocks and surfaces have moved or shifted. These include areas mapped as **Qms(ZYp)**, **Qms?(ZYp)**, and **Qms(Zpu)** on Figure 3, that are believed to have moved no more recently as upper Pleistocene age or approximately 12,000 ybp.

Sloping Surfaces

Figure 4, LiDAR Analysis presents the results of our slope analysis geoprocessing efforts described previously. The scene shown on Figure 4 shows the terrain and the steeper slope areas of the site, including 25 to 30 percent slopes, and greater than 30 percent slopes. Figure 6, Steep Slope Overlay Map illustrates the areas on the expansion parcel in excess of 25-percent. The average slope for the expansion area is 47.6-percent, with roughly 90-percent of the 346-acre parcel having slopes exceeding 25-percent. The Weber County Chapter 108-14 Hillside Development Review Procedures And Standards Sec 108-14-3 Applicability, specifies *...all parcels, subdivision lots, roads and accesses, where the natural terrain has average slopes at or exceeding 25 percent shall be reviewed by the Hillside Development Review Board as part of an application request for land use and building permits...*(Weber County Code, 2020).

Hazards Review:

This review includes discussions of the natural hazards included in the Weber County Code, Section 108-22 Natural Hazard Areas, and the exposure of the proposed site improvements to the potential affects and effects of the natural hazards. A summary of this review is provided as follows:

1. **Landsliding:** The active landslide units were not identified on the expansion parcel as part of this review. However presently inactive mass movement, slump, soil creep hazards (**Qms**) deposits, and mass movement, block failures including **Qms(ZYp)**, **Qms?(ZYp)**, and **Qms(Zpu)**, consist of slopes that have moved during the past. Because of the past movement, the soils and rock structures that comprise these units have been weakened by the past movement and deformation, the areas mapped as mass movement on Figure 5 should be considered susceptible to renewed movement, and site development grading, cuts and fills, and foundations placement should not be conducted in these areas without specific design-level geotechnical engineering and supervision.
2. **Alluvial fan debris flow processes** including flash flooding and debris flow hazard: The **Qafy** and **Qmdf** deposits on the represent areas of potential future debris flow process hazards on the site. With the present layout plan for site improvements, we do not believe the potential debris flow hazards are an impact to the proposed site improvements.
3. **Seismic Hazards: Surface fault rupture hazards, strong earthquake ground motion, tectonic subsidence and liquefaction potential:**

Surface fault rupture hazards: The nearest active (Holocene) earthquake fault to the site is the Weber section of the Wasatch fault zone (UT2351E) which is located 3.0 miles west of the site, thus fault rupture hazards are not considered present on the site (Black and others, 2004). The Ogden Valley southwestern margin faults (UT2375) is shown to cross the northeastern side of the site, however the most recent movement along this fault is estimated to be pre-Holocene (>15,000 ybp), and therefore is presently is not considered an active fault rupture risk (Black and others, 1999). Active earthquake faults are generally considered to be faults which have disrupted the ground surface within the past 11,000 years of earth history (the Holocene epoch). Implied with this definition is that such faults are likely to disrupt the ground surface in the relatively near future (Lund and others, 2016).

Strong earthquake ground motion originating from the Wasatch fault or other near-by seismic sources is capable of impacting the site and surrounding region. The Wasatch fault zone is considered active and capable of generating earthquakes as large as magnitude 7.3 (Arabasz and others, 1992). Based on probabilistic estimates (Peterson, and others, 2008) queried for the site, the expected peak horizontal ground acceleration on rock from a large earthquake with a ten-percent probability of exceedance in 50 years is as high as 0.18g, and for a two-percent probability of exceedance in 50 years is as high as 0.42g for the site.

The ten-percent probability of exceedance in 50 years event has a return period of 475 years, and the 0.18g acceleration for this event corresponds "strong" perceived shaking with "light" potential damage based on instrument intensity correlations. The two-percent probability of exceedance in 50 years event has a return period of 2475 years, and the 0.42g acceleration for this event corresponds "severe" perceived shaking with "moderate to heavy" potential damage based on instrument intensity correlations (Wald and others, 1999).

Future ground accelerations greater than these are possible but will have a lower probability of occurrence.

Tectonic Subsidence is surface tilting subsidence that occurs along the boundaries of active normal faults in response to surface-faulting earthquakes (Keaton, 1986). Because the site is not located in near proximity to active earthquake faults, tectonic subsidence hazards are not considered a risk to the site.

Liquefaction potential hazards: In conjunction with strong earthquake ground motion potential of large magnitude seismic events as discussed previously, certain soil units may also possess a potential for liquefaction during a large magnitude event. Liquefaction is a phenomenon whereby loose, saturated, granular soil units lose a significant portion of their shear strength due to excess pore water pressure buildup resulting from dynamic loading, such as that caused by an earthquake. Among other effects, liquefaction can result in densification of such deposits causing settlements of overlying layers after an earthquake as excess pore water pressures are dissipated. Horizontally continuous liquefied layers may also have a potential to spread laterally where sufficient slope or free-face conditions exist. The primary factors affecting liquefaction potential of a soil deposit are: (1) magnitude and duration of seismic ground motions; (2) soil type and consistency; and (3) occurrence and depth to groundwater.

Liquefaction potential hazards have not been studied or mapped for the Ogden Valley area, as has occurred in other parts of northern Utah (Anderson and others, 1994). Liquefaction commonly occurs in saturated non-cohesive soils such as alluvium, conditions may be present where the **Qafy** and **Qmdf** deposits are located on the site as shown on Figure 5, however none of the proposed improvements are located where the **Qafy** and **Qmdf** deposits are mapped.

4. **Rockfall and avalanche hazards:** The expansion parcel is not located upon or downslope from steep sloping areas with source outcrops where rockfall hazards may originate.

No existing process indices or set-up conditions for snow avalanche development, including starting zones, tracks, or runout zones (Perla and Martinelli, 1976) were observed to affect the expansion parcel during our analysis or reconnaissance of the expansion parcel. Although the snow avalanche hazard may not be presently apparent on the expansion parcel, the future clearing of slopes for the proposed improvements may increase the exposure or incidence of snow avalanche hazard on the site.

5. **Flooding:** No significant water ways pass in the vicinity of the site and flood insurance rate mapping by Federal Emergency Management Agency for the site vicinity indicates that the site is outside the 100-year Flood Zone (FEMA, 2015).

Local sheet flow, slope wash, and seasonally perched soil water typical of sloping areas should be anticipated for the site, and site improvements.

SITE RECONNAISSANCE

The expansion was reconnoitered by foot (snowshoes) on March 12, 2020, and at the time of the reconnaissance the area was covered with approximately three or more feet of snow. The expansion parcel was accessed from the west end of 1950 North Street, and by following an established trail the location of the upper terminal for the proposed Lift 5 was reached. From the upper terminal location, the Lift 5 alignment was generally followed downslope to the approximate lower terminal location, and from the lower terminal location, a traversing trail was followed back to the 1950 North Street end. The surface of the expansion parcel consists of a moderate to steep slope down to the northeast, with steeper side-slopes trending from the ridges down into Pine Canyon and Pole Creek drainageways. Cover vegetation protruding from the snow generally consisted of moderately dense scrub oak, and maple trees, with aspen and fir trees clustered on north facing slopes. During the reconnaissance no conditions of imminent or active geologic hazards or hazard processes were observed at the site.

CONCLUSIONS

It is our opinion that the proposed expansion parcel improvements can proceed in concept without adversely affecting the geological condition of the site, provided that the procedures outlined in Section 108-14 Weber County Hillside Development Review Procedures and Standards are appropriately followed and applied (Weber County, 2020), and the provisions of Utah State rules pertaining to ski lift construction safety prescribed by rule R920-50. Ropeway Operation Safety, which *...establishes regulations, requirements, and provides standards for the design, construction, and operation of a passenger ropeway...* are also followed (Utah Administrative Code, 2020).

Based on our understanding of the project and proposed improvements, the primary construction activities affecting the geological condition of the expansion parcel would include: 1) the construction of temporary and permanent construction access roadways (cuts, fills and grading) for the construction of the of the Lift 5 terminals and towers, and for the placement of the snowmaking water supply lines; 2) the construction of foundation systems for the Lift 5 terminals and towers; and 3) permanent cuts, fills and grading for ski trails and maintenance vehicles. Operational activities potentially affecting geological condition of the expansion parcel are anticipated to include augmented snowpack from the snowmaking activities, and potential failure of the snowmaking water supply lines, and the effects these activities may have on excessive soil moisture and susceptible slopes.

