SEPTEMBER 2025	VOLUME III: Appendices A - F

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Mission Ridge Expansion Master Planned Resort

Cover Page Photo Credit: Allison Rossman; 2020 USFS Mission Ridge Expansion Draft Environmental Assessment

APPENDIX A

2020 U.S. Forest Service Mission Ridge Expansion Project: Draft Environmental Analysis

Mission Ridge Expansion Project: Draft Environmental Analysis

February 2020

Okanogan Wenatchee National Forest
215 Melody Lane
Wenatchee, WA 98801
Responsible Official: Forest Supervisor

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Chapter 1: Purpose and Need

Introduction

The Forest Service has prepared this Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This EA discloses the direct, indirect, and cumulative environmental impacts that would result from issuing an amendment to the existing Mission Ridge Ski Area special use permit on the Wenatchee River Ranger District (WRRD) of the Okanogan-Wenatchee National Forest (OWNF).

The EA is organized as follows:

- Chapter 1 – Purpose and Need: describes the purpose and need for the project, and how the purpose and need will be achieved. This Chapter also describes how the Forest Service informed the public of the proposal and how the public responded. It lists issues raised during scoping and how the Interdisciplinary Team (IDT) considered them in the analysis.
- Chapter 2 – Proposed Action and Alternatives: provides a more detailed description of the agency's proposed action, alternatives, and mitigation measures.
- Chapter 3 - Environmental Consequences: describes the existing conditions for each affected resource area, and effects from taking no action and from implementing the proposed action.
- Chapter 4 - Agencies and Persons Consulted: Lists members of the IDT and the agencies consulted during the development of this EA.
- Appendices: The appendices provide more detailed information to support the analyses presented in the EA and also includes Literature Cited and a Glossary.
- Throughout this document the term "skier" is used to represent both skiers and snowboarders. The terms "ski runs" and "ski trails" mean the same thing and are used interchangeably.

Project Area Location and Background

Mission Ridge Ski and Board Resort (Mission Ridge) is located on approximately 2,080 acres of land and is managed by: the US Forest Service (USFS)(960 acres), the Washington Department of Fish and Wildlife (WDFW)(1,040 acres), and the Washington State Department of Natural Resources (DNR)(80 acres). It is located approximately 12 miles southwest of Wenatchee, Washington in T21N, R19E, Sections 24, 25 and 26. The Expansion Project Area is located in T21N, R19E, Sections 24 and 25 and in T21N, R20E, Sections 19 and 30 (Figure 1-1, 1-1A). The majority of the project area falls within the Squilchuck Subwatershed, while a small portion falls within the Stemilt Subwatershed (Figure 3-1). Mission Ridge operates under a Special Use Permit (2008) with the USFS to operate a recreational ski area on the National Forest and a Land Use Agreement with WDFW to operate a winter recreational ski area on WDFW lands. A Cooperative Agreement established between WDFW and USFS (US Forest Service and WA Department of Game 1985), designates the USFS to administer the ski area on WDFW lands. Mission Ridge has applied to the Okanogan-Wenatchee National Forest to amend the Mission Ridge Special Use Permit by adding the NW ¼ Section 30 and proposing to expand ski area operations, by building a new access road and constructing new alpine ski lifts and ski runs on National Forest lands. A connected action, construction of ski lifts and runs on WDFW lands (Section 25) is also proposed and would require consultation with WDFW for approval. There are also connected actions proposed on private land in Sections 19 and 30 adjacent to the existing ski area, which include: further expanding ski area facilities, developing a new base area with additional day lodge, parking, and overnight accommodations, and building a multi-family residential community. These actions would require approval from Chelan County.

