GN Northern, Inc.

Consulting Engineers   Environmental Scientists   Construction Materials Testing

December 19, 2019 **GNN Project No.: 217-854**

Mission Ridge Ski and Board Resort
7500 Mission Ridge Road
Wenatchee, WA 98801

Attn: Larry Scrivanich, President
CC: Josh Jorgenson, General Manager
Clay White, Director of Planning, LDC, Inc.

Subject: **MEMO: Review of Revised Expansion Plans**
Proposed Mission Ridge Ski Resort Expansion Project
Chelan County, Washington

Reference: GN Northern, Inc., November 16, 2017. Reconnaissance-Level Evaluation of Geologic Hazards Report, Proposed Mission Ridge Ski Resort Expansion Project, The Villages at Mission Ridge, Chelan County, WA, GNN Project No. 217-854.

Ecosign Resort Planners Ltd., November 20, 2019. Plan set for Mission Ridge, 19 sheets.

Gentlemen,

As requested, GN Northern (GNN) has reviewed the revised plans (referenced) for the proposed Mission Ridge Ski Resort expansion project in Chelan County, Washington.

The attached *Site Features and Geologic Constraints* map shows revised reconnaissance-level boundaries of the noted mass wasting and talus deposits based on a site-specific digital elevation model (DEM) surface not available at the time of the referenced report. Therefore, the attached map supersedes Figure No. 2 of the referenced report.

Based on our review of the revised expansion plans, we have determined that the findings, conclusions, and recommendations of the referenced geologic hazards report remain valid.

If you have any questions regarding this memo, please contact us at 509-248-9798 or 509-893-9400.

Respectfully submitted,

Digitally signed by Karl A. Harmon
Date: 2019.12.19 14:45:56 -08'00'

Karl A. Harmon, LEG, PE
Senior Geologist/Engineer

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Attachment: Site Features and Geologic Constraints (A-3)

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SITE FEATURES AND GEOLOGIC CONSTRAINTS A-3

Northern, Inc.
Consulting Engineers Environmental Scientists Geologists
Construction Materials Testing Geophysical Services

RECONNAISSANCE-LEVEL EVALUATION OF GEOLOGIC HAZARDS REPORT

PROPOSED MISSION RIDGE SKI RESORT EXPANSION PROJECT
THE VILLAGE AT MISSION RIDGE
CHELAN COUNTY, WASHINGTON

GNN PROJECT NO. 217-854

NOVEMBER 2017

Prepared for

MISSION RIDGE SKI AND BOARD RESORT
7500 MISSION RIDGE
WENATCHEE, WA 98801

Prepared by

GN NORTHERN, INC.
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Since 1995

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GN Northern, Inc.

At GN Northern our mission is to serve our clients in the most efficient, cost effective way using the best resources and tools available while maintaining professionalism on every level. Our philosophy is to satisfy our clients through hard work, dedication and extraordinary efforts from all of our valued employees working as an extension of the design and construction team.

November 16, 2017 **GNN Project No. 217-854**

Mission Ridge Ski and Board Resort
7500 Mission Ridge Road
Wenatchee, WA 98801

Attn: Larry Scrivanich, President
cc: Josh Jorgenson, General Manager

Subject: Reconnaissance-Level Evaluation of Geologic Hazards Report
Proposed Mission Ridge Ski Resort Expansion Project
The Village at Mission Ridge
Chelan County, Washington

Gentlemen,

As requested, GN Northern, Inc. (GNN) has completed a reconnaissance-level geologic hazards assessment for the proposed Village at Mission Ridge ski resort expansion project situated primarily within Section 19, Township 21 North, Range 20 East, east of the existing Mission Ridge Ski and Board Resort located southwest of Wenatchee in Chelan County, Washington.

Based on the findings of this preliminary reconnaissance-level study, we conclude that the proposed resort expansion site will be suitable for the intended development provided that the findings of this report, along with the recommendations contained within any additional geologic and/or geotechnical evaluations are addressed during the design and construction phases of the project.

This report describes in detail the results of our evaluation, summarizes our findings, and presents our professional opinions. If you have any questions regarding this report, please contact us at 509-248-9798.

Respectfully submitted,

GN Northern, Inc.

Karl A. Harmon, cn=Karl A. Harmon, o=GN Northern, Inc., ou, email=kharmon@gnnorthern.com, c=US 2018.04.10 17:52:43 -07'00'

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EXECUTIVE SUMMARY

GN Northern has prepared this executive summary to provide a general overview of this reconnaissance-level geologic hazards assessment for the proposed Village at Mission Ridge resort expansion project. The report itself should be relied upon for information about the findings, conclusions, professional opinions, and other concerns.

We understand the Mission Ridge Ski and Board Resort wishes to develop an expansion to the existing ski resort facilities. The site of the proposed expansion currently consists of approximately 140-acres of undeveloped hillside/mountainous terrain located within the southwest portion of Section 19, Township 21 North, Range 20 East. Future improvements at the expanded ski resort facilities will include construction of new infrastructure elements including new roadways, buried utilities, vehicle parking areas, numerous individual home sites with new cabins/homes, multi-family condominium buildings, restaurant and hotels facilities, along with new recreational ski facilities such as ski-lifts, slopes, and trails.

The project site is mapped for geologic hazards by Chelan County including Landslide and Erosion Hazards. The intent of this reconnaissance-level report is to assess various geologic hazards that may impact the proposed development at the site. Our evaluation of potential geologic hazards has been prepared in general compliance with the requirements of the Chelan County Code, Chapter 11.86 – Geologically Hazardous Areas Overlay District (GHOD).

Our site assessment was performed to identify common geologic conditions in the project region, including general and site-specific soil and bedrock conditions, groundwater, slopes, drainage, erosion, and geologic hazards. A review of selected information pertaining to the subject property and surrounding region was performed, that included published technical literature, published geologic maps, available aerial photographs, and previous geotechnical/geologic studies prepared for the subject site and other sites in the vicinity.

Development on sloping ground poses an inherent risk related to global and local stability of site slopes. The proposed project site development will require careful design and construction including slope stabilization and drainage/erosion control measures to mitigate the observed geotechnical and geologic site constraints. Selected surface soils at site are generally considered to be moderately erodible.

Based on our site evaluation, noted geomorphic features at the project site are consistent with large scale slump-block landslides. The classic characteristics of landslides can be readily seen, including clearly identifiable head scarps, rotated slump blocks, and hummocky topography of the slide mass. We believe the landslide events occurred under notably different geologic and climactic conditions during the end of the Pleistocene Epoch. The noted slump-block failures and surrounding mass wasting deposits from older landslide events appear to be relatively stable under the modern day geologic and climate conditions.

Proposed development of new infrastructure elements or structures within the basalt rubble/talus areas will likely pose a significant challenge for construction and geotechnical design. Selected areas of the steep basalt rubble slopes that include large blocks of basalt situated along the face and upper crest of the slopes may serve as a potential source of rockfall debris. While the blocky nature of the slope faces will likely attenuate the energy of rolling/tumbling rock debris, remedial efforts such as scaling of precarious areas during site grading, as well as delineation of appropriate setbacks (determined from a design-level study) should be implemented.

Preventative measures to control runoff and reduce erosion should be incorporated into the future site grading plans. Drainage design for the proposed project should direct stormwater runoff away from the identified slide mass, particularly along the upper surface of the various slump blocks and upper scarp interface.

While additional exploration and analyses of the site must be performed, we currently believe that the project should be developed as planned, provided that the findings of this report and recommendations contained within any subsequent feasibility- and design-level studies are addressed in the final design and construction. Additionally, based on our evaluation, near-surface site soils will not be subject to a significant threat of erosion, provided appropriate grading recommendations are followed during site grading along with careful design, construction, and maintenance of new stormwater management and disposal facilities is incorporated in the final project design.

INTRODUCTION

Project Description & Proposed Development

The ±140-acre site of the proposed Village at Mission Ridge expansion project is located southwest of the City of Wenatchee in Chelan County County, Washington. The entire subject site is mapped within areas defined by Chelan County as Geologically Hazardous Areas due to the risk from landslides and erosion hazards (see Figures 4 & 5).

Based on communications with key representatives of the Mission Ridge Ski & Board Resort, along with a review of the preliminary conceptual plans prepared by SCJ Alliance and Syndicate Smith, LLC, we understand that the resort expansion will include three (3) new ski lifts/chairs and several new ski runs. Proposed new facilities will include parking areas, single-family homes/cabins, condominium buildings, lodging units of various sizes, day lodge, restaurants and other commercial/ recreational services designed to accommodate skiers and overnight guests.

Access to the new Village at Mission Ridge area will be provided by construction of a new ~3,400-feet long access road, traversing U.S. Forest Service property, connecting the existing base area to the new area of proposed expansion. Based on a plan/profile drawing of the preliminary access prepared by Torrence Engineering, LLC, we understand that the access road will be constructed with a width of 28-feet, providing for (2) 14-feet wide lanes in opposite directions.

Purpose and Scope of Services

This reconnaissance-level evaluation of geologic hazards report has been prepared for the site of the proposed Village at Mission Ridge expansion project. Our evaluation was completed in general accordance with our *Revised Proposal for Geologic Hazard Evaluation Study* dated July 10, 2017; notice to proceed was provided by Mr. Larry Scrivanich on July 17, 2017 in the form of a signed copy of the proposal.

The purpose of our services was to complete a preliminary reconnaissance-level evaluation of geologic hazards based on a review of available information regarding surface and subsurface soil and bedrock conditions at and near the subject site as they relate to the proposed development, and provide professional opinions and preliminary recommendations for mitigations of any identified geologic hazards and constraints.

The scope of work included the following:

- A reconnaissance of the site;
- A review of selected/available published technical literature pertaining to the site/region and previous geotechnical/geologic reports prepared for other sites in the vicinity;
- Review of selected available historic aerial photos and USGS topographic maps of the project site and vicinity;
- A geologic/engineering analysis and evaluation of the acquired data from the field reconnaissance and available information;
- A summary of our findings and recommendations in this written report.

This report contains the following:

- Discussions on subsurface soil, bedrock and groundwater conditions;
- Discussions on regional and local geologic conditions;
- Discussions on geologic and seismic hazards;
- Recommendations for additional investigations/analyses and site- and structure-specific evaluations to assess geotechnical and geologic constraints, and formulate appropriate remedial actions to mitigate any noted concerns.

METHODS OF EXPLORATION AND TESTING

Technical Literature and Aerial Photo Review

A review of selected information pertaining to the site and surrounding area was performed, that included published technical literature, published geologic maps, aerial photographs and previous geotechnical and geologic reports prepared for the subject site and other sites in the vicinity. The review was performed to identify typical geotechnical and geologic constraints that may affect the proposed development, including soil and bedrock conditions, groundwater, slopes, drainage, erosion, and known geologic hazards.

Field Reconnaissance

Field reconnaissance of the subject property was performed to observe the on-site surficial geologic and geotechnical conditions and to confirm the data obtained from our technical literature review. In addition to a preliminary visit to the subject site on November 8, 2016, detailed reconnaissance was performed during visits to the project on four separate days, including a walk of the proposed access roadway alignment on July 24, 2017, and a number of hikes across various portions of the main resort expansion areas within Section 19 on July 25th, and September 12th & 13th, 2017. Our field observations were generally cursory in nature and not intended for quantitative analysis or detailed mapping of the site.

DISCUSSION

Site Conditions

The Mission Ridge Ski & Board Resort is located at 7500 Mission Ridge Road, approximately 7-miles southwest of the City of Wenatchee, near the southwestern boundary of Chelan County, Washington. The proposed Village at Mission Ridge expansion project site is located east-northeast of the existing Mission Ridge Ski & Board Resort and southeast of Squilchuck Creek, in the southwest portion of Section 19 (T21N/R20E). A new access roadway is planned across the SE ¼ of Section 24 (T21N/R19E) extending from the existing base area to the new facilities. The existing Mission Ridge Ski & Board Resort currently includes 4 ski lifts/chairs, 36 ski runs and associated retail/rental base facilities. Site location is shown on *Site Vicinity Map* (Figure 1).

The expansion project site consists of undeveloped and relatively undisturbed land with limited access via existing logging trails from the east. An existing side-hill cut trail extends around the east and north sides of the proposed project area. Portions of these existing trails also extend across the northern/northeastern portions of the proposed Village at Mission Ridge development.

Based on topographic data provided by Torrence Engineering along with a review of published topographic/aerial maps, site topography is best described as variable and erratic landslide terrain. Beginning at the top of the highest local peak (±5142') in the southeastern most portion of the site, grade change down to the northwest (±4500') includes a series of steps in the terrain. Large rubble fields consisting of broken cobble- to boulder-size basalt (talus) can be seen on the northwestern faces of the slopes between the steps. Various displaced yet intact blocks of basalt (Grande Ronde) were observed at the crest of these steps. The northern portion of the site is generally characterized by a locally elevated shelf (peak at ±4860') with relatively steep descending slopes around the northeastern side of the project site. The face of this relatively steep north-northeast facing slope includes a massive exposed outcrop of the underlying local sedimentary bedrock (Chumstick Formation).

Surface cover through the majority of the site, including the steps, includes a dense growth of brush and mature trees. The noted basalt boulder talus slopes typically include large areas that are barren of any significant vegetation.

Geologic Setting

Regional Geology:

The site of the proposed resort expansion is generally located along the margin between the Columbia Basin plateau and the Cascade Range physiographic provinces near Wenatchee, Washington. The project site is situated within a NW-SE trending basin identified as the Chiwaukum Graben, which is defined by the Entiat fault to the northeast and the Leavenworth fault to the southwest.

The Columbia Basin plateau was formed by a thick sequence of Miocene Age tholeiitic basalt flows, called the Columbia River Basalt Group (CRBG), which erupted from fissures in north central and northeastern Oregon, eastern Washington, and Western Idaho during the Miocene epoch approximately 12 to 26 million years ago. Relatively thin Miocene sedimentary beds (Ellensburg formation) are also common within the successive lava flows.