Based upon the findings of this review we believe for preliminary site development planning and design should undergo procedures outlined in Section 108-14 Weber County Hillside Development Review Procedures and Standards (Weber County, 2020). With respect to steep slope limitations, the excavation, grading and filling guidelines provided in Section 108-14-8 of the Weber County Code should be followed for site development planning and implementation. For preliminary site development guidance and planning, we recommend the following procedures be applied for site development based upon the areal classifications provided on Figure 5 and Figure 6:

- 1. Steep Slope Overlay areas on Figure 6:** These areas should undergo the requirements of Section 108-14 - Hillside Development Review Procedures and Standards, with specific attention to excavation, grading and filling guidelines provided in Section 108-14-8. These standards should also be supported by site specific geotechnical engineering studies including slope stability analysis as outlined by Weber County Natural Hazards Overlay Districts - Section 104-27-2.
- 2. Combined Mass Movement Hazards and Steep Slope Overlay areas on Figure 5 and Figure 6:** For areas that are shown on Figure 5 and Figure 6 to be exposed to both Mass Movement Hazards and Steep Slope conditions, we recommend that these areas be considered for avoidance where practical, however specific engineered design for the improvements in these areas, such as slope retention structures, and deep foundations, may be considered for mitigating the effects of the improvements and exposure to the natural hazards in these areas.

The Hillside Review and Natural Hazards Overlay studies will likely require additional specific geological, geotechnical and slope stability studies, and construction observations for proposed design and construction for the expansion parcel improvements and development.

LIMITATIONS

Our services were limited to the scope of work discussed in the introduction section of this report. The results provided by this study are limited to geological hazards included in the Weber County Code, Section 108-22 Natural Hazard Areas (Weber County, 2020). The reporting provided here is not based upon any subsurface observations, and should in no way preclude the results of a geotechnical engineering soils and groundwater studies for foundations, earthwork, and geoseismic design prepared by a professional engineer licensed in the State of Utah.

Although risk can never be eliminated, more detailed and extensive studies yield more information, which may help understand and manage the level of risk. The recommendations contained in this report are based on our site observations, available data, probabilities, and our understanding of the facilities investigated. This report was prepared in accordance with the generally accepted standard of practice at the time the report was written. No warranty, express or implied, is made.

This report may be used only by the client and only for the purposes stated within a reasonable time from its issuance. The regulatory requirements and the "state of practice" can and do change from time to time, and the conclusions presented herein may not remain current. Based on the intended use of the report, or future changes to design, GCS Geoscience may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else, unless specifically agreed to in advance by GCS Geoscience in writing will release GCS Geoscience from any liability resulting from the use of this report by any unauthorized party.

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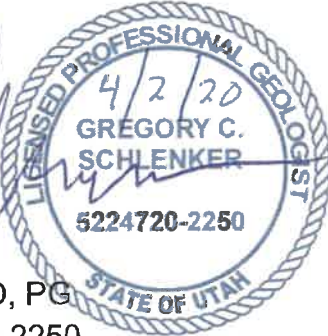
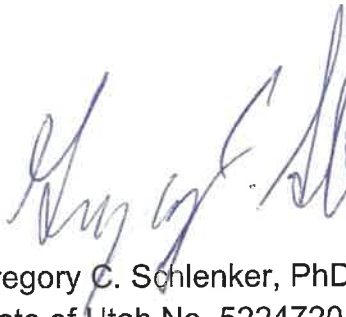
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CLOSING

We appreciate the opportunity to work with you on this project and look forward to assisting you in the future. If you have any questions or need additional information on this or other reporting, please contact the undersigned at (801) 745-0262 or (801) 458-0207.

Respectfully submitted,

GCS Geoscience

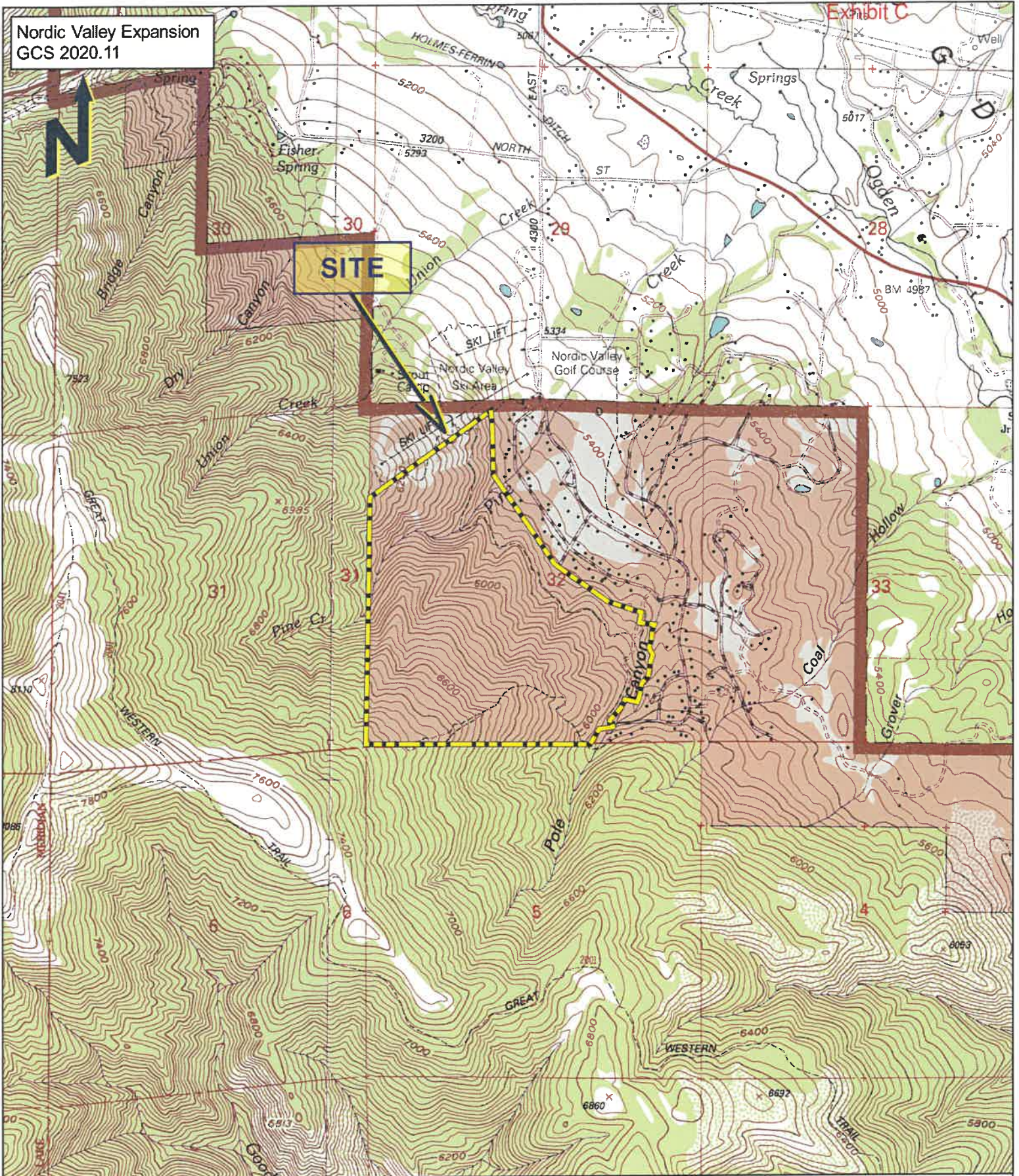


Gregory C. Schlenker, PhD, PG
State of Utah No. 5224720-2250
Principal Geologist

GCS Geoscience
554 South 7700 East Street
Huntsville, Utah 84317

Encl. Figure 1, Site Vicinity Map
Figure 2, Aerial Coverage
Figure 3, Geologic Mapping
Figure 4, LiDAR Analysis
Figure 5, Geologic Hazards Overlay Map
Figure 6, Steep Slope Overlay Map

Nordic Valley Expansion
GCS 2020.11



Base:
1998 USGS 7.5 Minute topographic
maps titled "Huntsville, Utah" and North
Ogden, Utah, from Utah AGRC;
<http://gis.utah.gov/>