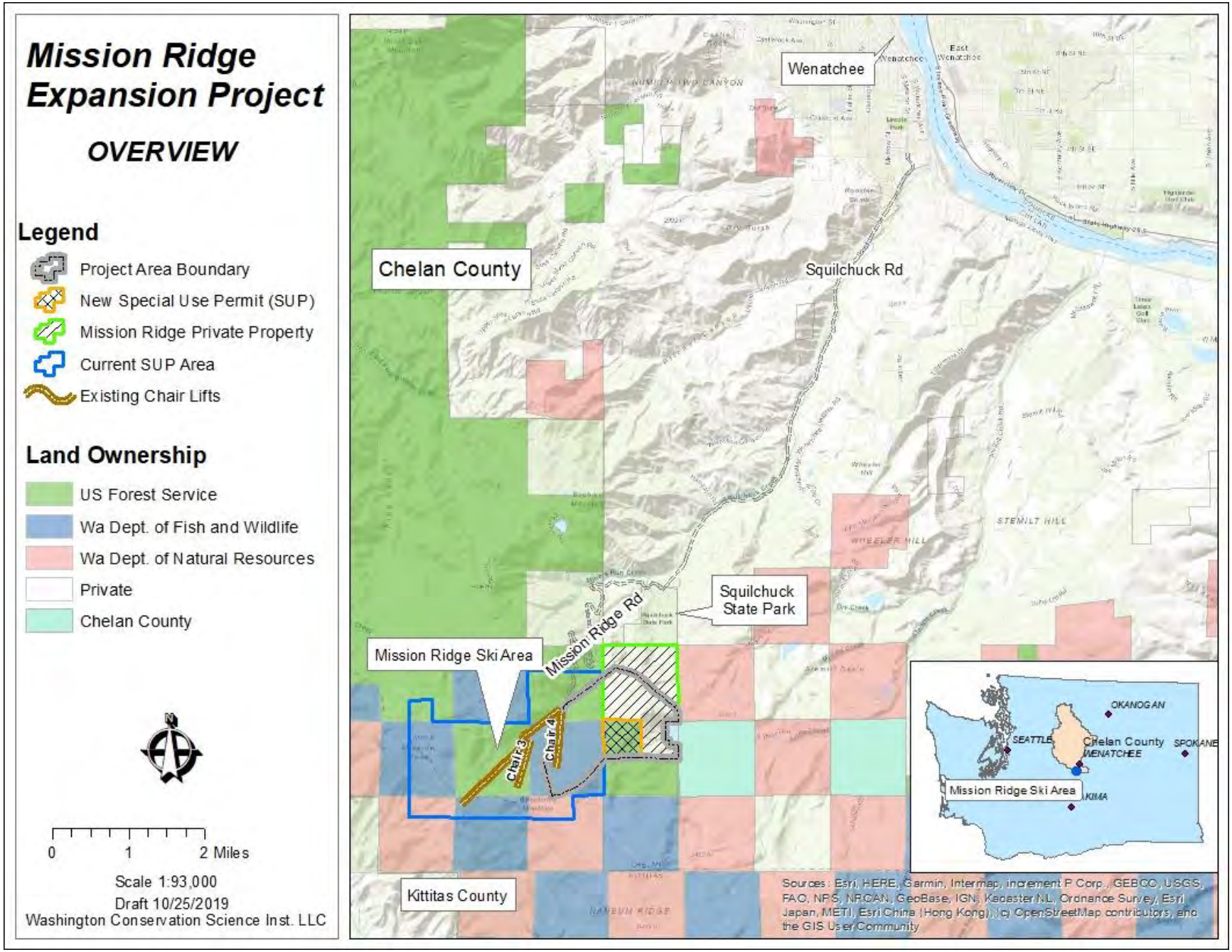


Figure 1-1. Location of Mission Ridge Expansion Project Area.