The CRBG flows in the Wenatchee area consist of various members of the Grande Ronde Basalt and represent the maximum west/northwestern extent of the lava flows along the eastern flanks of the Cascade Range. In the vicinity of the project site, the CRBG is generally underlain by Oligocene and Eocene sedimentary rocks of the Wenatchee and Chumstick formations. The prevailing Chumstick formation sedimentary rocks consist primarily of interbedded sandstones, siltstones, and conglomerates. Following placement of the Miocene basalt flows, the once relatively level plateau began to be uplifted at the marginal portion along the Cascade Range. Locally, this is identified as the Naneum Ridge Anticline (see Figure 3).

Near the end of the Pleistocene, the Columbia Basin was subjected to an increased flow of glacial melt water and associated debris including a series of incredibly massive, high energy floods known as the Missoula Floods. During this time, a lobe of the Cordilleran ice sheet extended south into Idaho, damming up the Clark Fork River and creating Glacial Lake Missoula, impounding as much as 500 cubic miles of water. These ice dams periodically failed and then reformed numerous times during this period, draining the lake suddenly and unleashing a series of massive torrents of water that significantly scoured and altered landscapes in the Columbia Basin including significant erosion and deposition. The repeated glacial outburst flooding events significantly scoured the Columbia River drainage resulting in erosional undercutting of slopes along the river edges. This erosional process caused removal of the toe support of the surrounding slopes and resulted in the triggering of many massive landslides along the Columbia River valleys throughout Washington and Oregon.

Landslides within the Columbia Basin, particularly along the Columbia River are known to be fairly common. Landslides in this region are often related in part to the presence of relatively thin layers of weaker sedimentary materials interbedded within the various basalt flows of the Columbia River Group. These weaker layers can erode or collapse under the stronger and heavier overlying material and can also act as slip planes, particularly along dipping beds.

The head scarp of the well documented Malaga Landslide (also referred to as the Stemilt Landslide) is located immediately south and east of the project site. The Malaga Landslide is one of the largest landslides in the State of Washington. The landslide is estimated to have started during the late Pleistocene at least 20,000 years ago, and believed to have been caused by "low strength of sand and silt interbeds of the Columbia River Group and the Eocene sandstone and siltstone beds. Saturation of these beds by ground water from high rainfall, possibly blockage of river flow near Rock Island contributed to the massive failures" (Atrim, 1974).

The area surrounding the project site and vicinity consists of a complex of ancient landslides dating back to the end of the Pleistocene, related to saturation of the underlying sedimentary units, undercutting of toe support along drainages, and repeated Missoula flooding events. The project area has apparently been displaced down-gradient from its original elevation/location, from the nearby intact Grande Ronde basalt along Naneum Ridge southwest of the site.

Regional Mapped Geologic Units:

Based on the published geologic map of the area (Geologic Map of the Wenatchee 1:100,000 Quadrangle, Central Washington), the following geologic units are mapped within the site vicinity as shown on Figure 3:

[Qls] *Mass Wasting Deposit:* Poorly sorted deposits ranging from muddy boulder gravel to boulder mid; clasts are angular and of only one or two local rock types; most slides have hummocky surfaces, bulbous toes, and moats at the head and margins; smaller slides generally head at theater-shaped scars; some large slides merge headward with block slides.

[Qs] Sidestream alluvium – moderately sorted boulder-to-pebble gravel of the few rock types that crop out in relatively small drainage basins.

[Qlso] *Mass Wasting Deposit of the Malaga Landslide:* Older landslide deposits – Hummocky Diamicton underlying younger quaternary flood deposits; upper surface of toe of slide along and in Columbia River near Malaga and Rock Island has high erosional relief; huge slide complexes on both sides of Columbia River valley between Wenatchee and Rock Island Dam are sparsely strewn up to altitude 325m with very angular light-colored granodiorite boulders ice-rafted by great floods. Landslide complex northeast of East Wenatchee consists near mountain from of huge rotated, somewhat deformed blocks of the Grande Ronde Basalt and Ellensburg Formation; to southwest is highly fractured deformed blocks and divided debris of the Grande Ronde Basalt deposited in valleys cut into Wenatchee Formation; east of river thickly mantled with loess and eolian sand.

[Qdy] *Mass Wasting Deposit / Basalt Boulder Rubble (Talus):* Diamicton – Diamicton mainly of angular basalt clasts, albeit matrix cemented; only rarely contains very large entablature boulders; deposited variously on minor divides and along modern stream valleys. Evidently formed by debris flows guided by existing topography; near Mission Peak derived directly from bedrock and is associated with large-block landslides.

[Tdyo] *Mass Wasting Deposit:* Older Diamicton – Diamicton of angular granule to boulder-sized clasts of basalt. Occupies divides descending toward the Columbia River valley parallel to tributaries like Squilchuck and Stemilt Creeks, which have incised as deeply as 300m into bedrock, inverting the ancient topography; debris derived from Mission Peak area.

[mf] Manmade fill and modified land

[Tc] *Chumstick Formation:* Sandstone, shale, and conglomerate – White, locally gray, medium- to coarse-grained, micaceous feldspathic sandstone averaging 35 to 40 percent quartz and 10 to 15 percent lithic clasts, 90 percent volcanic rock. Crossbedded and channeled, interbedded with lesser amounts of thin pebbly sandstone and green to bluish shale.

[Tcf] *Chumstick Formation:* Fanglomerate and monolithologic fanglomerate – In vicinity of Peshastin Creek, monolithologic fanglomerate made of well-rounded cobble- to small-boulder-size clasts of serpentinized peridotite in green to rusty brown matrix interbedded with angular to subangular clasts of quartz diorite to 1m in size in angular matrix of quartz diorite to granodiorite sand. In Mission Ridge areas, quartz diorite to granodiorite material only.

[Tgn2] *Grande Ronde Basalt:* Upper flows of normal magnetic polarity – Fine- to medium-grained basalt flows. Nonporphyritic to very sparsely plagioclase porphyritic. Groundmass textures dominantly intersertal with small clots of plagioclase and clinopyroxene. Complexly jointed. Pillows, hyaloclastites, and invasive flows common. Locally includes thin sedimentary deposits of Ellensburg Formation. Jointing patterns in much of area are considerably affected by interaction of flows with water and sediment.

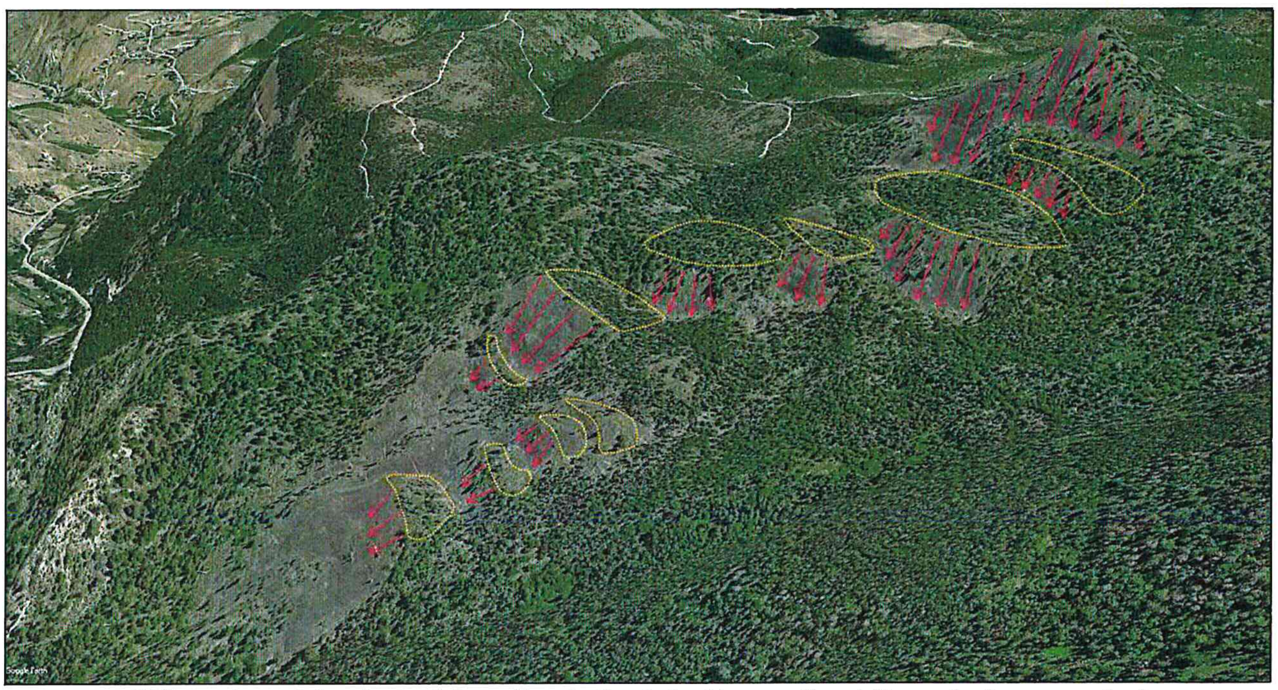
[Tgh] *Grande Ronde Basalt:* Invasive flow of Hammond.

Local Geology:

Geologic units at the resort expansion site and surrounding vicinity consist almost entirely of mass-wasting deposits resulting from significant landslide events. The basic (pre-landsliding) stratigraphy of the local geologic units at the site consists of a relatively thin layer of Miocene Grande Ronde Basalt atop the steeply dipping sedimentary beds of the Eocene Chumstick Formation. Based on geologic mapping and published attitude measurements, the interbedded sandstone/siltstone layers of the local Chumstick Formation have an average regional strike of ±300 degrees with a dip angle of ±60 degrees to the northeast.

Although not shown on published geologic maps of the area, several notable outcrops of granitic intrusive dikes were observed in the project vicinity (see Figure 2). Two separate outcrops of this granitic rock were observed on the northwest facing slope near the proposed access roadway alignment. The noted outcrops of this resistant rock are generally present as pinnacles and cliff faces. A correlating outcrop of this intrusive rock was also observed on the southeast facing slope above Mission Ridge Road, less than ¼ mile from the base area of Mission Ridge Ski Resort.

Current site topography is best characterized as variable and erratic landslide terrain. The top of the highest local peak (±5142') in the southeastern portion of the site grades down to the northwest (±4500') and includes a series of steps in the terrain. Large rubble fields consisting of broken cobble- to boulder-size basalt (talus) can be seen on the northwestern faces of the slopes between the steps (Figure 2). Various displaced yet intact blocks of Grande Ronde basalt were observed at the crest of these steps. The following oblique aerial image depicts the noted slump-block failures across the site. The dotted yellow perimeters represent the rotated upper surfaces of the slump blocks, while the red arrows denote the face/relative displacement of the secondary scarps.



Oblique view of site obtained from Google Earth, looking northeast (3x vertical exaggeration)

The northern portion of the site is generally characterized by a hummocky elevated shelf (peak at ±4860') with relatively steep descending slopes around the northeastern side of the project site. The face of this relatively steep north-northeast facing slope includes a massive exposed outcrop of the underlying local Chumstick Formation.

The noted landslide events are believed to have occurred under notably different geologic and climactic conditions during the end of the Pleistocene Epoch. The classic characteristics of landslides can be readily seen in the vicinity of the basalt talus slopes at the site, including clearly identifiable head scarps, rotated slump blocks, and hummocky topography of the slide mass. The noted slump-block failures at the project site may be secondary to the overall regional deformation of the surrounding area, possibly triggered later during a seismic event in the Holocene. The noted slump-block failures and surrounding mass wasting deposits from older landslide events appear to be relatively stable under the modern day geologic and climate conditions.

Near-Surface Soil Conditions

The soil survey map of the site prepared by the Natural Resources Conservation Service (NRCS) identifies the soils in the vicinity of the subject site to include *Loneridge very stony loam* [LoF], *Stemilt silt loam* [StD/StE], and *Rubble land-Rock outcrop complex* typically located on slopes ranging from 25 to 65 percent. The typical soil profiles mapped at the subject site generally include very gravelly/cobbly/stony silt loam and ashy loam. The landform of these soil units is described as 'Mountain slopes', with the parent material typically noted to consist of 'residuum and colluvium from basalt mixed with volcanic ash and loess'. According to the NRCS, these soil units generally consists of 'well drained' materials. Refer to the NRCS Soil Survey Map in the appendices for more details.

Surface Waters and Groundwater Conditions

Depths to static groundwater beneath the subject site are believed to be fairly significant and primarily controlled by the nearby Squilchuck Creek drainage situated approximately 300 to 400 feet below the site. To assist in estimating groundwater levels in the vicinity, we reviewed selected/available nearby well logs obtained from the Washington State Department of Ecology (DOE) database. Based on our review of the nearest well log in the area, apparently drilled at the base facilities of the existing Mission Ridge Resort with a recorded static water depth of 40' BGS, groundwater levels beneath the project site are anticipated to be greater than several hundred feet.

A number of smaller unnamed drainages/intermittent-streams are mapped across the project site (see Figure 6), however the watershed area associated with the noted drainages is relatively small. While no indications of onsite seeps or springs were observed during our site reconnaissance, minor localized and seasonal areas of perched groundwater conditions may occur at selected locations of the site. Onsite surface waters within the various onsite drainages will likely contribute to areas of perched groundwater.

GEOLOGIC HAZARDS

Seismic Conditions & Regional Faulting

The Chelan County region is located within an area of moderate seismic activity. There are a number of significant active faults and seismic sources capable of producing moderate to strong earthquakes within a 100-mile radius from the project site.