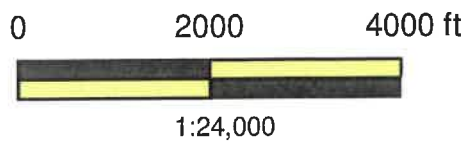







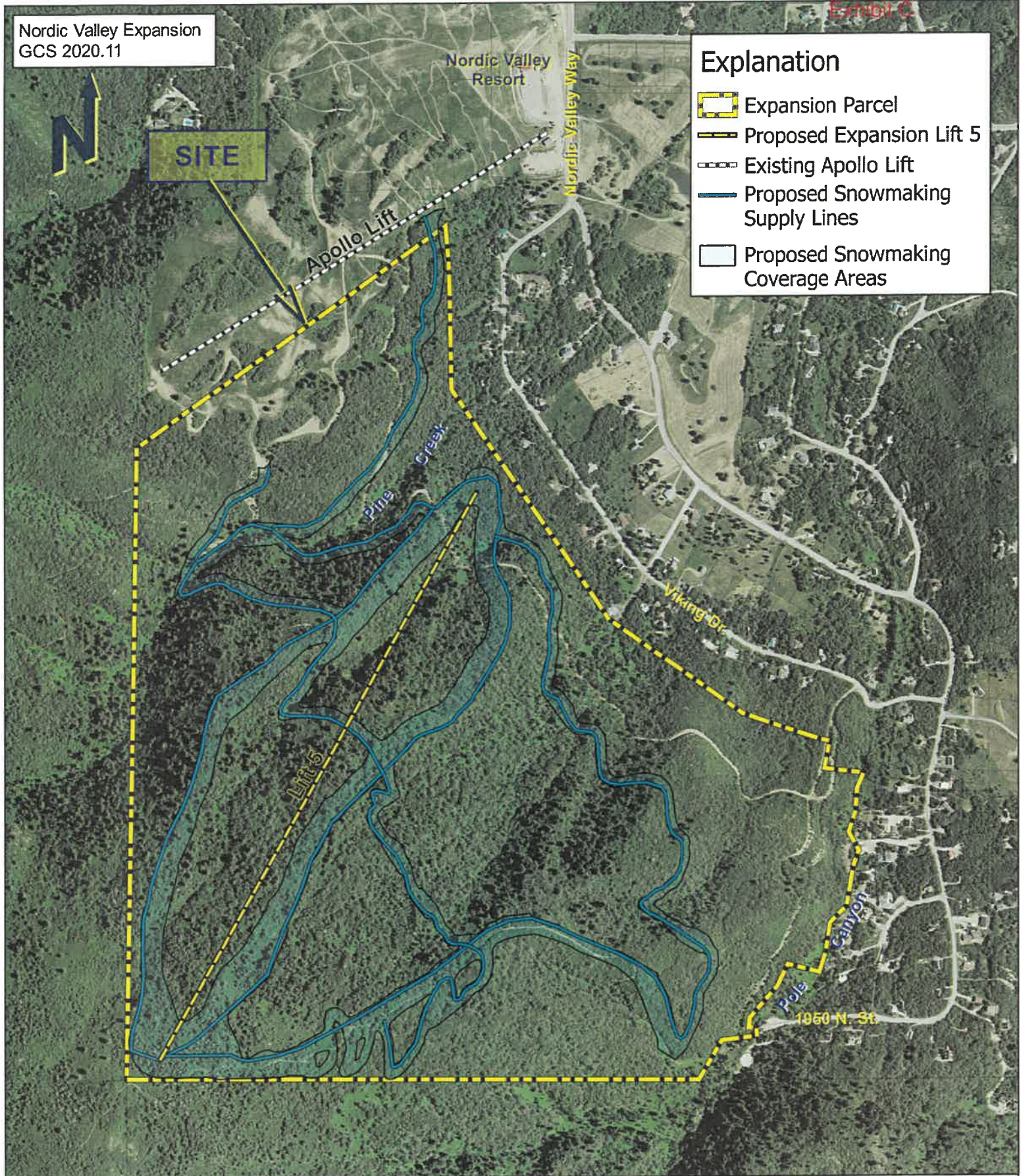
FIGURE 1
SITE VICINITY MAP
GCS Geoscience

Nordic Valley Expansion
GCS 2020.11

Exhibit C

Explanation

-  Expansion Parcel
-  Proposed Expansion Lift 5
-  Existing Apollo Lift
-  Proposed Snowmaking Supply Lines
-  Proposed Snowmaking Coverage Areas



Base:
2014 1.0m NAIP Color Orthoimagery,
from Utah AGRC; <http://gis.utah.gov/>

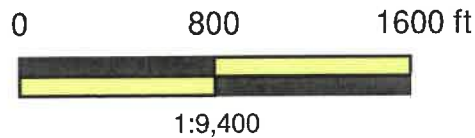
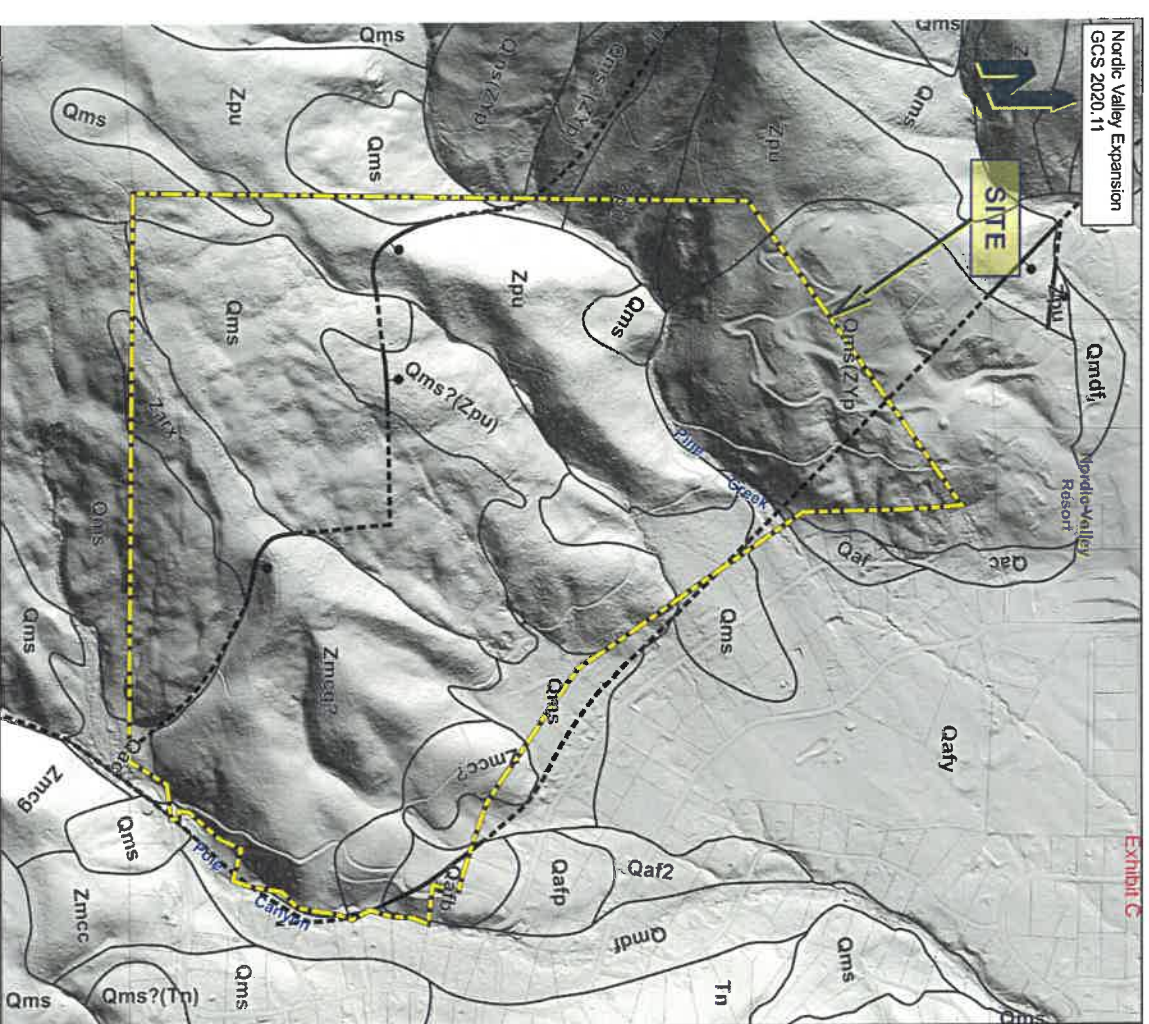


FIGURE 2
AERIAL COVERAGE
GCS Geoscience



Nordic Valley Expansion
GCS 2020.11

Exhibit C

Geology (after Coogan and King, 2016)

Qmndf - Debris- and mud-flow deposits (Holocene and upper and middle? Pleistocene) – Very poorly sorted, clay- to boulder-sized material in unstratified deposits characterized by rubbly surface and debris-flow levees with channels, lobes, and mounding...

Qafy, Qaf, Qaf2 - Alluvial-fan deposits (Holocene and Pleistocene) – Mostly sand, silt, and gravel that is poorly bedded and poorly... variably consolidated; includes debris flows, particularly in drainages and at drainage mouths (fan heads)... with unit Qafy being the younger, and Qaf2 the older, and Qaf fans being undivided in age determination...

Qac - Alluvium and colluvium (Holocene and Pleistocene) – Unsorted to variably sorted gravel, sand, silt, and clay in variable proportions; includes stream and fan alluvium, colluvium, and, locally, mass-movement deposits...

Qms - Landslide deposits (Holocene and upper and middle? Pleistocene) – Poorly sorted clay- to boulder sized material; includes slides, slumps, and locally flows and floods...

Qafp, Qafp - Lake Bonneville-age alluvial-fan deposits (upper Pleistocene) – ... Qafp and Qafp fans typically contain well-rounded, recycled Lake Bonneville gravel and sand and are moderately well sorted...

Qms(Tn) – Qms?(Tn) Block landslide and possible block landslide deposits (Holocene and upper and middle? Pleistocene) – Mapped where nearly intact block composed of Norwood Formation (Tn) is visible in landslide...