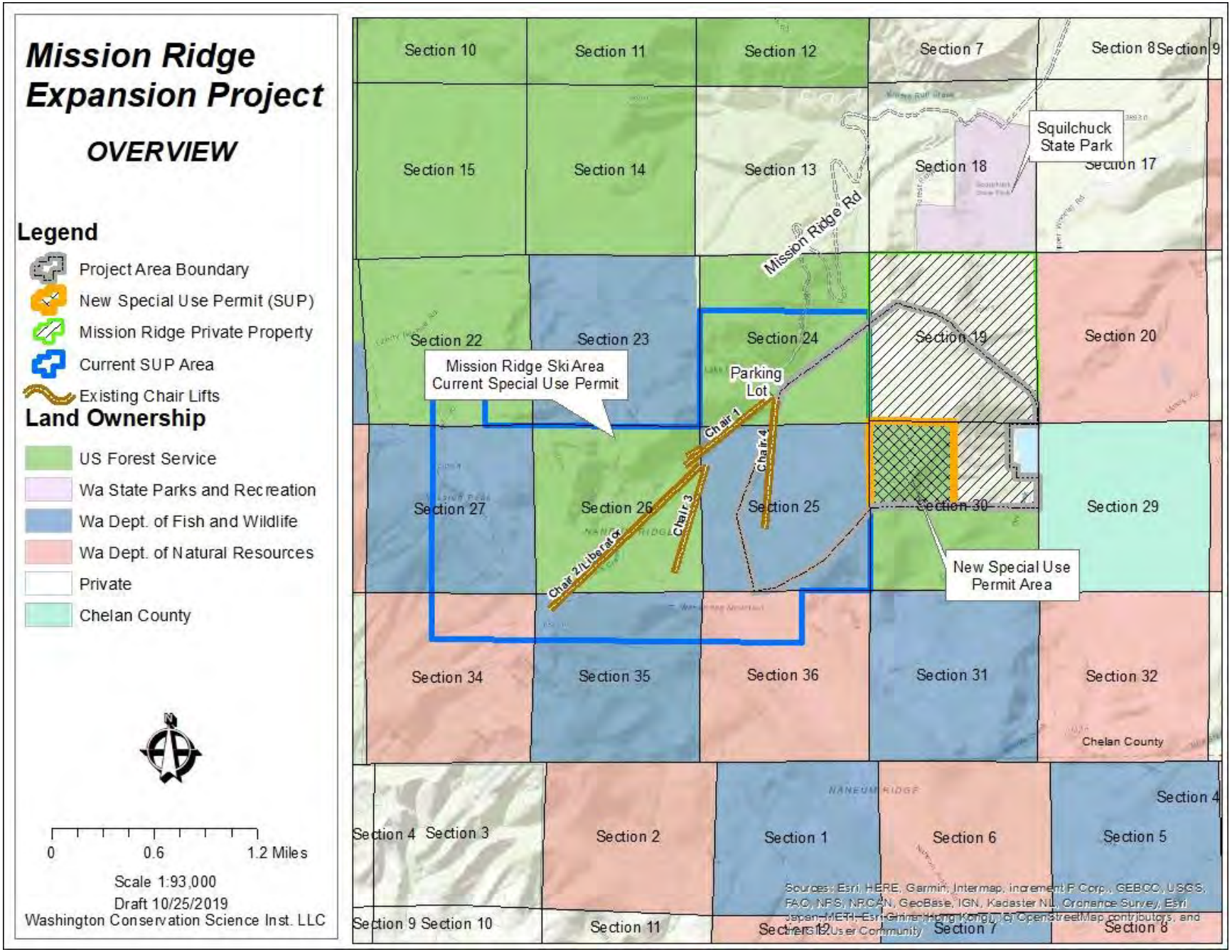


Figure 1-1A. Land ownership in the vicinity of the Mission Ridge Ski Area and Expansion Project Area.

Mission Ridge has provided outdoor recreational experiences since its inception in 1966, and interest in these recreational opportunities has grown over time. Currently, Mission Ridge is primarily a day and local use alpine ski area, but also serves regional skiers who rely on overnight accommodations in Wenatchee or surrounding communities for multi-day skiing experiences. The ski area is approximately 2,080 acres with 33 designated trails serviced by three fixed-grip double chairlifts, one detachable high-speed quad chairlift, and two rope tows (Figure 1-2). There are two day lodges: Hampton Lodge, located in the Base Area and Midway Lodge located at the bottom of Chairs 2 and 3. Other facilities include a Ski School and Skier Services Buildings, which provide first aid, day care, rest rooms, administrative offices, and maintenance facilities.

In 2014, New Mission, LLC, owner of Mission Ridge, purchased approximately 750 acres of private land adjacent to the current Mission Ridge Special Use Permit Area in Section 19 and NE ¼ Section 30. Access to this newly acquired land would allow Mission Ridge to provide new recreational opportunities and address elements that have inhibited growth of the ski area. Development on the new property could improve the following elements; parking, beginner terrain, overnight accommodations, day lodge space, alpine skiing terrain, Nordic skiing, winter snow play, access to backcountry ski-touring, and providing these recreational experiences close to local communities.