Seismic hazard may result from three types of seismic sources, including interplate events, intraslab events, and crustal events. Each of these types of seismic events result from different causes and therefore, combined with the specific site soil/rock characteristics, produces ground motions with different characteristics (*i.e.,* peak ground accelerations, response spectra, and duration of strong shaking). Each type is capable of generating a peak ground acceleration (pga) of greater than 0.05g at rock sites.

Two of the potential seismic sources, interplate and intraslab events, are related to the subduction of the Juan De Fuca plate beneath the North American plate. Interplate events occur due to movement at the interface of these two tectonic plates. Intraslab events originate within the subducting tectonic plate, away from its edges, when built-up stresses within the subducting plate are released. These source mechanisms are referred to as the Cascadia Subduction Zone (CSZ) source mechanism. The CSZ originates off the coast of Oregon and Washington and subducts beneath both states.

Earthquakes caused by movements along crustal faults, generally in the upper 10 to 15 miles, result in the third source mechanism. These movements occur on the crust of the North America tectonic plate when built-up stresses near the surface are released. For the purposes of this report, an active fault is defined as a fault that has had displacement within the Holocene epoch or last ~11,500 years. There are several crustal faults within a 100-mile radius of the project site (see Figure 7). The following table provides a list of known active faults located within an approximate 100-mile radius of the project site:

Table 1: Quaternary Active Faults / Fault Zones Within 100-Mile Radius

Distance in Miles	Name	Geologic Slip Rate (mm/year)	Dip (degrees)	Dip Dir	Slip Sense	Length (km)
27.16	Saddle Mountain fault	0.06	60	S	reverse	91
68.87	Mill Creek thrust fault	0.04	60	S	reverse	56
75.71	Rattlesnake – Wallula fault system	0.05	60	SW	reverse	109
75.73	Seattle fault zone-northern	-	45	S	thrust	71
78.47	Seattle fault zone-middle	-	45	S	thrust	64
81.60	Horse Heaven Hills structure (NW trend)	0.04	60	W	reverse	59
81.64	Southern Whidbey Island fault-middle	0.23	60	N	reverse	91
82.20	Southern Whidbey Island fault-northern	0.23	60	N	reverse	86
83.46	Seattle fault zone-southern	-	45	S	thrust	56
84.42	Southern Whidbey Island fault-southern	0.23	60	N	reverse	90
87.14	Devils Mountain fault	0.17	60	N	reverse	125
99.72	Tacoma fault zone	0.29	60	N	reverse	35

Leavenworth Fault Zone:

The project site is located in the immediate area of the Leavenworth Fault Zone, with one of the mapped traces generally extending through the parking area of the Mission Ridge base facilities. The Leavenworth fault zone consists of a series of northwest-southeast trending high-angle faults and associated folds marking the southwest side of the Chiwaukum Graben basin. Evidence of any strike-slip motion has not been documented. Vertical offset is noted to vary, with an observed maximum of approximately 1000 meters, decreasing to the southeast near the project site. Tertiary sediments of the Chumstick Formation are separated by the faults from the Swauk Formation in the vicinity of the basalt margin. The Leavenworth fault zone passes beneath the Columbia River basalt generally along the Naneum Ridge in the vicinity of the project site. Faulting in the basalt is limited to vertical offset of only only a few meters. The Leavenworth Fault Zone has not been identified with any Quaternary activity.

Newly Discovered Spencer Canyon Fault:

In 2014, geologists from the USGS solved a 142-year old mystery when they discovered the apparent source of the historic North Cascades Earthquake of 1872. The estimated 6.8 magnitude earthquake occurred on December 14th, 1872 and was felt throughout the northwest. However, due to a lack of instrumentation at the time, scientists could not determine the epicenter or source of the historic quake. The trace of this newly discovered fault scarp was located by reviewing lidar surveys of the region. Trenching and inspection of the fault scarp has confirmed that it was the source of the significant earthquake and that it is an active fault with Holocene displacement.

Recent Earthquake Activity

During the past approximately fifty (50) years there have been a total of ten (10) earthquakes with a moment magnitude greater than 4.5 that have occurred within a 100-mile radius from the site. The strongest of these events had a magnitude of 6.7 and a hypocenter of 64.7 kilometers below the surface. It occurred in 1965 and the epicenter was 95 miles away from the site near Tacoma, Washington. The following table includes a list of the noted 4.5+ earthquake events within a 100-mile radius of the site:

Table 2: List of Earthquakes with M>4.5 within 100-mile Radius

Magnitude	Date	Location	GPS Coordinates	Depth
6.7	4/29/1965	NE Tacoma, Pierce Co.	47.288°N, 122.406°W	64.7 km
5.4	5/3/1996	ENE of Duvall, King Co.	47.761°N, 121.876°W	3.8 km
5.0	5/28/1981	N of Tieton Peak, Yakima Co.	46.525°N, 121.394°W	2.1 km
5.0	1/29/1995	E of Maury Island, Puget Sound	47.387°N, 122.364°W	15.4 km
4.9	12/24/1989	SE of Mineral, Lewis Co.	46.650°N, 122.116°W	17.3 km
4.7	4/20/1974	SE of Mount Rainier, Lewis Co.	46.716°N, 121.476°W	4.2 km
4.6	6/24/1997	Between Twisp & Omak, Okanogan Co.	48.364°N, 119.888°W	10.2 km
4.6	11/18/2011	NW of Omak, Okanogan Co.	48.469°N, 119.608°W	11.2 km
4.5	10/8/2006	Mount Rainier, Pierce Co.	46.850°N, 121.600°W	1.6 km
4.5	5/9/1989	SW of Malott, Okanogan Co.	48.231°N, 119.854°W	14.6 km

Not included in this table is the earthquake of 1872, with an estimated magnitude of 6.8, that apparently occurred along the recently discovered Spencer Canyon fault, approximately 22 miles north of the site near Orondo and Entiat, Washington.

Seismic Scenarios

The Washington State Seismic Scenario Catalog contains loss estimates for a suite of earthquake scenarios. These scenarios were selected to represent reasonable estimates of the most serious earthquake hazards everywhere in Washington as a basis for planning. The data is calculated by the Federal Emergency Management Agency's Hazards United States (HAZUS) loss estimation software using scenario earthquakes developed by the United States Geological Survey. A scenario represents one realization of a potential future earthquake by assuming a particular magnitude, location, and fault-rupture geometry and estimating shaking intensity using a variety of strategies.

The effect of an earthquake on the Earth's surface is called the intensity. The Modified Mercalli Intensity (MMI) scale consists of a series of certain key responses such as people awakening, movement of furniture, damage to chimneys, and finally total destruction. This scale is designated by Roman numerals, and is composed of increasing levels of intensity that range from imperceptible shaking (I) to catastrophic destruction (X). It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects. The MMI value assigned to a specific site after an earthquake has a more meaningful measure of severity to the nonscientist than the magnitude because intensity refers to the effects actually experienced at that place.

The following table summarizes the expected shaking intensity at the project site based on selected pertinent seismic scenarios:

Table 3: Shaking Intensity for Pertinent Seismic Scenarios

Earthquake Event	Magnitude	MMI	Shaking
Cascadia	9.0	V	Moderate
Cascadia North	8.3	IV	Light
Chelan	7.2	VI	Strong
Cle Elum	6.8	V	Moderate
Mill Creek	7.1	IV	Light
Saddle Mountains	7.2	VI	Strong

Site-Specific Ground Motions

A standard quantitative method of describing ground motion associated with propagating seismic waves is to specify peak horizontal ground accelerations (PGAs) in bedrock. PGAs are based on empirical attenuation relationships of seismic wave energy with distance from the causative source. PGAs are expressed as a fraction of the acceleration of gravity. PGA's were determined as part of this analysis for the site using Probabilistic Seismic Hazard Assessment (PSHA) which considers the probability of earthquake occurrence during a defined interval of reoccurrence (typically the design life of the planned development).

The following table presents USGS mapped peak horizontal ground accelerations (PGA) obtained from PSHA data using the online USGS deaggregation tool. The deaggregation provides the relative contributions of hazard for each seismic source, and was based on the *Dynamic Conterminous U.S. 2014 (v4.1.1)* hazard model for the maximum credible earthquake (MCE) for various return intervals. PGAs were calculated for rock, which is appropriate for the subject site and is defined as the boundary between Site Class 'B' and 'C' (V_s = 760 m/s or 2,500 ft/s).

Table 4: Mapped PGA At Various Return Intervals

Probability of Exceedance	Return Interval (RI)	USGS Mapped MCE PGA_{ROCK}
2% in 50 years	2,475 years	0.2118 g
5% in 50 years	975 years	0.1377 g
10% in 50 years	475 years	0.0957 g

*GPS coordinates used for calculation: 47.2957, -120.3871

Based on the deaggregation, it appears that about 8% of the contribution to the probabilistic hazard at the site comes from the Cascadia Subduction Zone, with the remaining contribution primarily from the 'Western U.S. Shallow Gridded' source.

Flooding and Erosion

Based on topography and location, the subject site is not situated within an area that would be prone to flooding. However, portions of the subject property include areas where sheet flow and erosion may occur. Selected areas of the near-surface site soils and surface conditions are known to exhibit a moderate risk for erosion.

Erosion susceptibility from water is based on several factors, including the intensity of rainfall and runoff, soil erodibility, length and steepness of slopes, and surface condition. The erodibility factor of the soils is a measure of the soils resistance to erosion based on its physical characteristics. Typically, very fine sand, silt and clay soils are generally susceptible to erosion. Based on site specific observations during our site reconnaissance, exposed materials at the surface range from cobble and boulder sized talus deposits to gravelly/cobbly silt and fine sand.

Soil erodibility is only one of several factors affecting the erosion susceptibility. Soil erosion by water also increases with the length and steepness of the site slopes due to the increased velocity of runoff and resulting greater degree of scour and sediment transport. Appropriate erosion and sediment control plan(s) and a drainage plan shall be prepared by the project civil engineer with the final construction drawings.

The need for, and design of, flood control devices and erosion protection measures is within the purview of the design Civil Engineer. In general, erosion should be mitigated with best management practices (BMPs) consisting of proper drainage design including collecting and disposal (conveyance) of water to approved points of discharge in a non-erosive manner. Appropriate project design, construction, and maintenance will be necessary to mitigate the site erosion hazards.

Secondary Seismic Hazards

Secondary seismic hazards related to ground shaking include soil liquefaction, ground subsidence, tsunamis, and seiches. The site is far inland, so the hazard from tsunamis is non-existent. The potential hazards from seiches are also non-existent due to the lack of any significant water storage reservoirs located at a distance or elevation effecting the site.

Soil Liquefaction

Liquefaction is the loss of soil strength from sudden shock (usually earthquake shaking), causing the soil to become a fluid mass. In general, for the effects of liquefaction to be manifested at the surface, groundwater levels must be within 50 feet of the ground surface and the soils within the saturated zone must also be susceptible to liquefaction. A detailed liquefaction analysis was beyond the scope of this report.

Based on the published Liquefaction Susceptibility Map of Chelan County, Washington (dated September 2004) prepared by Washington State Department of Natural Resources, the site is primarily mapped with a 'Low to Moderate' potential for liquefaction. The map indicates a 'Moderate to High' potential for liquefaction along the alluvial deposits of the Squilchuck Creek drainage. Based on our preliminary assessment of the project site conditions, the risk for liquefaction at this site is considered to be negligible due to the presence of bedrock materials and depth to groundwater.

PRELIMINARY FINDINGS AND CONCLUSIONS

The following is a summary of our preliminary findings, conclusions and professional opinions based on the data obtained from a review of selected technical literature and the site evaluation:

General:

- ***While additional exploration and analyses must be performed during a subsequent design-level geologic/geotechnical study, based on our current understanding of the site conditions and proposed development, we believe that the site should be suitable for the proposed development, provided the findings of this report and the recommendations contained within any subsequent feasibility- and design-level geologic and geotechnical evaluations are addressed in the final design and construction phases of the project.***

Geologic/Geotechnical Constraints and Mitigation:

- The primary geologic hazards and site constraints for the proposed project include surface erosion and the potential for slope failures. Appropriate engineered design and careful construction can mitigate these geologic constraints and increase safety to allow development of potentially geologically hazardous areas.

- Geomorphic features noted at the project site during our preliminary research and confirmed during field reconnaissance are consistent with large scale slump-block landslides. The classic characteristics of landslides can be readily seen, including clearly identifiable head scarps, rotated slump blocks, and hummocky topography of the slide mass. We believe the landslide events occurred under notably different geologic and climactic conditions during the end of the Pleistocene Epoch.

- The noted slump-block failures and surrounding mass wasting deposits from older landslide events appear to be relatively stable under the modern day geologic and climate conditions. Additional site-specific exploration and analyses should be performed to assess the actual stability of site slopes and ancient slide failure surfaces at the project site. Stability analyses of the slopes shall include an assessment of the potential risk from seismically induced slope failures.

- Proposed development of new structures or infrastructure elements within the basalt rubble/talus areas will likely pose a significant challenge for construction and geotechnical design. Development of these areas will require removal of loose rubble to expose competent subgrade conditions.

- Selected areas of the steep basalt rubble slopes that include large blocks of basalt situated along the face and upper crest of the slopes may serve as a potential source of rockfall debris. While the blocky nature of the slope faces will likely attenuate the energy of rolling/tumbling rock debris, remedial efforts such as scaling of precarious areas during site grading, as well as delineation of appropriate setback (determined from a design-level study) should be implemented.

- Preventative measures to control runoff and reduce erosion should be incorporated into the future site grading plans. Drainage design for the proposed project should direct stormwater runoff away from the identified slide mass, particularly along the upper surface of the various slump blocks and upper scarp interface.

- The project site is located within an area of moderate seismic activity.

- The risk from other common geologic hazards, including fault rupture and liquefaction are considered relatively low on this site.

- Development on sloping ground poses an inherent risk related to global and local stability of site slopes. The proposed project site development will require careful design and construction including slope stabilization and drainage/erosion control measures to mitigate the observed geotechnical and geologic site constraints.