Qms?(Zpu) - Block landslide and possible block landslide deposits (Holocene and upper and middle? Pleistocene) – Jumbled mass of formation of Perry Canyon bedrock; Upper member (Zpu) with blocks...

Qms(ZYp), Qms?(ZYp) - Block landslide and possible block landslide deposits (Holocene and upper and middle? Pleistocene) – Jumbled mass of formation of Perry Canyon (ZYp) with blocks...

Tn - Norwood Formation (lower Oligocene and upper Eocene) – Typically light-gray to light-brown altered tuff (claystone), altered tuffaceous siltstone and sandstone, and conglomerate...

Zpu - Formation of Perry Canyon bedrock; Upper member (Neoproterozoic) – Olive drab to gray, thin-bedded slate to argillite to phyllite to micaceous meta-siltstone to meta-graywacke to meta-sandstone in variable proportions such that unit looks like both the "greywacke-sandstone" and "mudstone" ... This unit is prone to slope failures...

Zpd - Formation of Perry Canyon bedrock; Diamictite member (Neoproterozoic) – Tan to gray weathering, gray to dark-gray meta-diamictite containing pebble to boulder-sized quartzite and granitoid (quartzo-feldspathic gneiss) clasts in dark-gray sandy (up to granule size) to micaceous argillite matrix...

Zmcc? - Maple Canyon Formation, Upper (conglomerate) member (Neoproterozoic) – Light-gray coarse-grained, quartzite to pebble and small cobble meta-conglomerate with local fan-weathering, dark gray, meta-graywacke matrix; thin olive-gray, laminated, weakly resistant argillite in middle...

Zmcc? - Maple Canyon Formation bedrock; Lower unit (green arkose) member (Neoproterozoic) – Grayish-green, fine-grained arkosic (feldspathic) meta-sandstone and sandy argillite (meta-graywacke), with local quartzite lenses... is prone to slope failures...

Zarx - Argillite of lower member of Maple Canyon Formation or upper member of Formation of Perry Canyon (Proterozoic) – Greenish-gray argillite to meta-graywacke... This unit is prone to slope failures...

- Normal Fault Bar on downthrown dashed where concealed
- Strike and Dip Long bar represents strike axis, numerical value equals dip angle

Base:
Merged 2018 0.5m (West side), and 2011
1.0m (East side) Bare Earth LIDAR Imagery
from Utah AGRC; <http://gis.utah.gov/>

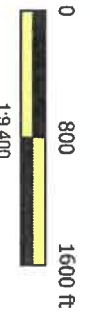


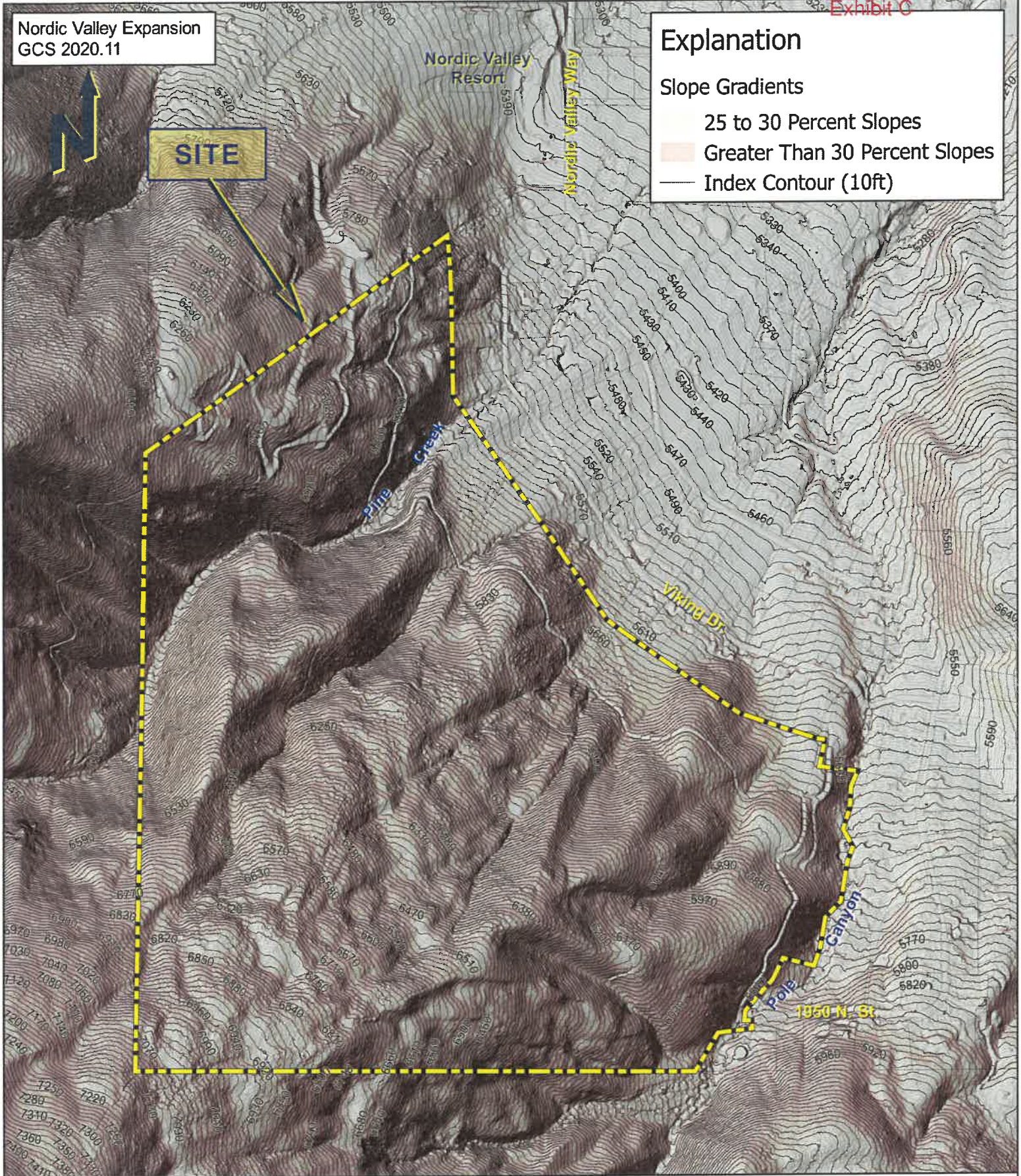
FIGURE 3
GEOLOGIC MAPPING
GCS Geoscience

Nordic Valley Expansion
GCS 2020.11

Explanation

Slope Gradients

- 25 to 30 Percent Slopes
- Greater Than 30 Percent Slopes
- Index Contour (10ft)



Base:
Merged 2018 0.5m (West side), and 2011
1.0m (East side) Bare Earth LiDAR Imagery
from Utah AGRC; <http://gis.utah.gov/>