The Forest Service is interested in responding to public demand for developed winter sports recreation in the lower Wenatchee Valley. Use at Mission Ridge has grown steadily since opening in 1966; from 68,000 visits in 1966-67 to 114,000 visits in 2016-17. The projection for the 2019-2020 season is 127,000 visits, an increase of 11% (RRC Associates, 2018). In the Pacific Northwest, snow sports visits during 2015 -2018 were 20% higher than visits during 1995-1998 (US Ski Area Association, 2019). As demand for outdoor experiences increases, the Forest Service identified the need in the 1990 Wenatchee Forest Plan to respond to “opportunities to develop partnerships with the private sector to magnify abilities to meet expanding demand for outdoor recreation” and to provide “a well-balanced array of recreation opportunities in accordance with resource capability and public demands and expectations” (USFS 1990). Skier surveys conducted at Mission Ridge indicated that the highest priorities for improvement are: upgrading lifts with faster, higher capacity conveyances, expanding terrain served by lifts, and improving snow conditions by expanding snowmaking (USFS, 2003). Mission Ridge, a partner in providing recreational opportunities, has designed the Expansion Project to enhance and diversify the recreational and economic opportunities in Chelan County. It would provide a mixture of visitor-oriented accommodations, including a variety of residential, recreational and commercial facilities (Mission Ridge, 2018).

Maps and Acres Precision

All map boundaries and acreage figures are approximations based on best available information at the time. Actual implementation may differ slightly to better reflect on the ground conditions.

Analysis Process

Field review, professional expertise, public input, and several analysis methods were used by interdisciplinary team (IDT) members to assess current conditions, determine needed changes, and evaluate effects of proposed actions. The Wenatchee River District Ranger initiated the project in May 2017. IDT members compared the existing condition to desired conditions that are consistent with the amended Wenatchee National Forest Land and Resource Management Plan (Forest Plan) (USDA Forest Service, 1990) and other guidance and analyzed the impact of proposed actions on the range of resources within the context of consistency with Forest Plan Guidance and Federal rules and regulations. The IDT also considered changing climates by assessing potential impact of climate change on natural