- Remedial site grading, as recommended within a subsequent design-level geotechnical engineering investigation, will be necessary to develop appropriate cut/fill slopes and provide uniform competent support for future structures and infrastructure improvements.

- All slope faces shall be protected with appropriate erosion control measures (BMPs) to insure long-term surficial stability.

- Appropriate slope set-backs for future structures and development should be incorporated in the final planning and design of the project, as recommended within a subsequent design-level geotechnical engineering investigation.

- ***While additional feasibility- and design-level exploration and analyses of the subject site are necessary, we currently believe that the proposed ski resort expansion development should pose no significant threat to the health or safety of the citizens, or increase hazards to surrounding properties, provided the findings in this report and the recommendations contained within any subsequent geotechnical and/or geologic evaluations are addressed in the final design and construction phases of the project. Final classification of the noted geologic hazards at the site (in accordance Chelan County Code, Chapter 11.86, Section 11.86.020) cannot be determined without further investigation and analyses.***

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LIMITATIONS OF THE GEOLOGIC HAZARDS REPORT

This GEOLOGIC HAZARDS REPORT ("Report") was prepared for the exclusive use of the Client. GN Northern, Inc.'s (GNN) findings and conclusions in this Report are based on site reconnaissance, and GNN's understanding of the proposed project at the time the Report is prepared. Furthermore, GNN's findings and conclusions are based on the assumption that soil, rock and/or groundwater conditions do not vary significantly from those found at areas of site reconnaissance at the project site. Variations in soil, bedrock and/or groundwater conditions could exist between and beyond points of observation. The nature and extent of these variations may not become evident until during or after construction. Variations in soil, bedrock and groundwater may require additional studies, consultation, and revisions to GNN's recommendations in the Report.

This Report's findings are valid as of the issued date of this Report. However, changes in conditions of the subject property or adjoining properties can occur due to passage of time, natural processes, or works of man. In addition, applicable building standards/codes may change over time. Accordingly, findings and conclusions of this Report may be invalidated, wholly or partially, by changes outside of GNN's control. Therefore, this Report is subject to review and shall not be relied upon after a period of one (1) year from the issued date of the Report.

In the event that any changes in the nature, design, or location of structures are planned, the findings, conclusions and preliminary recommendations contained in this Report shall not be considered valid unless the changes are reviewed by GNN and the findings, conclusions, and recommendations of this Report are modified or verified in writing.

This Report is issued with the understanding that the owner or the owner's representative has the responsibility to bring the findings, conclusions, and recommendations contained herein to the attention of the architect and design professional(s) for the project so that they are incorporated into the plans and construction specifications, and any follow-up addendum for the project. It is further understood that the owner or the owner's representative is responsible for submittal of this Report to the appropriate governing agencies. The foregoing notwithstanding, no party other than the Client shall have any right to rely on this Report and GNN shall have no liability to any third party who claims injury due to reliance upon this Report, which is prepared exclusively for Client's use and reliance.

GNN has provided geotechnical/geologic services in accordance with generally accepted practices in this locality at this time. GNN expressly disclaims all warranties and guarantees, express or implied.

Although GNN can provide environmental assessment and investigation services for an additional cost, the current scope of GNN's services does not include an environmental assessment or an investigation for the presence or absence of wetlands, hazardous or toxic materials in the soil, surface water, groundwater, or air on, below, or adjacent to the subject property.

APPENDICES

SITE VICINITY MAP (FIG. 1)

SITE FEATURES & GEOLOGIC CONSTRAINTS MAP (FIG. 2)

GEOLOGIC MAP OF WENATCHEE 1:100,000 QUADRANGLE (FIG. 3)

CHELAN COUNTY LANDSLIDE HAZARD OVERLAY MAP (FIG. 4)

CHELAN COUNTY EROSION HAZARD OVERLAY MAP (FIG. 5)

U.S. FISH & WILDLIFE NATIONAL WETLANDS INVENTORY MAP (FIG. 6)

WASHINGTON DNR FAULTS AND EARTHQUAKES MAP (FIG. 7)

SITE PHOTOGRAPHS

NRCS SOIL SURVEY MAP

WASHINGTON DEPARTMENT OF ECOLOGY WELL LOG

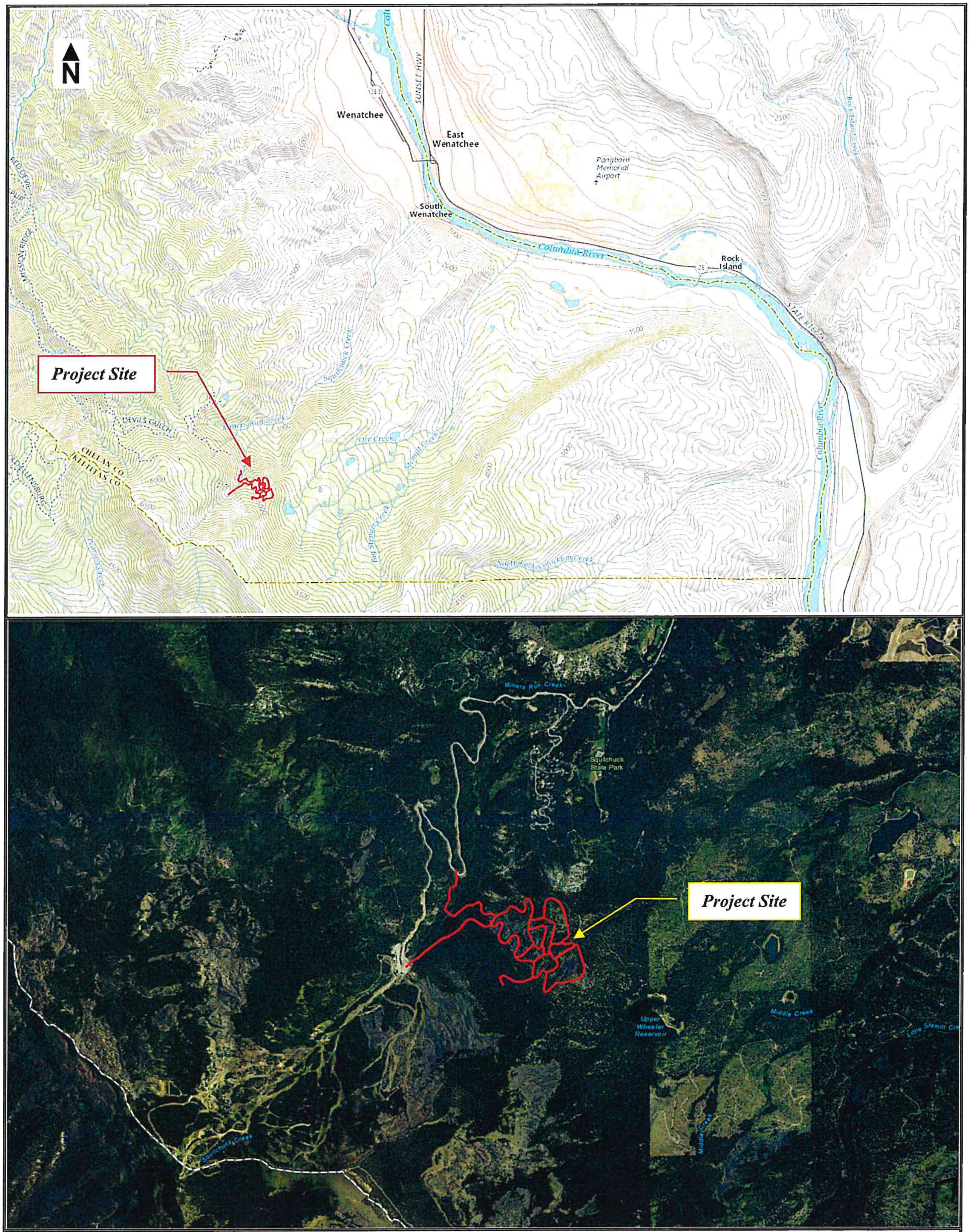
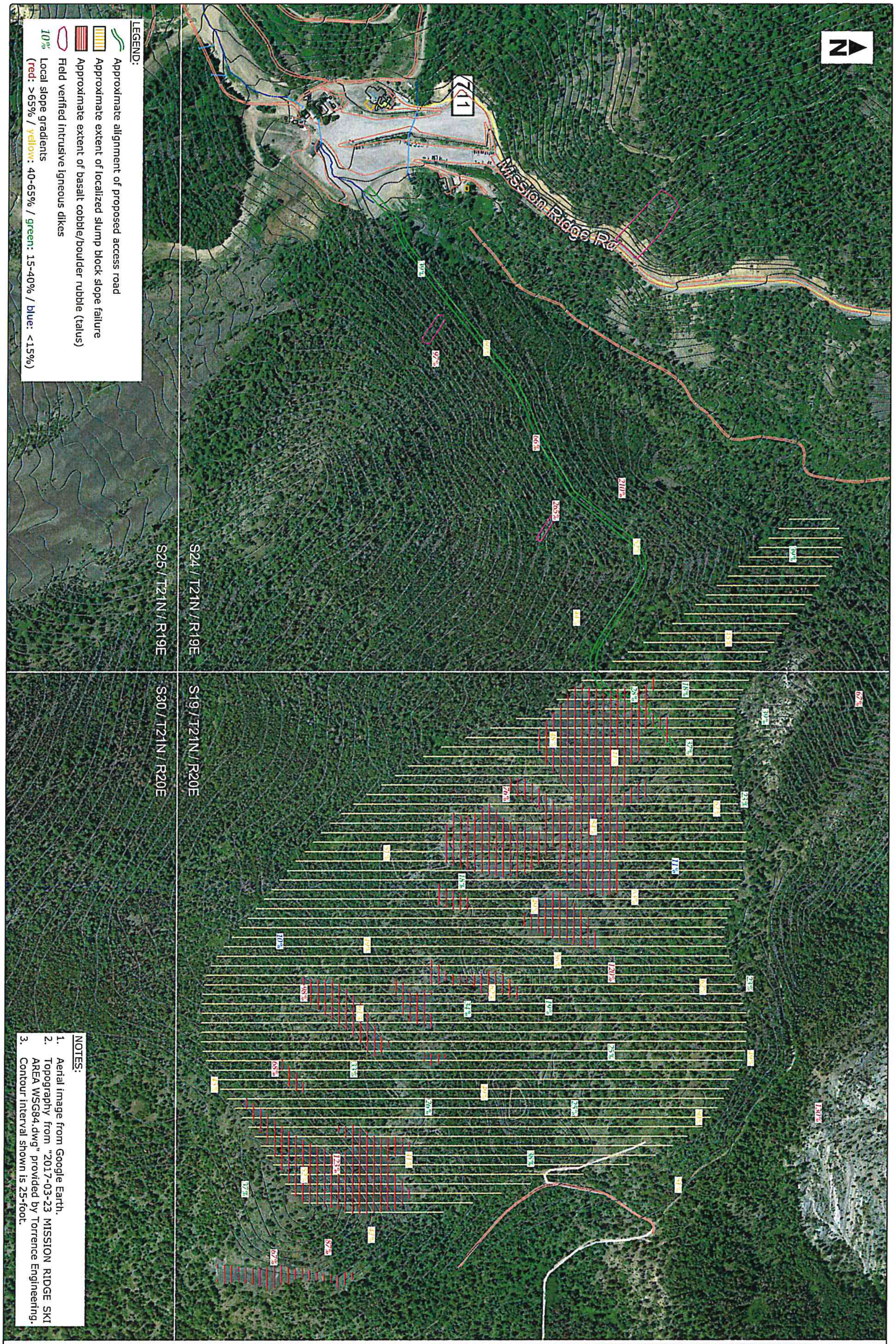


FIGURE 1: SITE VICINITY MAP **PROJECT NO. 217-854**

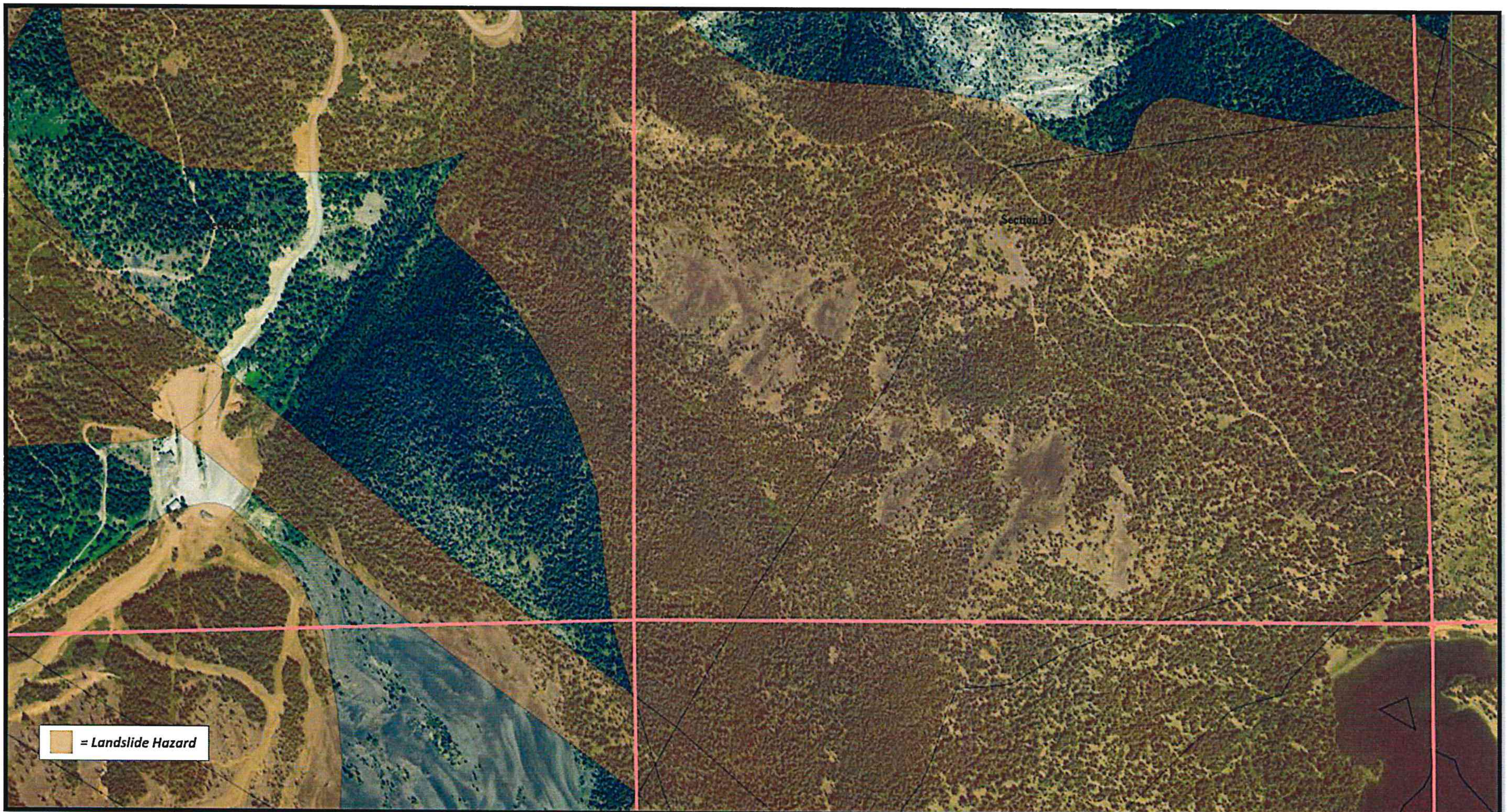


PROJ. NO. 217-854
DATE: 11/15/2017
FIGURE NO. 2

SITE FEATURES & GEOLOGIC CONSTRAINTS MAP
Village at Mission Ridge
Chelan County, Washington