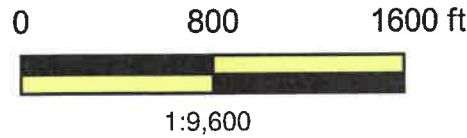


FIGURE 4
LIDAR ANALYSIS
GCS Geoscience

Nordic Valley Expansion
GCS 2020.11

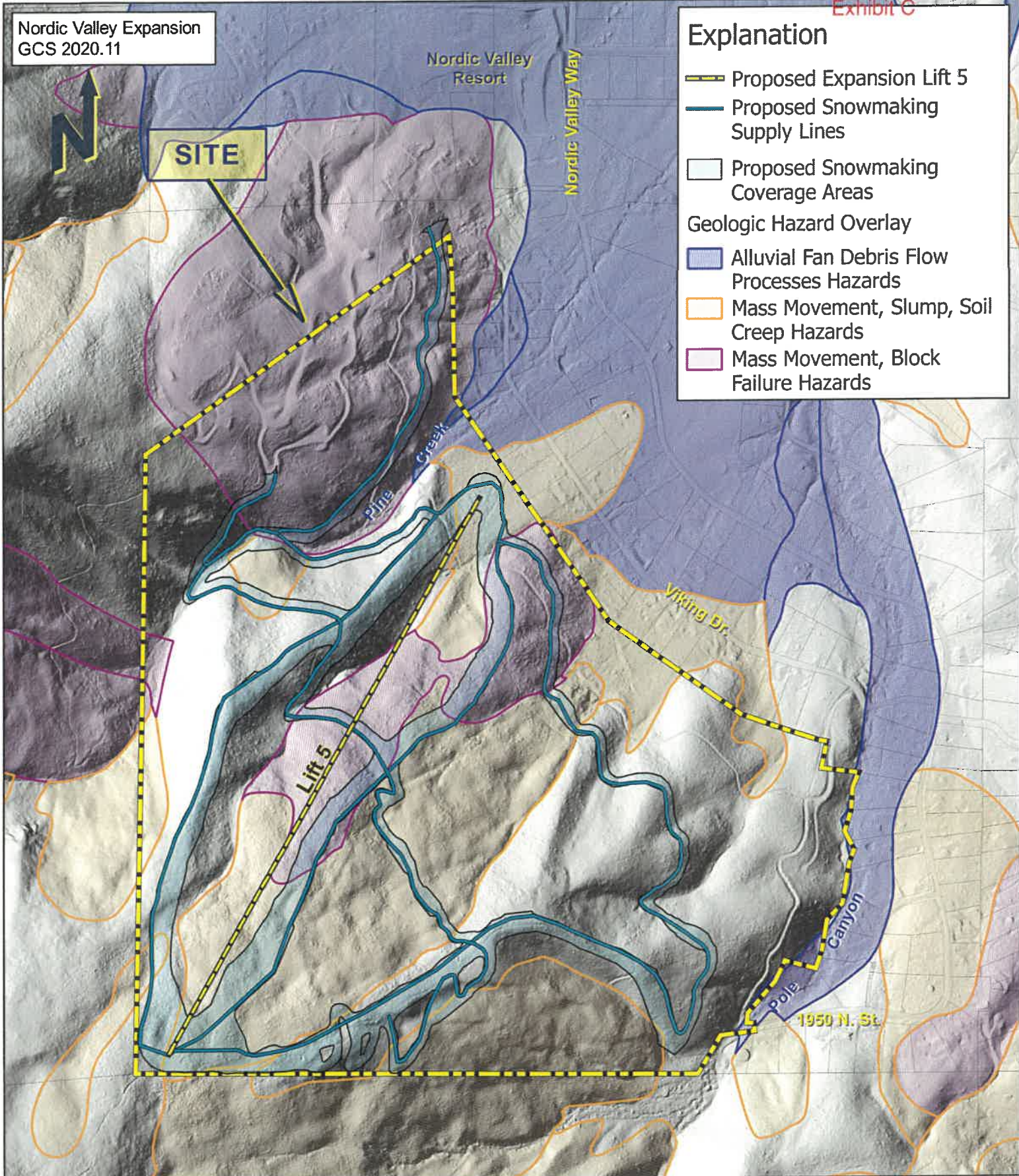
Explanation

- Proposed Expansion Lift 5
- Proposed Snowmaking Supply Lines

- Proposed Snowmaking Coverage Areas

Geologic Hazard Overlay

- Alluvial Fan Debris Flow Processes Hazards
- Mass Movement, Slump, Soil Creep Hazards
- Mass Movement, Block Failure Hazards



Base:
Merged 2018 0.5m (West side), and 2011
1.0m (East side) Bare Earth LiDAR Imagery
from Utah AGRC; <http://gis.utah.gov/>

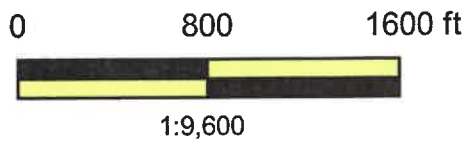




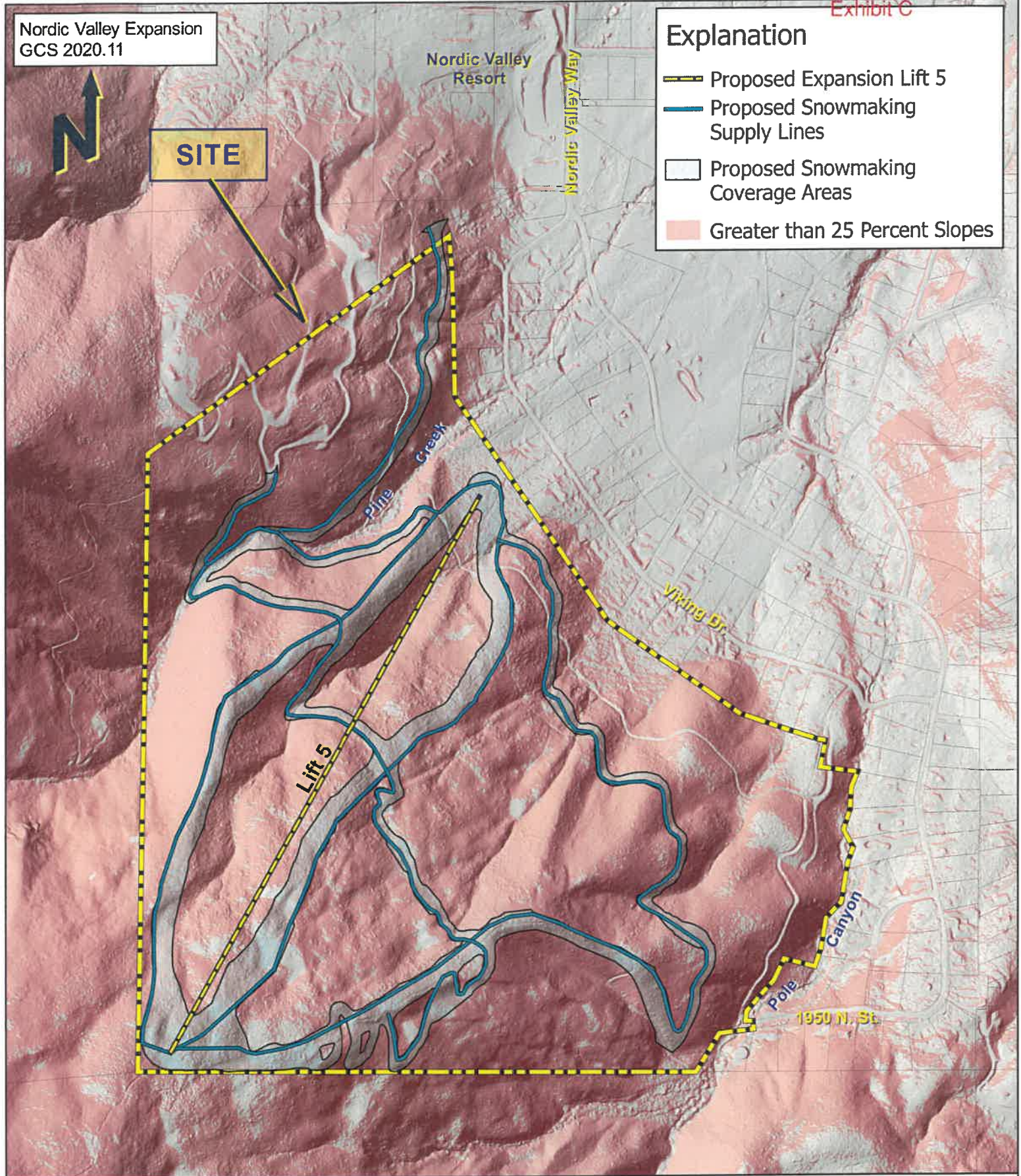


FIGURE 5
GEOLOGIC HAZARDS
OVERLAY MAP
GCS Geoscience

Nordic Valley Expansion
GCS 2020.11

Explanation

-  Proposed Expansion Lift 5
-  Proposed Snowmaking Supply Lines
-  Proposed Snowmaking Coverage Areas
-  Greater than 25 Percent Slopes



Base:
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1.0m (East side) Bare Earth LiDAR Imagery
from Utah AGRC; <http://gis.utah.gov/>

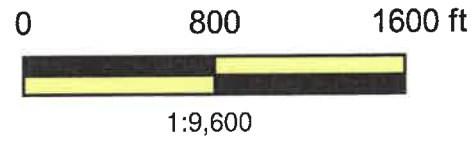


FIGURE 6
STEEP SLOPE
OVERLAY MAP

September 25, 2020

Mr. Brandon Fessler
Nordic Valley Ski Resort
3567 Nordic Valley Way
Eden, Utah 84310

Subject: Geotechnical Engineering Study- Addendum 1
 Proposed Nordic Valley Ski Lift Expansion
 About 3567 Nordic Valley Way
 Eden, Utah
 CMT Project Number: 14998

Mr. Fessler:

INTRODUCTION

A geotechnical report has recently been completed for this project by CMT Engineering Laboratories Inc. (CMT) dated September 3, 2020¹. The findings in the completed report indicated that the proposed locations of lift tower poles 5, 6, and 9 were located within relatively steep sloping areas which were as steep as about 41 degrees (1.15 Horizontal to 1.0 Vertical). The representative slope stability analysis provided in the referenced report for these steep tower locations indicated unsuitable safety factors through the given tower locations without significant foundation alterations and the insertion of a concrete cut off trench extending to bedrock directly down slope of each tower.

However, since the time of the report the proposed locations of towers 5, 6, and 9 have been moved upslope and downslope (see the revised Figure 3 Attached to this addendum letter) to locations where the sloping conditions at the new tower locations are at about 22 degrees (2.5 Horizontal to 1.0 Vertical) or shallower. Additional slope stability analysis have been completed along the added cross section E-E and cross section A-A (See revised figure 3 attached) which indicate that if towers 6 and 9 are placed a minimum 50 feet upslope of the crest where the slope increases from about 22 degrees to about 41 degrees, then they will be located within zones meeting the minimum factors of safety (1.5 for static conditions and 1.0 for seismic conditions). The graphical stability results for the revised tower 6 location, which is representative, are attached as Figures 21 through 24. Tower 5 has been moved downhill to a similarly flatter sloped area.