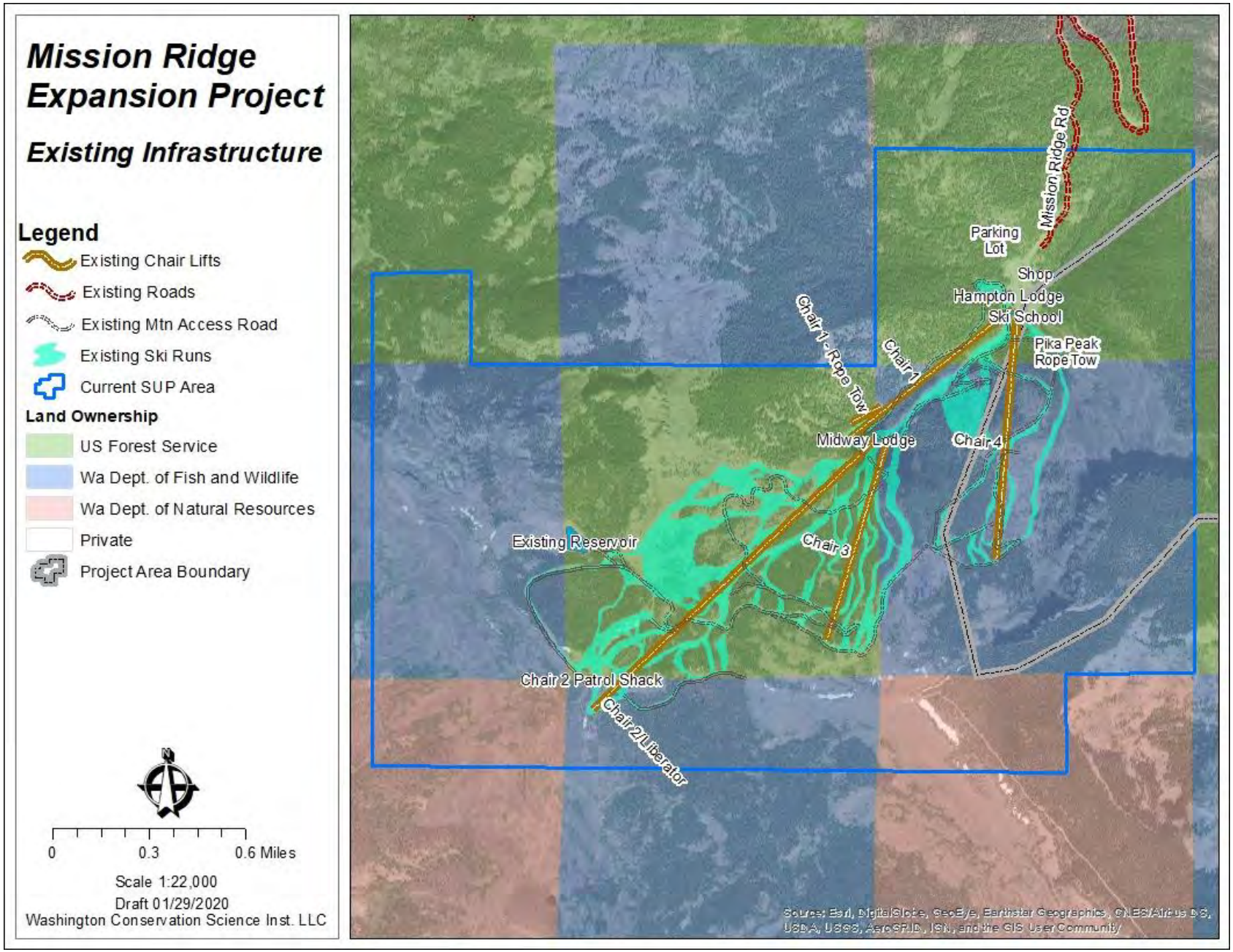


Figure 1-2. Existing infrastructure within Mission Ridge ski area.

processes, functions, and patterns across the landscape and how proposed actions might influence impacts.

Mission Ridge is working with Washington State Department of Ecology, WDFW, DNR, Chelan County and other relevant agencies to analyze and plan the development on and road access to private land in Sections 19 and 30. This will be documented in the State Environmental Protection Act (SEPA) analysis and the County application process. The analysis in this document will consider the environmental effects of the proposed project on lands administered by the USFS in Sections 24 and 30. It will consider the effects of proposed improvements on private land in Sections 19 and 30 and on WDFW land in Section 25 as connected actions. This analysis does not imply approval for actions on private or WDFW land.

Purpose and Need for Action

The Okanogan-Wenatchee National Forest is proposing to amend the existing special use permit held by Mission Ridge to expand ski area operations into adjacent National Forest land on the Wenatchee River Ranger District (Figure 1-1). The Expansion Project fulfills the Purpose and Need and is consistent with the 1990 Forest Plan as amended. The Project proposal includes responding to Mission Ridge's application and would:

1) Amend the Mission Ridge Special Use Permit by expanding the permit area.
2) Build a new access road across the National Forest to a second base area.
3) Construct new alpine ski lifts, ski runs, Nordic ski trails, and snowmaking on National Forest lands.
4) Coordinate with WDFW. Land within Section 25 is managed by WDFW but administered by USFS under the ski area operations special use permit and agreement.

The purpose for action is for the OWNF to respond to the application, and if the permit is amended, identify any mitigation measures needed to ensure consistency with Forest Plan standards and guidelines. The purpose of the Project is to expand Mission Ridge operations in order to meet the demand for local, economically sustainable, winter sport recreational opportunities. The Project Area falls within the RE-1 Forest Plan Management Allocation where the goal is to provide high quality developed recreation facilities and opportunities and is applicable to ski areas.