Northern, Inc.
Consulting Engineers — Environmental Scientists — Geologists
Construction Materials Testing — Geophysical Services

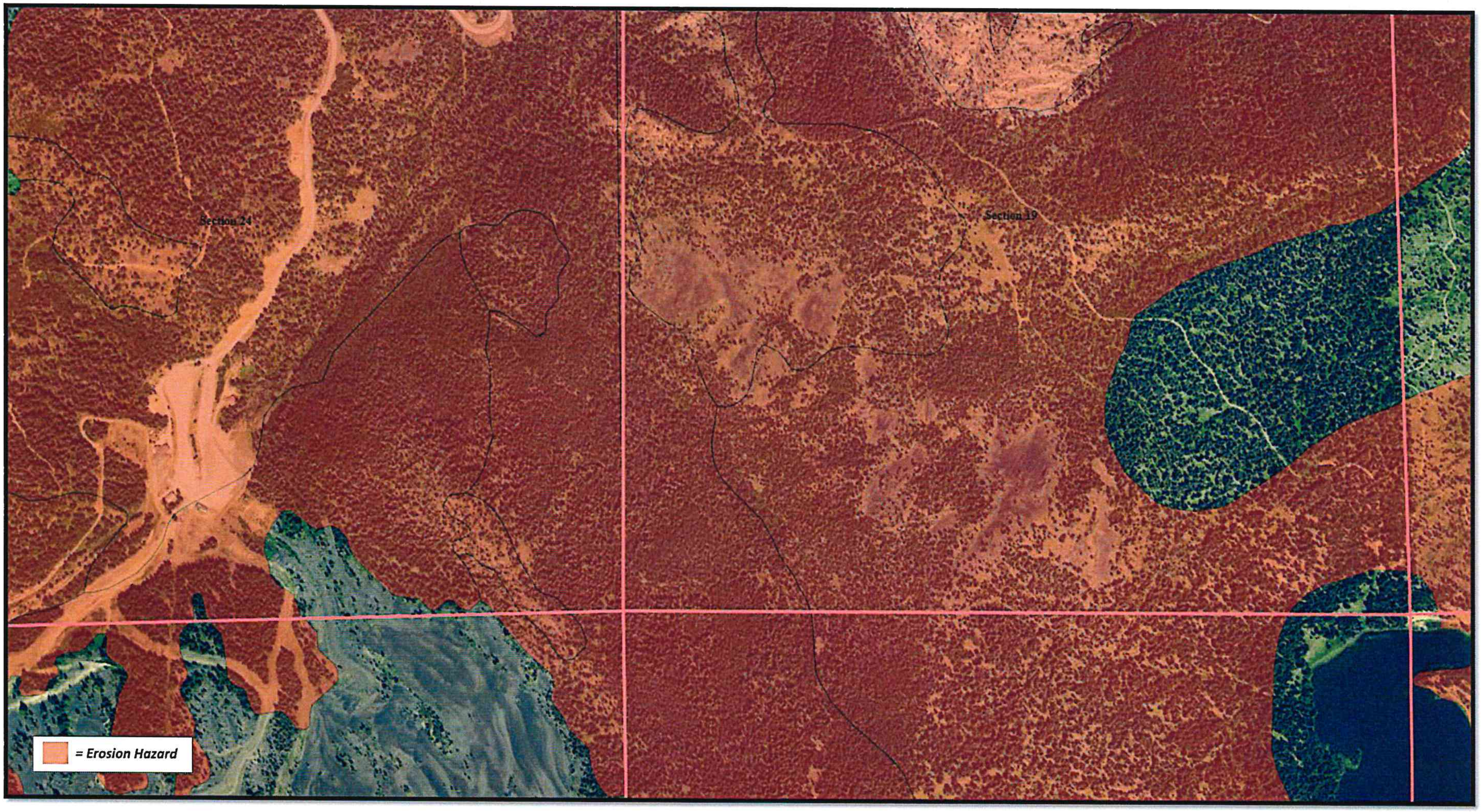
Northern, Inc.



CHELAN COUNTY GIS – LANDSLIDE HAZARD OVERLAY MAP (FIGURE 4)

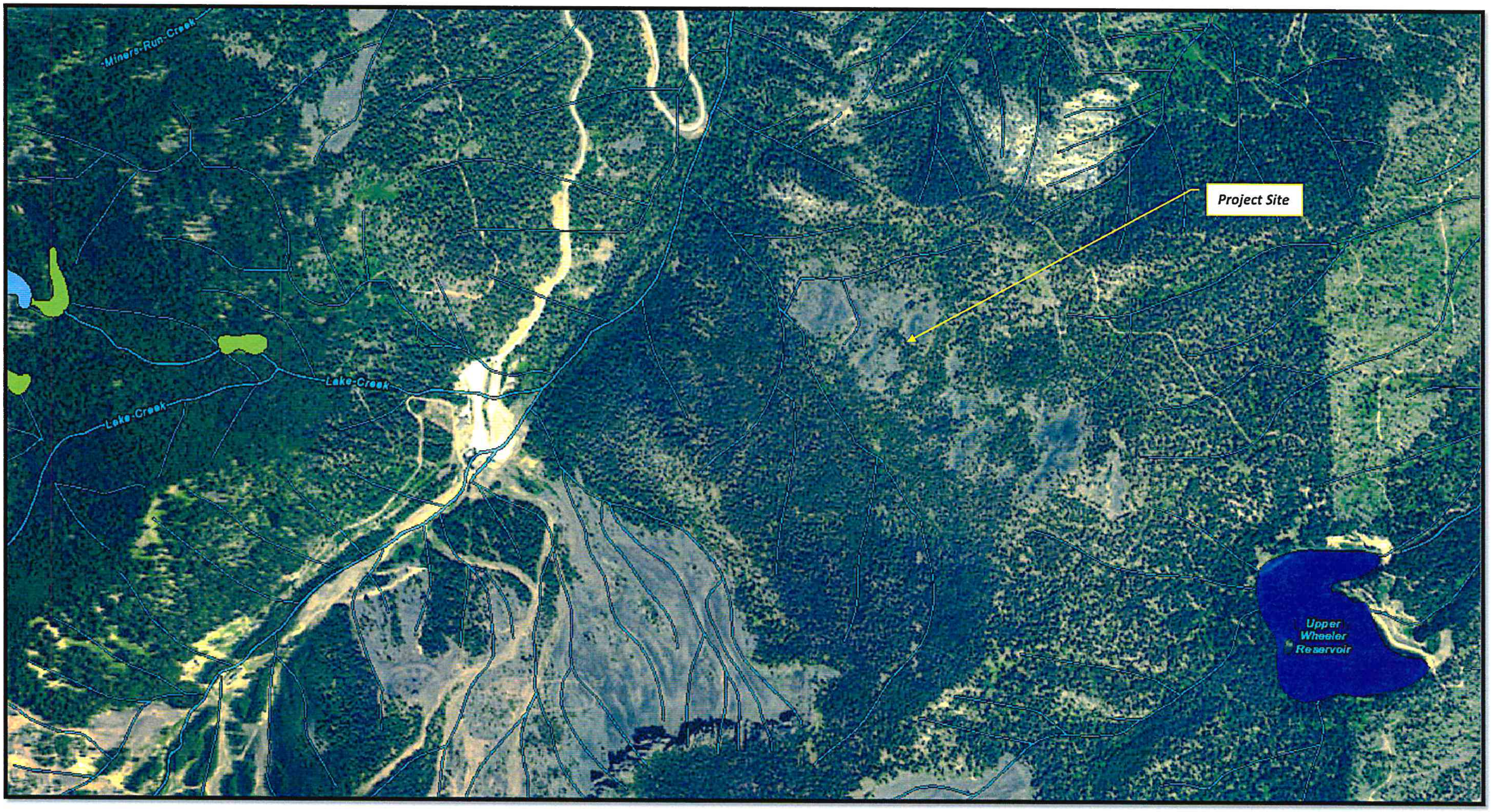
Village at Mission Ridge
Chelan County, Washington

Northern, Inc.



CHELAN COUNTY GIS – EROSION HAZARD OVERLAY MAP (FIGURE 5)

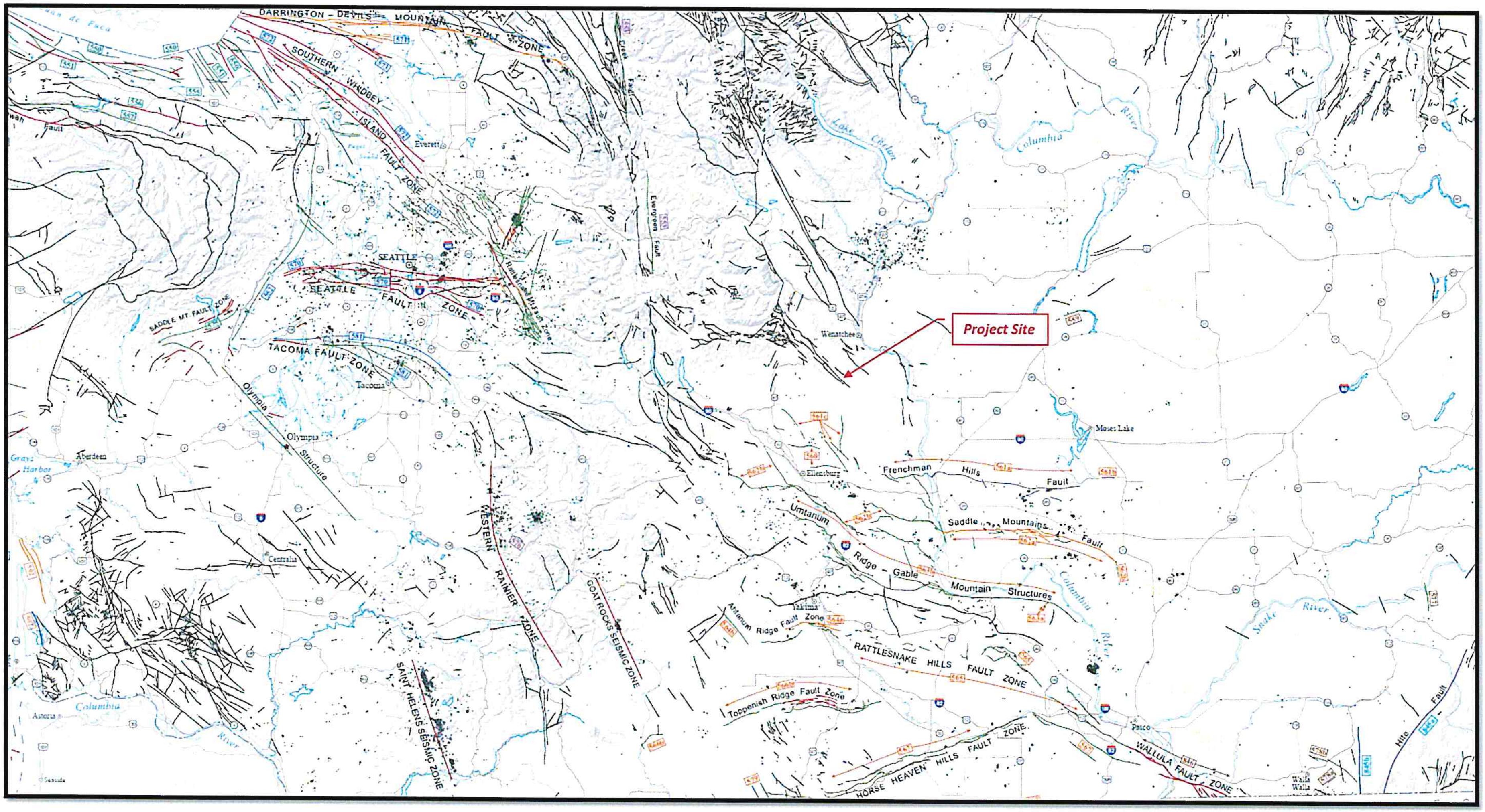
Village at Mission Ridge
Chelan County, Washington



U.S. FISH & WILDLIFE – NATIONAL WETLANDS INVENTORY MAP (FIGURE 6)

Village at Mission Ridge
Chelan County, Washington

Northern, Inc.