¹ "Geotechnical Engineering Services, Proposed Nordic Valley Ski Lift Expansion, about 3567 Nordic Valley Way, Eden, Utah, CMT Project No. 14998, Dated September 3, 2020.

Geotechnical Engineering Study-Addendum 1
 Proposed Lofts at Deer Run Development, South Weber, Utah
 CMT Project No. 12921

Page 2

RECOMMENDATIONS

If towers 5, 6 and 9 are moved as shown on the revised figure 3, attached, and placed a minimum of 50 feet upslope of the crest where the slope increases from about 22 degrees to about 41 degrees, then it is our opinion that the new tower alignment will meet the minimum factors of safety for slope stability.

All other recommendations provided in the referenced geotechnical report remain applicable.

CLOSURE

This addendum must be attached to the original geotechnical study dated September 3, 2020. We appreciate the opportunity to provide geotechnical services on your project. Please call with any questions at 801-870-6730.

Sincerely,
CMT Engineering Laboratories

Bryan N Roberts

Bryan N. Roberts, P.E.
 Senior Geotechnical Engineer

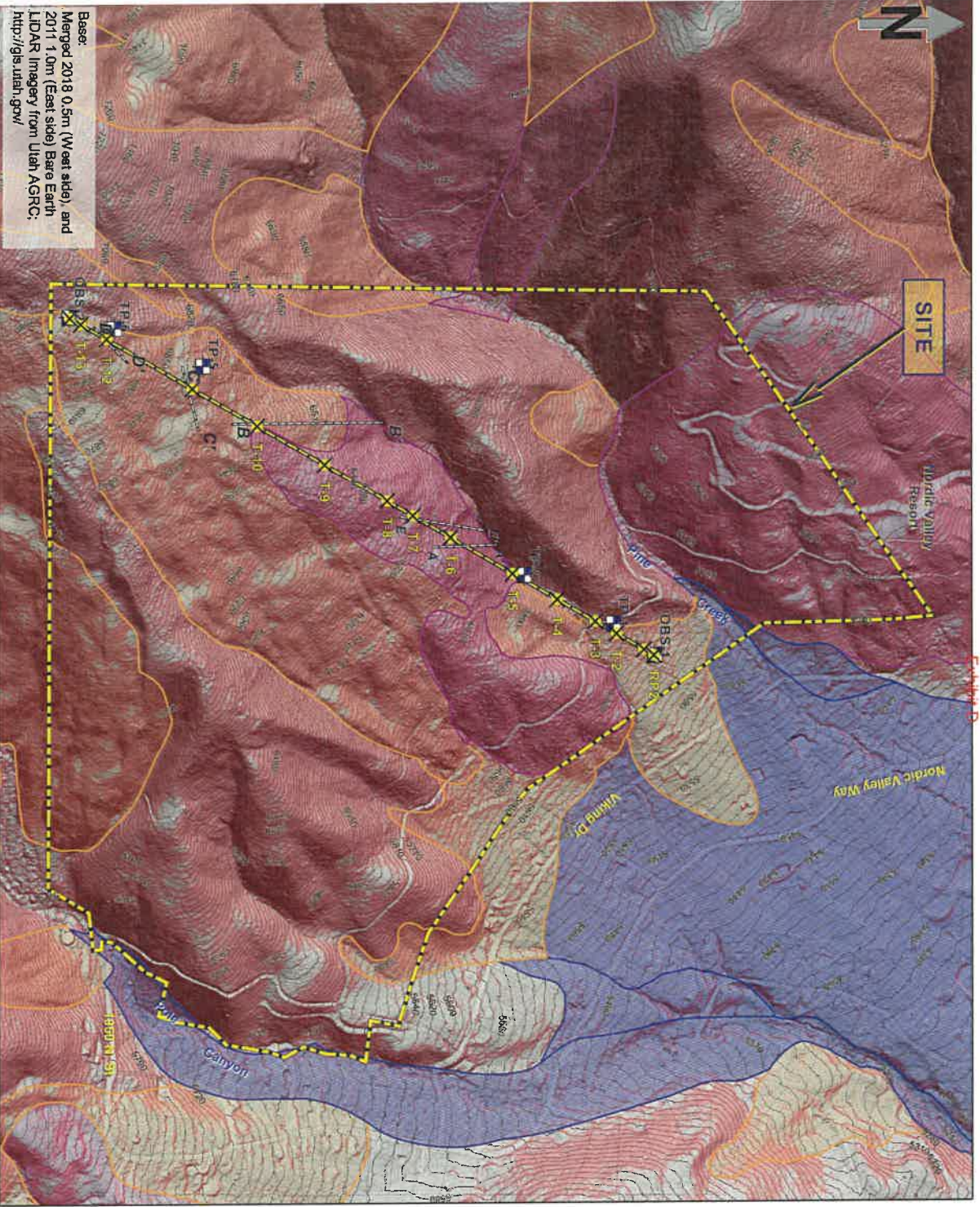


Reviewed by:

Andrew M Harris

Andrew M. Harris, P.E.
 Geotechnical Division Manager

Addressee (email)



Base:
 Merged 2018 0.5m (West side) and
 2011 1.0m (East side) Bare Earth
 LIDAR Imagery from Utah AGRC:
<http://gis.utah.gov/>

Nordic Valley High Speed Six Lift
 Nordic Valley Ski Resort
 Eden, Weber County, Utah

Explanation

- Proposed High Speed Six Lift
- Proposed Towers_9.24.20_Rev
- Geologic Hazard Overlay*
- Alluvial Fan Debris Flow Processes Hazards
- Mass Movement, Slump, Soil Creep Hazards
- Mass Movement, Block Failure Hazards
- *from 2020, GCS Geoscience Geologic Reconnaissance
- Slope Gradients
- 25 to 30 Percent Slopes
- Greater than 30 Percent Slopes
- Index Contour
- Test Pits and Excavation Observation Locations
- Slope Stability Analysis Line



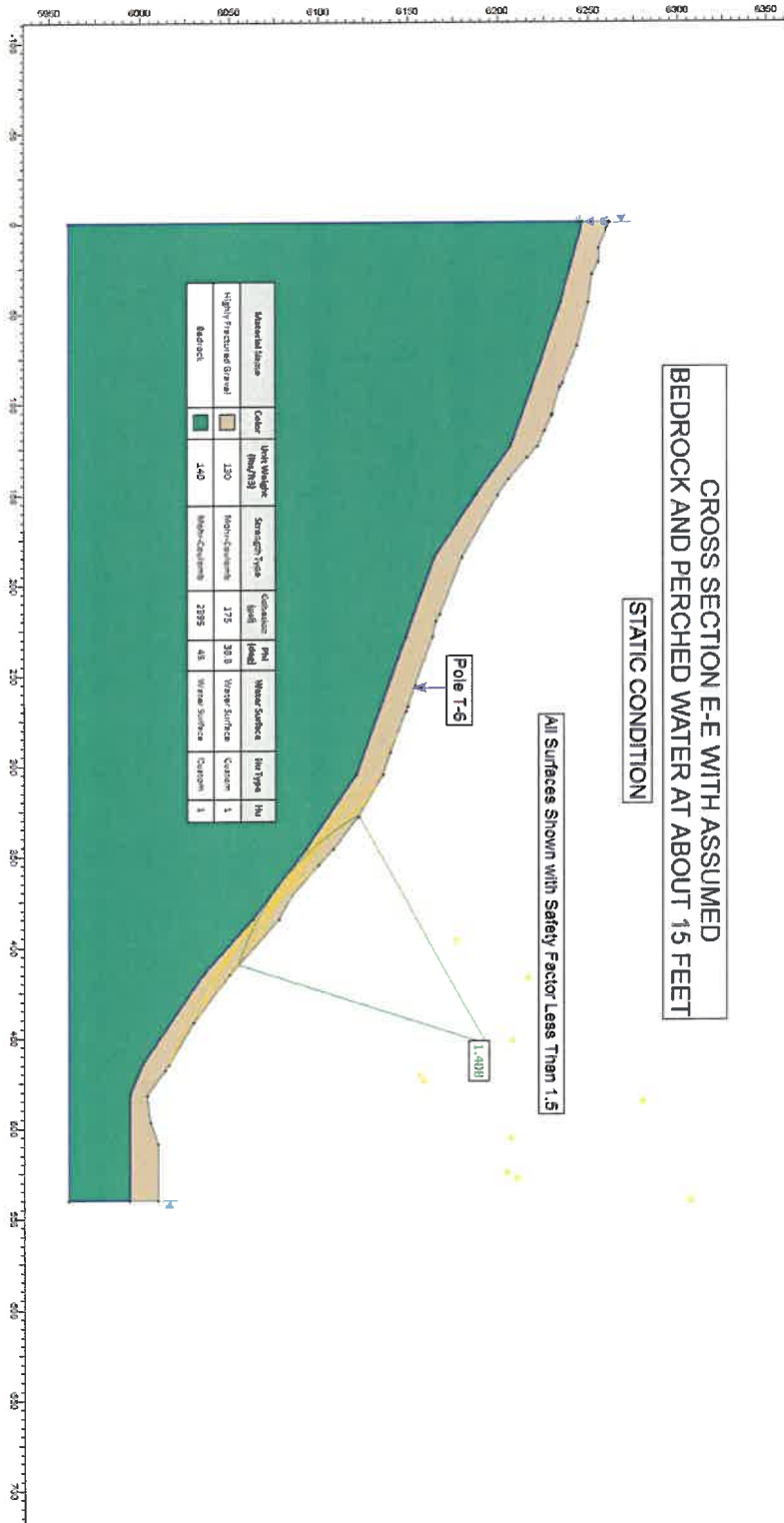
SITE EVALUATION	SITE	Date:	24 Sept-20
		Job #	14998