Existing Condition: The existing facilities at Mission Ridge have limitations that have impeded growth and have put economic sustainability of the ski area at risk. For example, existing on-site parking lots have proven to be insufficient for current peak days. Parking lots fill early in the day and overflow parking is accommodated at pullouts along the County Road, at Scout-a-Vista Boy Scout Camp, and at Squilchuck State Park. A shuttle van transports skiers from these satellite locations to the Base Area. Beginner skiers are currently limited to insufficient amounts of learning terrain with high skier volume. The Mimi run, the main beginner run, is also used by all other skiers, because it is the only route to ski from the upper mountain to the base area. Advanced skiers that move at higher speeds are mixed with beginning skiers that are moving slowly, creating safety concerns. Natural snow pack sometimes needs to be supplemented by snowmaking facilities, especially on the eastern portion of the ski area. The Day Lodges are crowded with limited seating during peak times and peak days. The Base Area is located in a narrow valley and there is no opportunity to develop Nordic ski trails or snow-play areas in the existing Base Area. Families or groups that include non-skiers or Nordic skiers do not have recreational options at Mission Ridge. Mission Ridge lacks onsite overnight accommodations, is unable to meet the needs for families looking for a full-service vacation experience, and as a result loses many sales opportunities. This lack of overnight accommodations at the ski area along with limited infrastructure to handle the current increased use, are the factors that affect ski area economic viability.

Desired Condition: Land and resource management on the OWNF envisions providing more outdoor recreational opportunities in close proximity to local communities, including more developed alpine skiing and other associated winter sport opportunities. The Wenatchee National Forest Management Plan (USFS 1990) has identified the need to provide "a well-balanced array of recreation opportunities in accordance with resource capability and public demands and expectations". Mission Ridge Ski Area is approximately 12 miles southwest of Wenatchee. The additional alpine and Nordic skiing proposed in the Mission Ridge Expansion would be 15 to 20 minutes from Wenatchee, the largest population center in North-Central Washington. The Squilchuck Watershed Assessment (USFS 1998a) identified the need to upgrade and expand the Mission Ridge Ski Area and facilities.

There is increasing interest and demand for developed alpine skiing and associated recreational opportunities on the Forest and near population centers. For example, from 2000-2009, recreation across the nation increased by 7% (Cordell 2012). In general, skiing is anticipated to be one of the top five activities to experience growth (Cordell 2012), while user-days at developed ski areas are estimated to increase by 40% from 2008-2030 (White et al. 2014). As described earlier, visits to Mission Ridge have doubled since opening in 1966. There is also interest in developed Nordic skiing opportunities in the lower Wenatchee Valley where that type of experience is lacking. At present, developed Nordic skiing can be found in the Upper Wenatchee Valley at Leavenworth, Steven's Pass, and Lake Wenatchee and at Echo Ridge near Chelan.

The Forest Plan anticipated growth in the alpine ski industry, and subsequently, an increase in winter sports and snow-related recreation on the forest, and specifically increased visitor use at developed alpine skiing sites. Expansion of developments like Mission Ridge was identified in the Forest Plan as a means to provide a diverse array of recreation opportunities and settings to the public. "Additional developed recreation sites will be added and existing sites expanded to meet growing needs of the public for outdoor recreation. Specifically, additional capacity may be provided by ski areas." (USFS, 1990).

The desired condition is based on management direction and guidance and public demands. The desired condition of the Ski Area would be an economically sustainable model that would provide improved, safe, high quality developed alpine skiing and other associated winter sport opportunities, services, and accommodations in close proximity to local communities. Roaded access to private sections 19 and 30 would allow Mission Ridge to grow in vital areas. On the private property, the desired condition would be to improve the economic viability of the ski area by adding and/or improving the following facilities; parking capacity, beginner terrain, overnight accommodations, Nordic skiing, snow play areas, access to backcountry ski-touring, and to provide those recreational experiences close to Wenatchee that the public desires (Mission Ridge, 2018). On the National Forest, the desired condition would be to provide additional lift capacity and alpine ski terrain, development of Nordic ski trails, access to new facilities on private land, and dependable snow coverage throughout the normal operating season.