WASHINGTON DEPARTMENT OF NATURAL RESOURCES – FAULTS AND EARTHQUAKES MAP (FIGURE 7)

Village at Mission Ridge
Chelan County, Washington

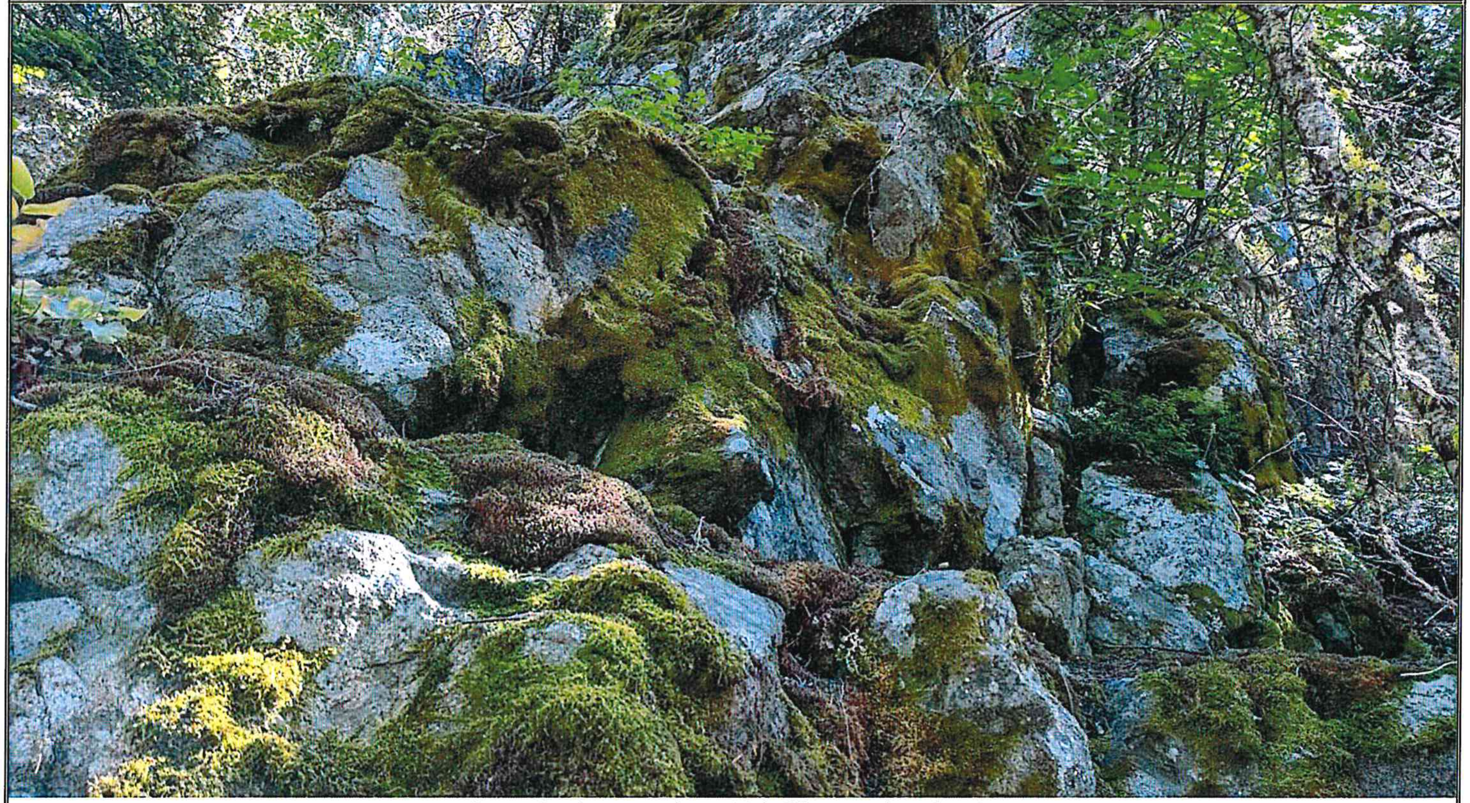
Overall panoramic view of the basalt cobble/boulder rubble talus from the southeast, looking northwest

Talus slope with basalt outcrop near crest of slope

View of basalt rubble (talus) at the site

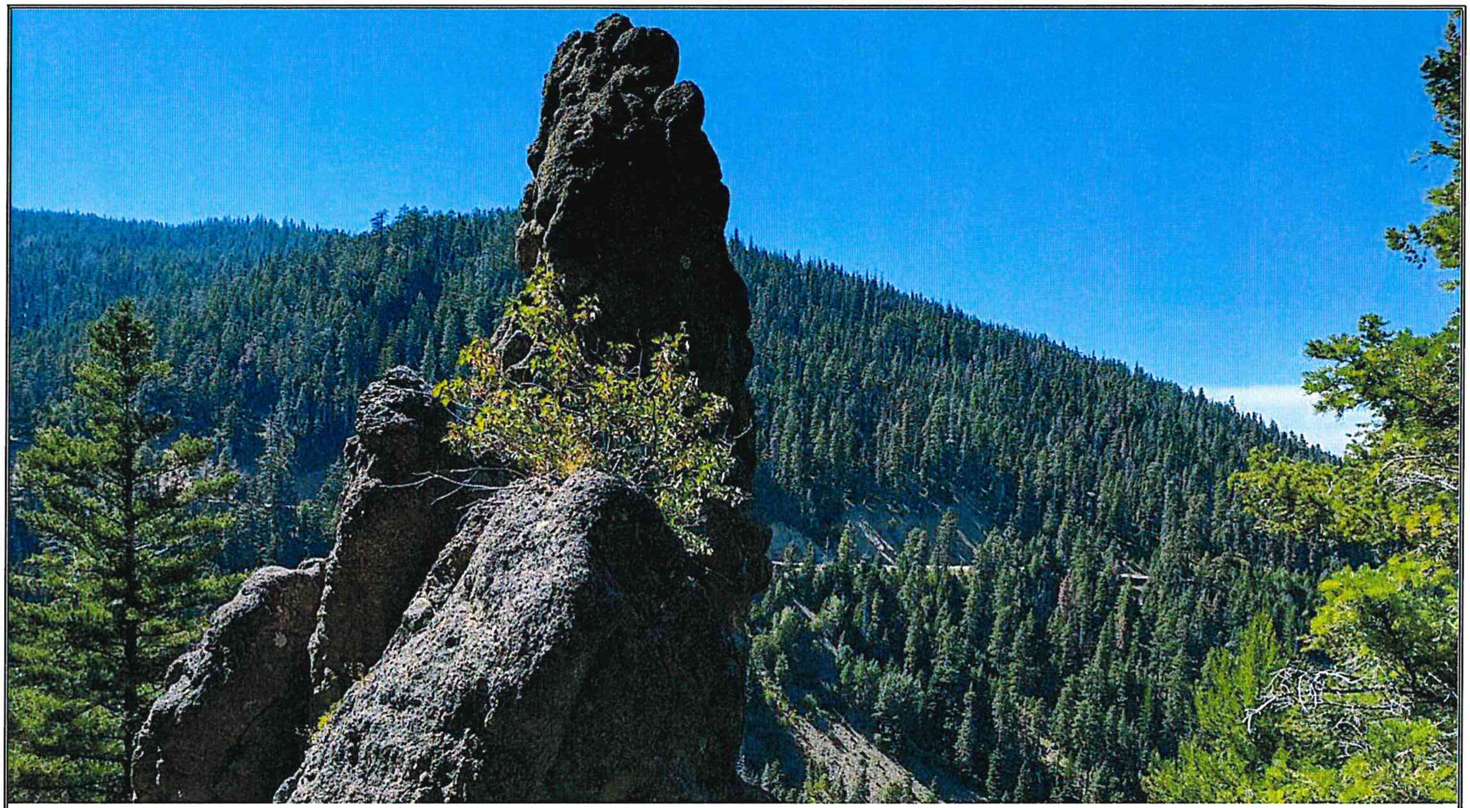
GN Northern, Inc.	**Site Photographs** The Village at Mission Ridge Chelan County, Washington			
Job Number: 217-854	Date 11/15/2017	Mounted By: MYM	Reviewed By: KAH	Plate 1

Sedimentary Chumstick Formation exposed along existing road cut at project site

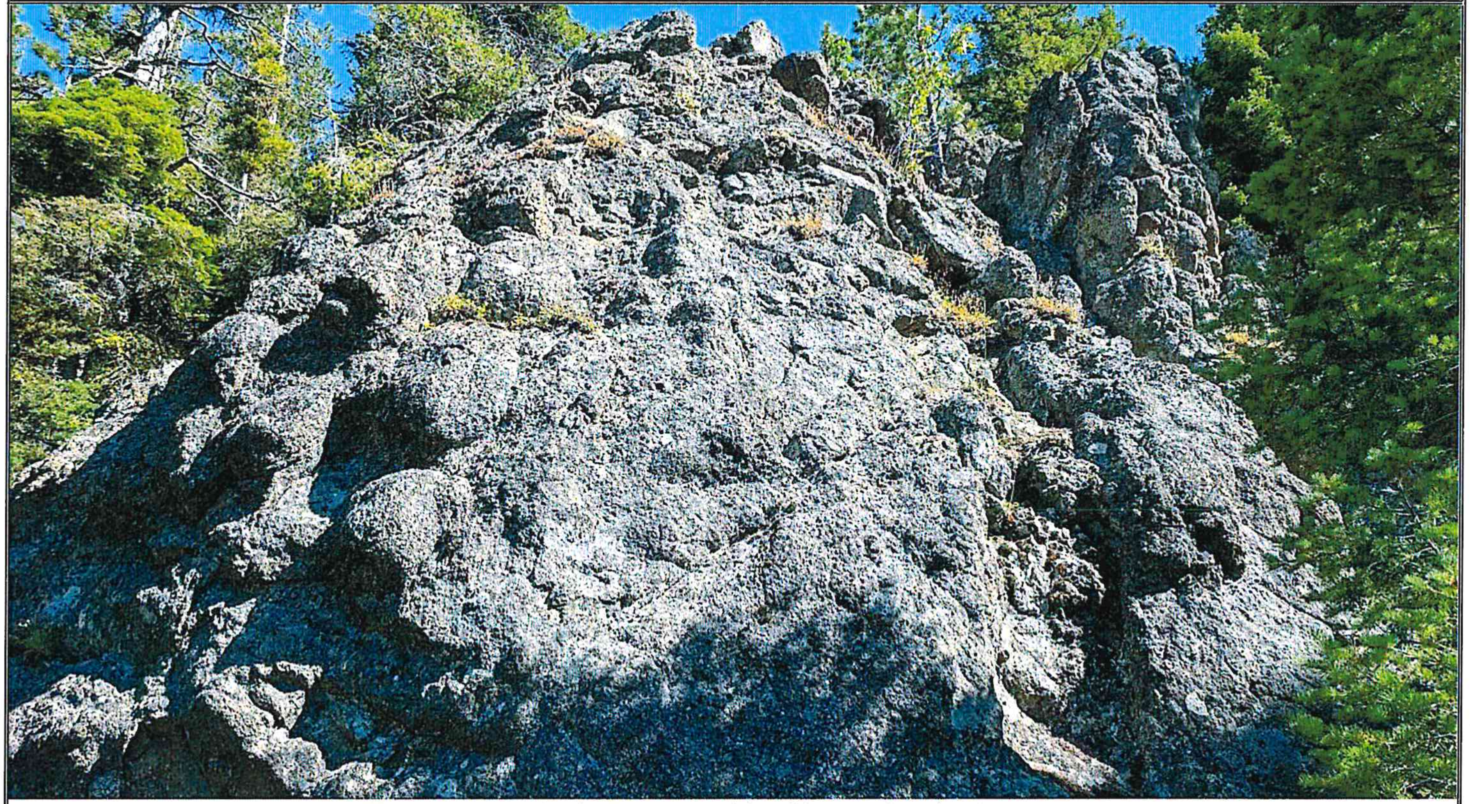


Intrusive igneous (granitic) dike noted at the site

Northern, Inc.	**Site Photographs** The Village at Mission Ridge Chelan County, Washington			
Job Number: 217-854	Date 11/15/2017	Mounted By: MYM	Reviewed By: KAH	Plate 2