STABILITY RESULTS

NORDIC VALLEY LIFT EXPANSION

Cross Section E-E (TOWER 6 REVISED LOCATION)

STATIC



CROSS SECTION E-E WITH ASSUMED
BEDROCK AND PERCHED WATER AT ABOUT 15 FEET
STATIC CONDITION

All Surfaces Shown with Safety Factor Less Than 1.5

Pole T-6

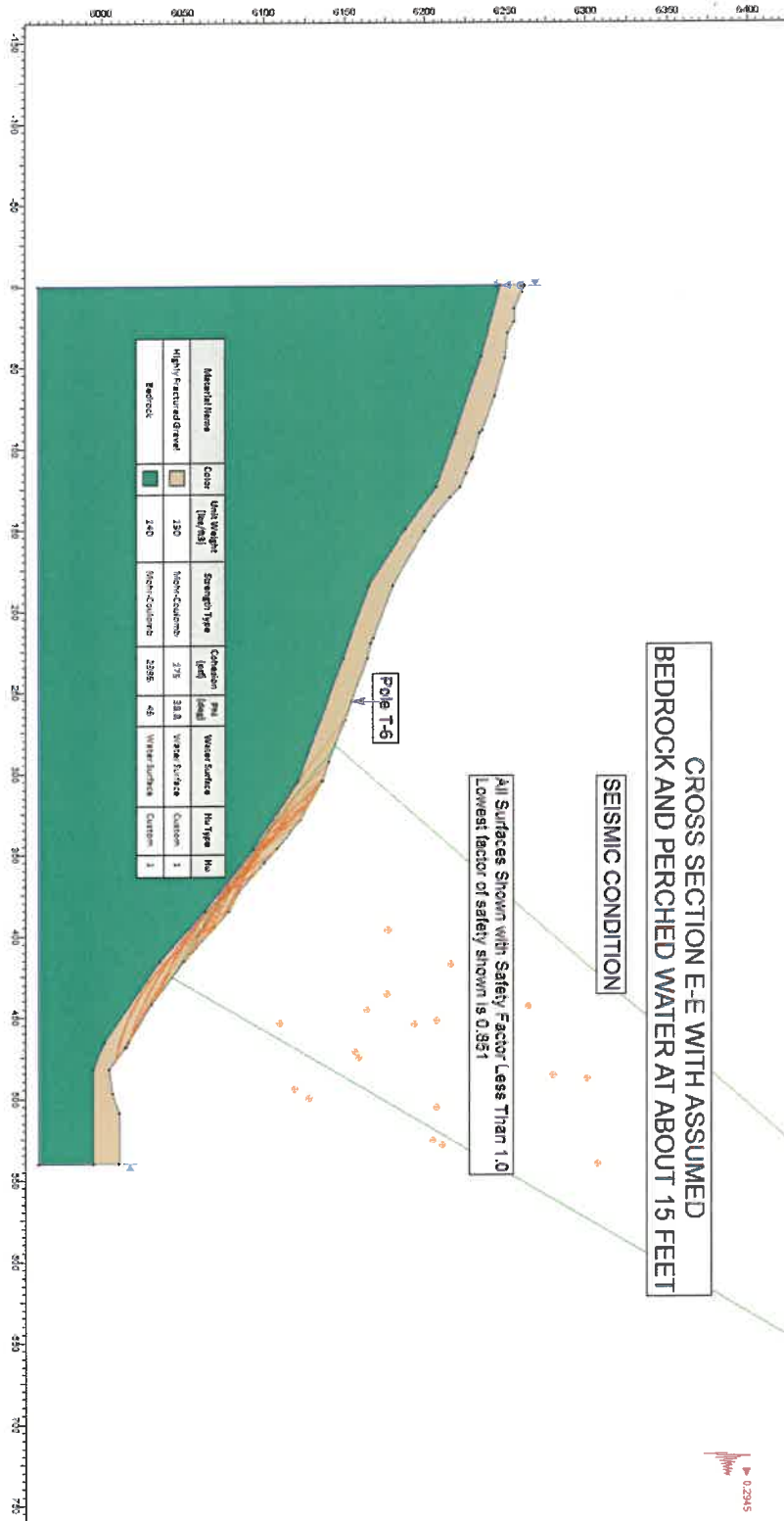
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STABILITY RESULTS

NORDIC VALLEY LIFT EXPANSION

Cross Section E-E (TOWER 6 REVISED LOCATION)

SEISMIC



PROJECT NO.: 14998

NORDIC VALLEY LIFT 5

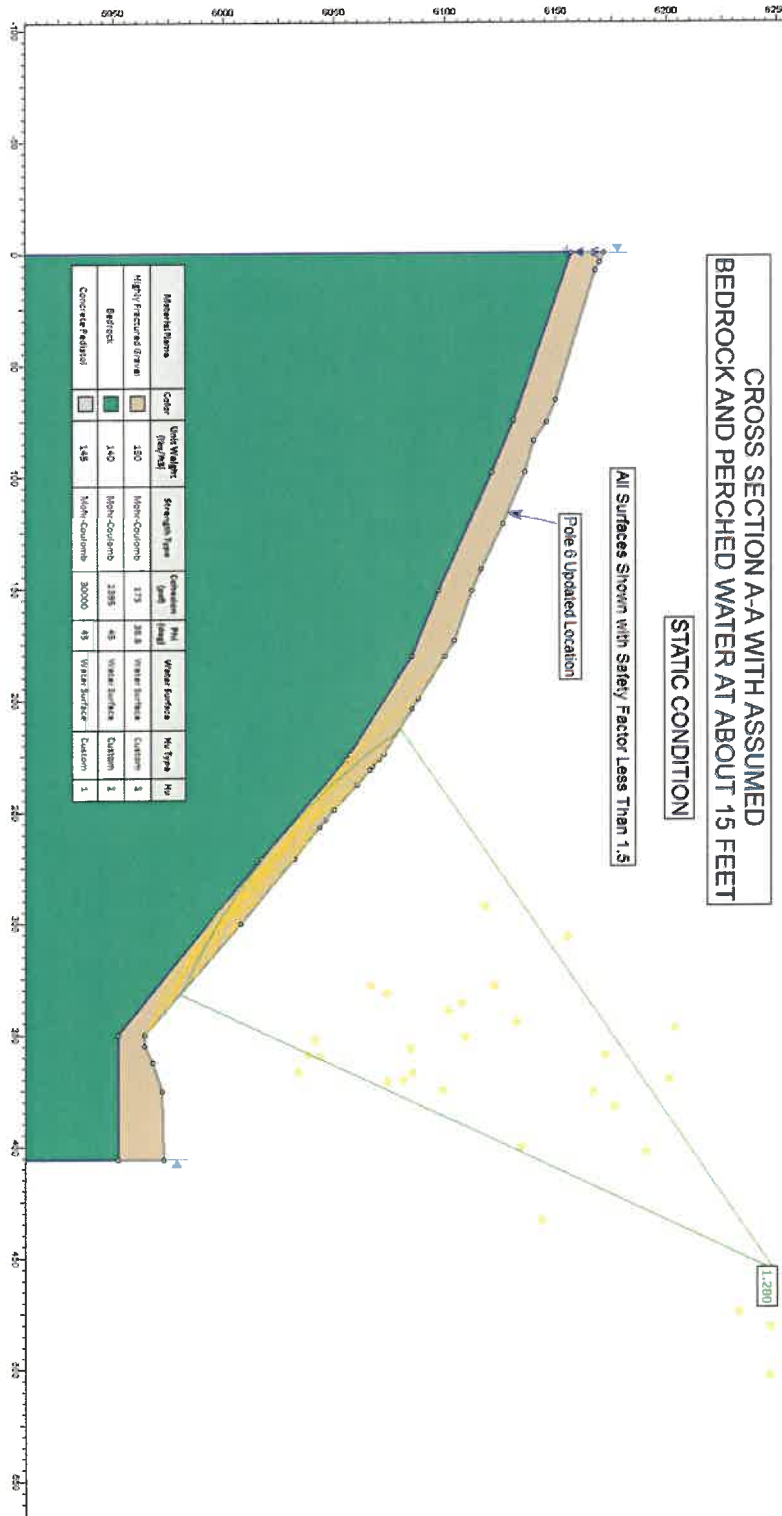
FIGURE NO.: 22

STABILITY RESULTS

NORDIC VALLEY LIFT EXPANSION

Cross Section A-A (TOWER 6 REVISED LOCATION)

STATIC



PROJECT NO.: 14998

NORDIC VALLEY LIFT 5

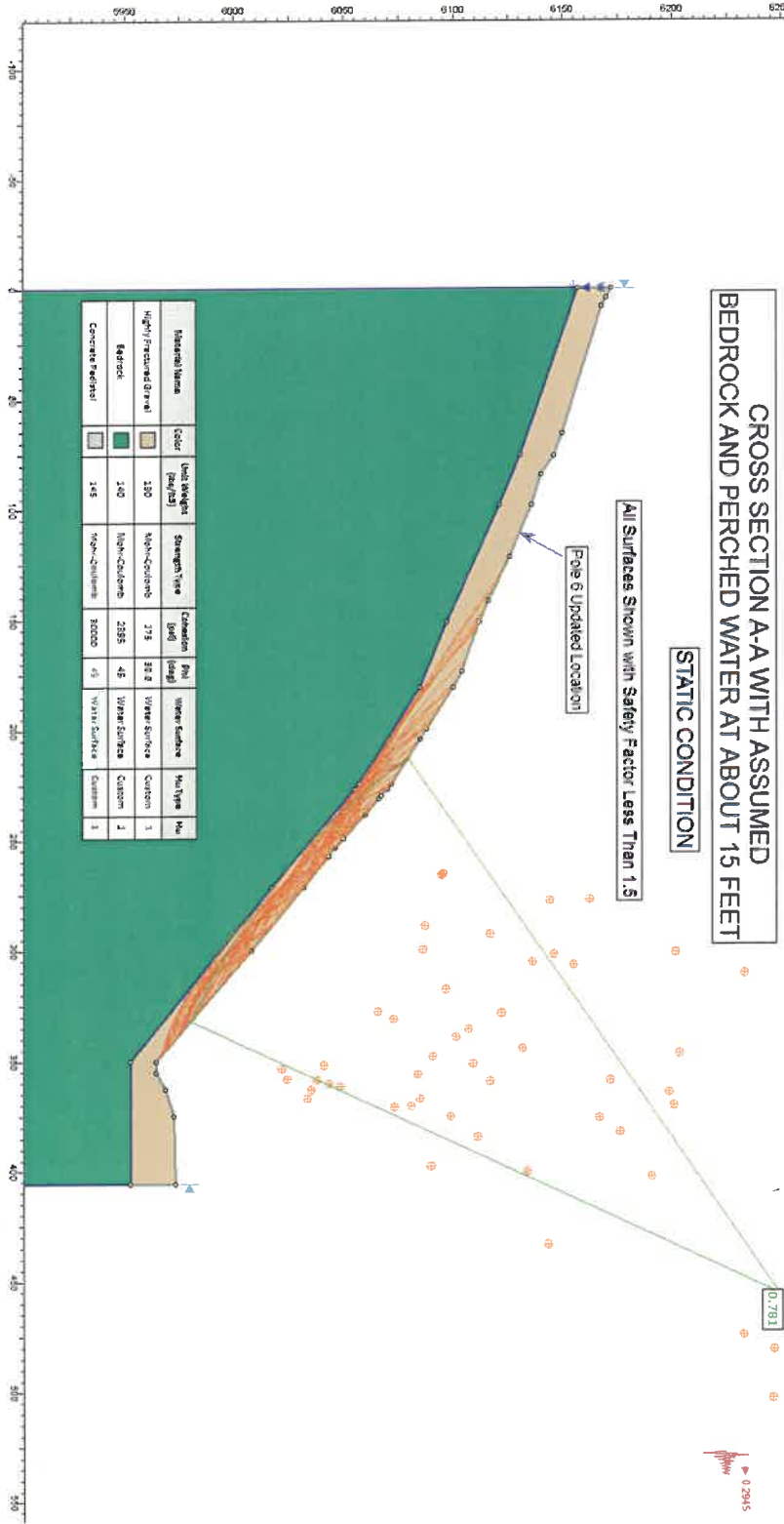
FIGURE NO.: 23

STABILITY RESULTS

NORDIC VALLEY LIFT EXPANSION

Cross Section A-A (TOWER 6 REVISED LOCATION)

SEISMIC



PROJECT NO.: 14998

NORDIC VALLEY LIFT 5

FIGURE NO.: 24

GCS Geoscience

554 South 7700 East Street
Huntsville, Utah 84317
d| 801 745 0262
m| 801 458 0207

File No: 2020.11

Mountain Capital Partners
PO Box 17000
Durango, Colorado
81302

ATTN: Brandon Fessler

**Subject: Lift Terminal Review Status
Proposed Nordic Valley High Speed Six Lift
Nordic Valley Ski Resort
3567 Nordic Valley Way
Eden, Weber County, Utah**

This letter has been prepared to address the status of the upper and lower terminal locations for the Proposed Nordic Valley High Speed Six Lift. On April 2, 2020 GCS Geoscience prepared a Geological Site Reconnaissance and Review¹ for Mountain Capital Partners (Nordic Valley) for the Conditional Use permit application with Weber County.

The conclusions and recommendations of the April 2, 2020 GCS reconnaissance and review were as follows:

Based upon the findings of this review we believe for preliminary site development planning and design should undergo procedures outlined in Section 108-14 Weber County Hillside Development Review Procedures and Standards (Weber County, 2020). With respect to steep slope limitations, the excavation, grading and filling guidelines provided in Section 108-14-8 of the Weber County Code should be followed for site development planning and implementation.

At this time the High Speed Six Lift is undergoing construction, and CMT Engineering Laboratories (CMT) is conducting geotechnical evaluations with County Hillside Development Review Procedures and Standards, for the lift development as specified by the April 2, 2020 GCS reporting. The finalized geotechnical reporting from CMT for the lift construction and Hillside Review is forthcoming.

Because the upper and lower terminal locations are located on flatter ground (less than 25-percent slopes) the excavation, and the setting of the concrete forms for these structures has already been performed. An inspection report letter was prepared by CMT

¹ Report, Professional Geologist Site Reconnaissance and Review, Proposed Lift 5 and Snowmaking Expansion, Parcel #22-029-0010, Nordic Valley Ski Resort, Eden, Weber County, Utah, April 2, 2020: Unpublished consultants report, 17 p., Plates.

August 6, 2020 for the two terminal locations, documenting the suitability of the soils and the placements of the forms.

During an August 27, 2020 video-conference meeting between Nordic Valley, Weber County Planning, GCS and CMT, the status of the ongoing geotechnical evaluations and the timeline of the Hillside Review were discussed. The During the meeting it was pointed out that the lift terminals were outside the 25-percent slope areas that require the Hillside Review process, and it was suggested that the permitting and construction for the terminal locations could be allowed to proceed, while the Hillside Review studies continue for the other elements of the High Speed Six Lift on steeper ground.

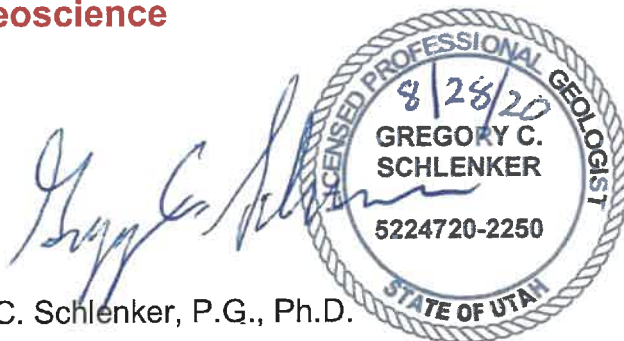
County staff agreed that permitting and construction for the terminal locations could be allowed to proceed, pending the submittal of this letter, confirming that the terminal locations were outside the 25-percent slope areas. A review of our April 2, 2020 GCS Reconnaissance and Review, found that both the upper and lower terminal locations were outside the 25-percent slope areas (see Figure 6 of April 2, 2020 GCS report).

Because the upper and lower terminal locations are outside the 25-percent slope area, and because the foundations of these structures have been inspected by the Geotechnical Engineer (CMT), we believe construction should be permitted to proceed at the upper and lower terminal locations for the High Speed Six Lift.

We appreciate the opportunity to provide this communication, and look forward to continuing work with you on this project. If you have any questions or need additional information, please contact the undersigned at (801) 745-0262 or (801) 458-0207.

Sincerely,

GCS Geoscience



Gregory C. Schlenker, P.G., Ph.D.
Principal

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