Intrusive igneous (granitic) dike noted at the site



Intrusive igneous (granitic) dike noted at the site

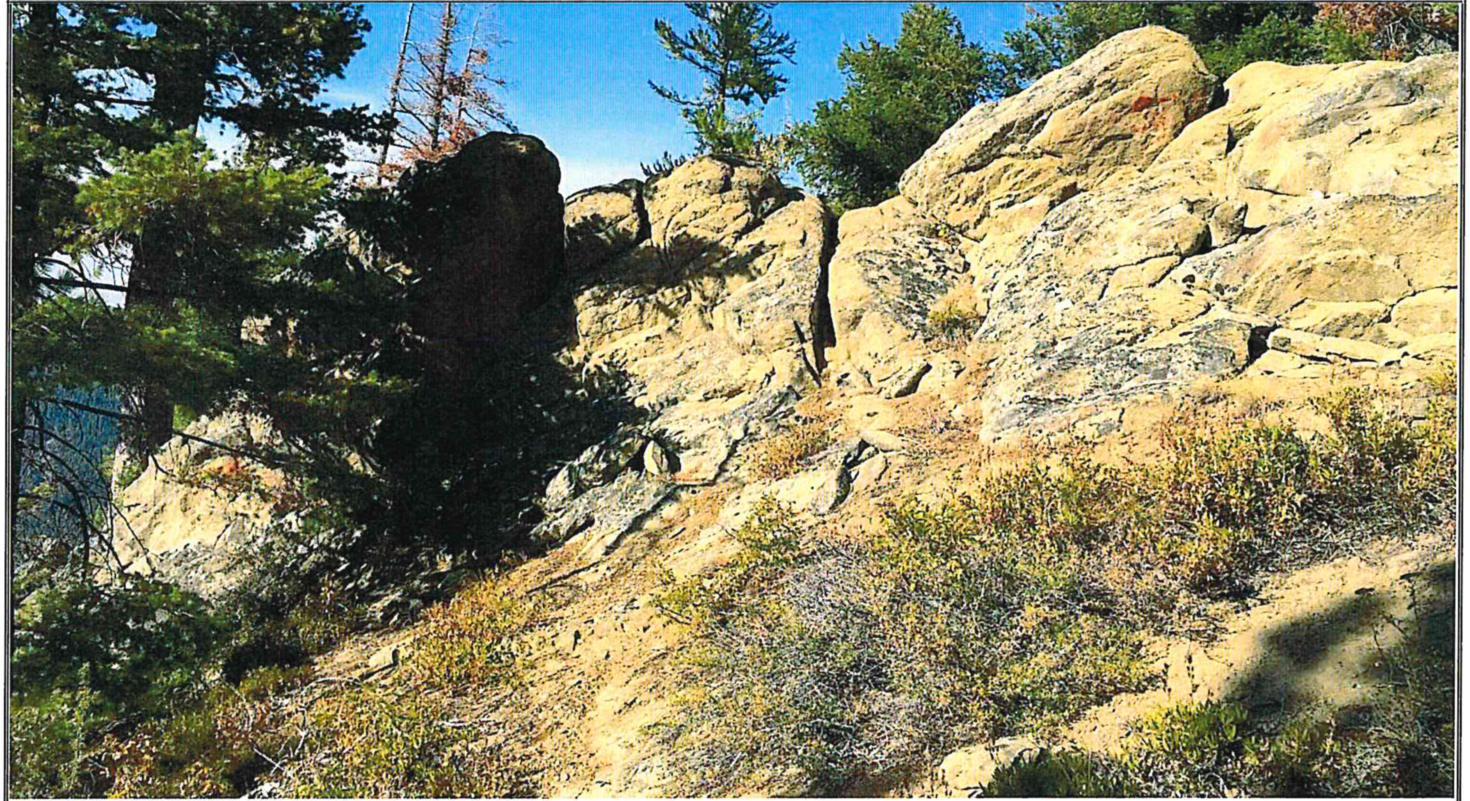
Northern, Inc. **Job Number: 217-854**	**Site Photographs** The Village at Mission Ridge Chelan County, Washington			
	Date 11/15/2017	Mounted By: MYM	Reviewed By: KAH	Plate 3

Sedimentary Chumstick Formation exposed along existing road cut at project site

View of basalt rubble (talus) at the site

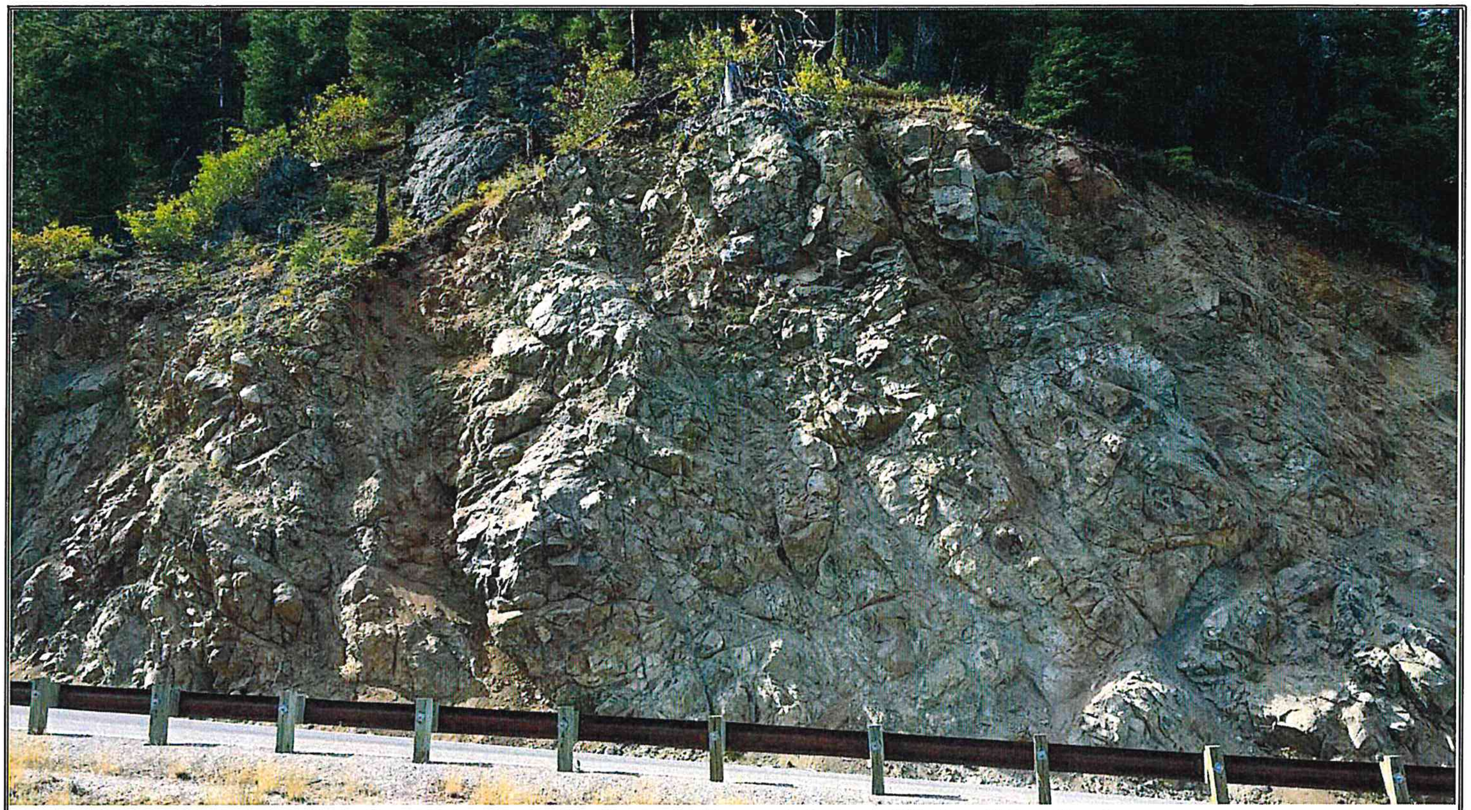
NG Northern, Inc.	**Site Photographs** The Village at Mission Ridge Chelan County, Washington			
Job Number: 217-854	Date 11/15/2017	Mounted By: MYM	Reviewed By: KAH	Plate 4

Talus slope with basalt outcrop near crest of slope



Outcrop of the local sedimentary Chumstick Formation noted near the northwestern portion of the site

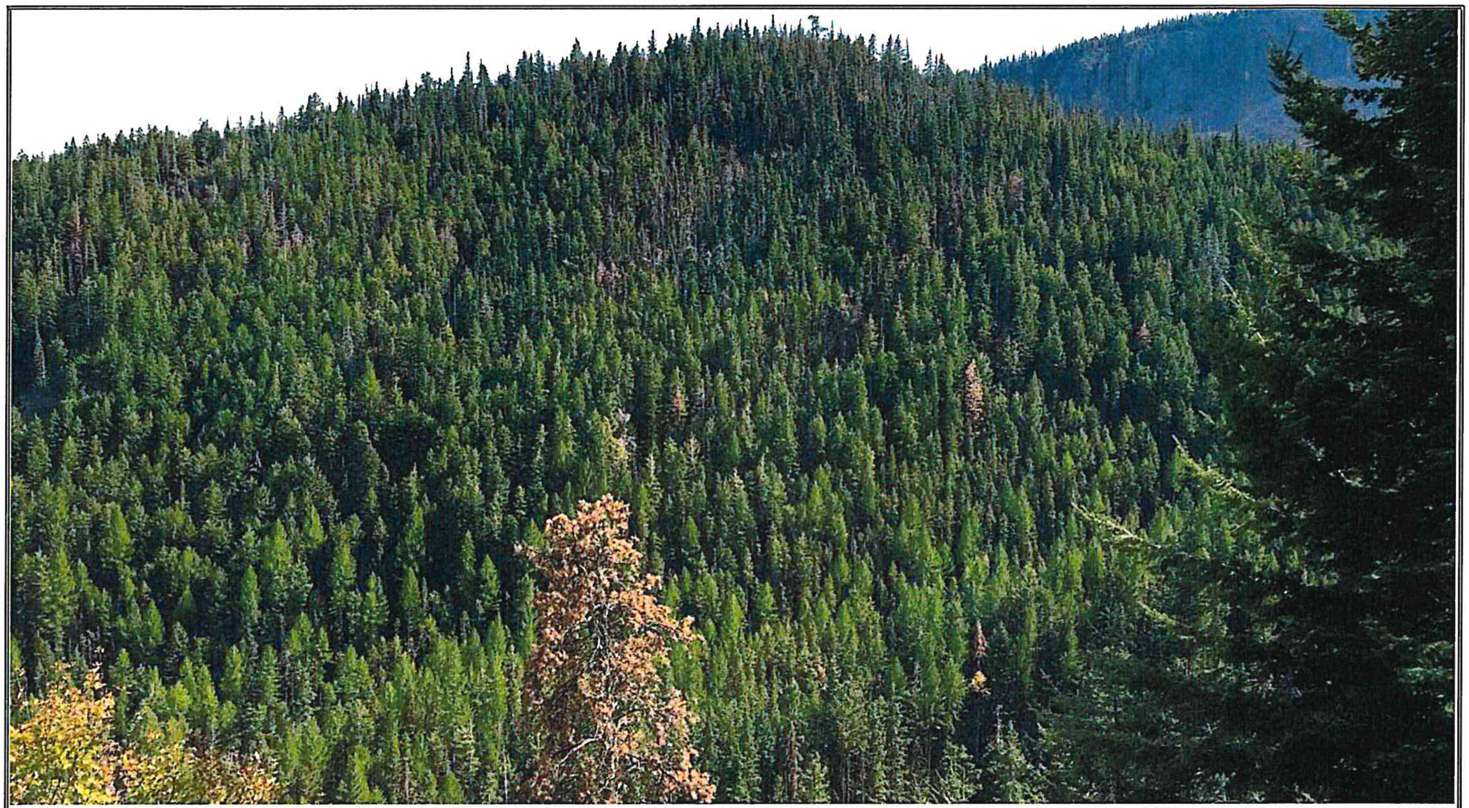
Northern, Inc.	**Site Photographs** The Village at Mission Ridge Chelan County, Washington			
Job Number: 217-854	Date 11/15/2017	Mounted By: MYM	Reviewed By: KAH	Plate 5



Correlating intrusive igneous dikes noted along Mission Ridge Road

Close-up view of the basalt cobble/boulder rubble (talus)

NG Northern, Inc.	**Site Photographs** The Village at Mission Ridge Chelan County, Washington			
Job Number: 217-854	Date 11/15/2017	Mounted By: MYM	Reviewed By: KAH	Plate 6



View of project site from Mission Ridge Road, looking southeast

View of typical sloping terrain with dense tree cover at the project site

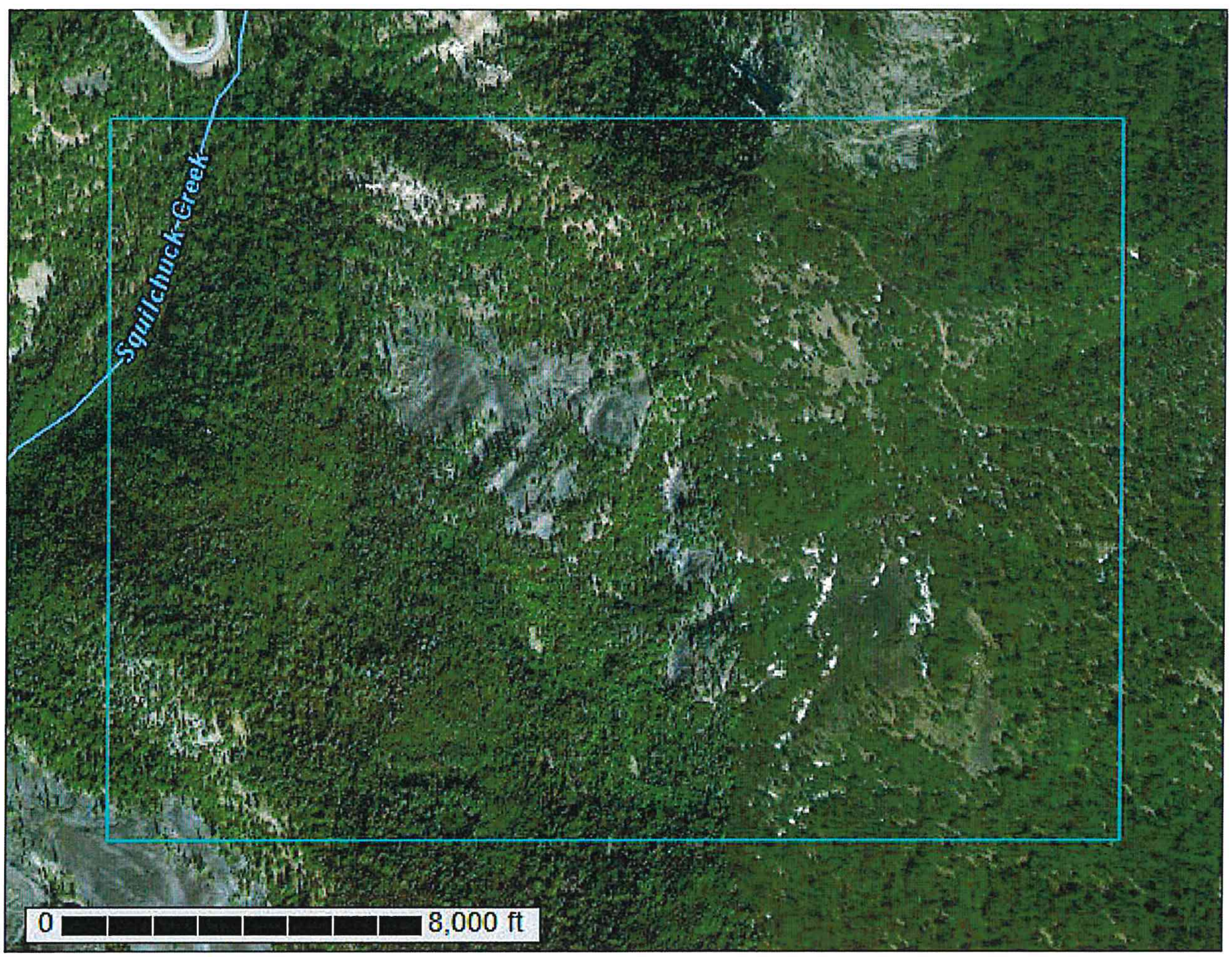
NG Northern, Inc.	**Site Photographs** The Village at Mission Ridge Chelan County, Washington			
Job Number: 217-854	Date 11/15/2017	Mounted By: MYM	Reviewed By: KAH	Plate 7

USDA United States Department of Agriculture

NRCS Natural Resources Conservation Service

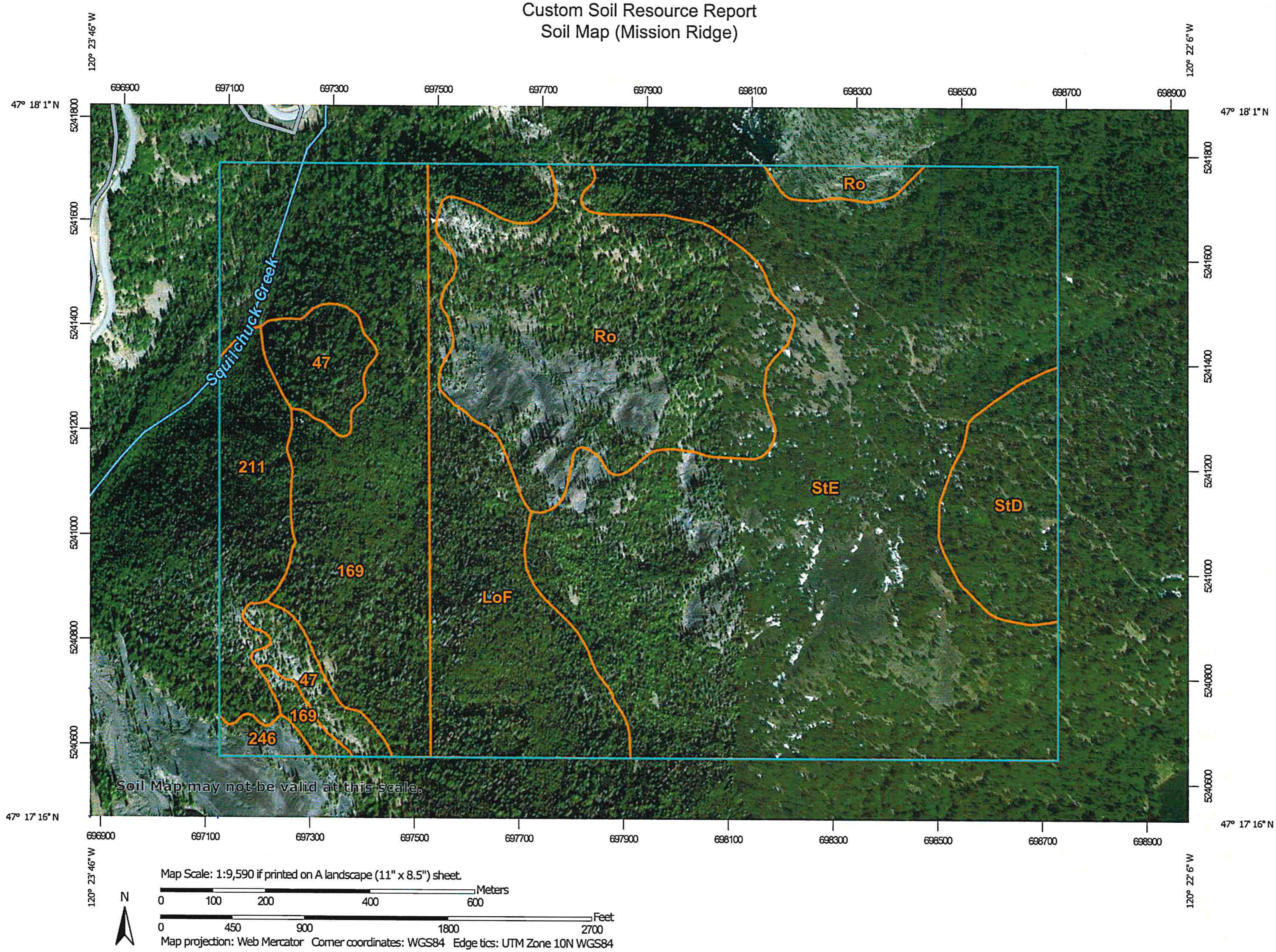
A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Cashmere Mountain Area, Washington, Parts of Chelan and Okanogan Counties; and Chelan County Area, Washington (Parts of Chelan and Kittitas Counties)



November 8, 2017

Soil Map (Mission Ridge)



Cashmere Mountain Area, Washington, Parts of Chelan and Okanogan Counties

47—Blewett-Rock outcrop complex, 30 to 60 percent slopes

Map Unit Setting

National map unit symbol: 28rq
Elevation: 3,600 to 5,800 feet
Mean annual precipitation: 22 to 40 inches
Mean annual air temperature: 42 to 44 degrees F
Frost-free period: 90 to 130 days
Farmland classification: Not prime farmland

Map Unit Composition

Blewett and similar soils: 65 percent
Rock outcrop: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blewett

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Parent material: Residuum and colluvium from sandstone mixed with volcanic ash and loess

Typical profile

H1 - 0 to 3 inches: very gravelly sandy loam
H2 - 3 to 10 inches: extremely gravelly sandy loam
H3 - 10 to 14 inches: unweathered bedrock

Properties and qualities

Slope: 30 to 60 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 0.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Other vegetative classification: grand fir/pinegrass (CWG124)
Hydric soil rating: No

Description of Rock Outcrop

Properties and qualities

Slope: 30 to 60 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

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

169—Loneridge very stony loam, 30 to 60 percent slopes

Map Unit Setting

National map unit symbol: 286p
Elevation: 3,000 to 4,900 feet
Mean annual precipitation: 20 to 30 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 75 to 100 days
Farmland classification: Not prime farmland

Map Unit Composition

Loneridge and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Loneridge

Setting

Landform: Mountain slopes
Parent material: Residuum and colluvium from basalt or andesite mixed with loess and volcanic ash

Typical profile

H1 - 0 to 8 inches: very stony ashy loam
H2 - 8 to 60 inches: very cobbly clay loam

Properties and qualities

Slope: 30 to 60 percent
Depth to restrictive feature: 4 to 15 inches to abrupt textural change
Natural drainage class: Well drained
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 storage in profile: Very low (about 1.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Other vegetative classification: grand fir/pinemat manzanita (CWS338)
Hydric soil rating: No

211—Naxing very stony loam, 30 to 60 percent slopes

Map Unit Setting

National map unit symbol: 28cy
Elevation: 4,600 to 6,800 feet
Mean annual precipitation: 22 to 30 inches
Mean annual air temperature: 40 to 42 degrees F
Frost-free period: 70 to 110 days
Farmland classification: Not prime farmland

Map Unit Composition

Naxing and similar soils: 75 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Naxing

Setting

Landform: Mountain slopes
Parent material: Colluvium and residuum from basalt mixed with a mantle of volcanic ash and loess

Typical profile

H1 - 0 to 10 inches: very stony ashy loam
H2 - 10 to 29 inches: very cobbly ashy loam
H3 - 29 to 60 inches: extremely cobbly loam

Properties and qualities

Slope: 30 to 60 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Other vegetative classification: subalpine fir/dwarf huckleberry (CES422)
Hydric soil rating: No

246—Rubble land-Rock outcrop complex

Map Unit Setting

National map unit symbol: 28gn
Elevation: 1,000 to 3,000 feet
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 45 to 54 degrees F
Frost-free period: 150 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Rubble land: 65 percent
Rock outcrop: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rubble Land

Typical profile

H1 - 0 to 60 inches: fragmental material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Description of Rock Outcrop

Properties and qualities

Slope: 0 to 99 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

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

Chelan County Area, Washington (Parts of Chelan and Kittitas Counties)

LoF—Loneridge very stony loam, 25 to 65 percent slopes

Map Unit Setting

National map unit symbol: 2gbc
Elevation: 2,400 to 5,400 feet
Mean annual precipitation: 20 to 40 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 75 to 105 days
Farmland classification: Not prime farmland

Map Unit Composition

Loneridge and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Loneridge

Setting

Landform: Mountain slopes
Parent material: Residuum and colluvium from basalt with loess and volcanic ash in the upper part

Typical profile

H1 - 0 to 10 inches: very stony ashy loam
H2 - 10 to 16 inches: extremely gravelly clay
H3 - 16 to 60 inches: extremely gravelly clay loam

Properties and qualities

Slope: 25 to 65 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Other vegetative classification: grand fir/pinemat manzanita (CWS338)
Hydric soil rating: No

Ro—Rock outcrop

Map Unit Composition

Rock outcrop: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rock Outcrop

Properties and qualities

Slope: 0 to 90 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

StD—Stemilt silt loam, 0 to 25 percent slopes

Map Unit Setting

National map unit symbol: 2gcg
Elevation: 2,000 to 4,900 feet
Mean annual precipitation: 16 to 22 inches
Mean annual air temperature: 45 to 46 degrees F
Frost-free period: 75 to 100 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Stemilt and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stemilt

Setting

Landform: Mountain slopes
Parent material: Residuum and colluvium from basalt or andesite with a component of volcanic ash

Typical profile

H1 - 0 to 5 inches: ashy silt loam
H2 - 5 to 17 inches: ashy silt loam
H3 - 17 to 60 inches: extremely cobbly silty clay loam

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
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 storage in profile: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C

Hydric soil rating: No

StE—Stemilt silt loam, 25 to 45 percent slopes

Map Unit Setting

National map unit symbol: 2gch
Elevation: 2,000 to 4,900 feet
Mean annual precipitation: 16 to 22 inches
Mean annual air temperature: 45 to 46 degrees F
Frost-free period: 75 to 100 days
Farmland classification: Not prime farmland

Map Unit Composition

Stemilt and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stemilt

Setting

Landform: Mountain slopes
Parent material: Residuum and colluvium from basalt or andesite with a component of volcanic ash

Typical profile

H1 - 0 to 5 inches: ashy silt loam
H2 - 5 to 17 inches: ashy silt loam
H3 - 17 to 60 inches: extremely cobbly silty clay loam

Properties and qualities

Slope: 25 to 45 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
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 storage in profile: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Hydric soil rating: No

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. WO 94314
UNIQUE WELL I.D. # AEH 922
Water Right Permit No.

(1) OWNER: Name Harbor Properties Address P.O. Box 1668 Wenatchee 98807-1668

(2) LOCATION OF WELL: County Chelan SE ¼ SW ¼ Sec 24 T 21 N., R 19E W.M.

(2a) STREET ADDDRESS OF WELL (or nearest address) 2500 mission Ridge. Road Wenachee 98807

(3) PROPOSED USE: [X] Domestic [ ] Irrigation [ ] DeWater [ ] Industrial [ ] Test Well [ ] Municipal [ ] Other

(4) TYPE OF WORK: Owner's number of well (if more than one)
[ ] Abandoned [X] New well [ ] Deepened [ ] Reconditioned
Method: [ ] Dug [ ] Cable [ ] Rotary [ ] Bored [ ] Driven [ ] Jetted

(5) DIMENSIONS: Diameter of well 8 inches.
Drilled 100 feet. Depth of completed well 82 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 8 " Diam. from 0 ft. to 82 ft.
[ ] Welded " Diam. from ft. to ft.
[ ] Liner installed
[ ] Threaded " Diam. from ft. to ft.

Perforations: Yes [ ] No [X]
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes [ ] No [X]
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes [ ] No [X] Size of gravel
Gravel placed from ft. to ft.

Surface seal: Yes [X] No [ ] To what depth? 20 ft.
Material used in seal Bentinite chips.
Did any strata contain unusable water? Yes [ ] No [X]
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 40 ft. below top of well Date 8-20-98
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes [ ] No [ ] If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test gal./min. with ft. drawdown after hrs.
Airtest 100 gal./min. with stem set at 60 ft. for 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes [ ] No [ ]

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Boulders & Silts.	0	32
Brown gravels & Clay.	32	35
Gravels, Sands, [redacted]	35	45
Grey Clay's	45	48
Basalts Fracture. with Gravel. Water.	48	95
Grey gravels, Clay.	95	100

DEPT. OF ECOLOGY Received FEB 22 1999 CENTRAL REGION OFFICE

Work started 8-18-98, 19. Completed 8-20-98, 19.

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Holt Drilling INC (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address 10621 Todd Rd E Puy 98372
(Signed) [signature] (WELL DRILLER) License No. 2359
Contractor's Registration No. HOLTDI*B60G Date 9-5-98, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329-