Based on the existing versus the desired condition, the need for action includes the following, some of which would be addressed on the National Forest administered lands and some addressed on private land. There is a need to:

1. Address increasing public demand for a quality ski experience by providing:
    a. Additional beginner terrain because this type of terrain is lacking in the current ski area, resulting in limited opportunities and potential safety concerns due to bottlenecks on beginner ski runs. The beginner skiing and teaching terrain is limited and problematic. The rope tow and associated slope is very small and rope tows are difficult for beginners to master.

b. Additional and improved ski terrain and uphill transport facilities. New lifts and terrain would connect the new base area to the existing base area, providing additional ski opportunities.

c. Additional day lodge capacity. The day lodges are very crowded during peak times and peak days. There is often not seating available for skiers taking a break and the lines for food service are long.

d. Overnight on-site accommodations. There are no on-site, overnight accommodations available because the Base Area is located in a narrow valley on the National Forest.

e. Nordic ski terrain and snow play areas. Developed Nordic ski opportunities and snow play areas close to the greater Wenatchee community are lacking. The Base Area is located in a narrow valley and there are no opportunities to develop Nordic ski trails or snow-play areas at the existing Base Area.

2. Provide additional parking, because existing parking is inadequate to meet peak demand, requiring additional parking along Mission Ridge road and the use of a shuttle system. There are three parking lots for skiers, but these are not adequate and routinely fill on weekends and other peak days. Latecomers must wait for someone to leave or park in managed areas along the access road for pickup by a Mission Ridge Shuttle. On peak days, skiers must park as far down as the Squilchuck State Park and shuttle up to the Base Area.

3. Provide snowmaking facilities on new proposed ski terrain north and east of the existing ski area to ensure adequate snow coverage throughout the normal operating season. Ski terrain proposed for development lies north and east of the existing ski area and does not likely receive enough natural snow to ensure operations through the normal season.

4. Address Ski Area Viability: This issue relates to the continued presence of a ski area at Mission Ridge and the continued offering of developed winter recreation on the Okanogan and Wenatchee National Forests. Many of these issues were identified in the Mission Ridge Master Plan EA (USFS 2003).

    a. There is a need to improve the economic sustainability of the ski area because long-term sustainability is at risk. Many of the facilities date from the 1960's when the ski area was developed. The double chairlifts are 1960's vintage; the newest lift, the Chair 2 Quad, was constructed in 2005. The Hampton Lodge has been remodeled over the years, but the footprint remains the same from when it opened in 1966. Even in a good year for skier visits, Mission Ridge is not profitable. There are no funds available for capital facility improvement. Mission Ridge has not been able to substantially infiltrate the Puget Sound market because of tough competition from closer Washington ski areas and British Columbia ski-in/ski-out areas. Mission Ridge cannot continue to operate as a hometown day-use ski area with outdated facilities.

    b. The Mission Ridge Ski Area is operated by a private concessionaire under a Special Use Permit from the U.S. Forest Service. The Special Use Permit required development of the area as an alpine ski area. Private capital is used for development. An underlying assumption of this arrangement is that investors would receive a fair return on their investments. If this expectation is not achieved, there is a possibility the ski area would cease operations.

    c. Continuing changes in the recreation industry, an increasingly sophisticated user, improved ski equipment, and competition from other ski areas demand continual upgrades, diversification, and improvements. Areas that fail to upgrade and

remain competitive in the marketplace suffer declining visits and eventual loss of capital for maintaining a quality recreation experience. In the years preceding 1992, the Mission Ridge Ski Area experienced a number of years of declining revenue. That loss of revenue forced the sale of the ski area. In order to continue to operate as a successful enterprise and provide quality developed recreation opportunities to the public, the facilities need to be diversified and improved.

5. Provide road access across the National Forest to the proposed development site on the privately owned land. Expand the existing special use permit area allowing for the proposed developments (ski lifts and ski terrain) connecting the new base area and the existing ski area. The National Forest land adjacent to the existing permit provides topography suitable for alpine skiing and is adjacent to the existing ski area.

Regulatory Framework: Management Direction and Guidance (Relationship to other Planning Documents and Analyses)

Regulatory Framework

Under the National Forest Management Act (NFMA), all activities on National Forest System land must be consistent with approved Land and Resource Management Plans (Forest Plan). To eliminate repetition and focus on site-specific analyses, this EA tiers to the *Final Environmental Impact Statement (FEIS) for the Wenatchee National Forest Land and Resource Management Plan (USFS 1990, as amended 1994, 2001, and 2005).* It tiers to the respective FEISs for the following decisions that amended the Forest Plan:

- Record of Decision (ROD) for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl (USDA and USDI 1994). This decision established the Northwest Forest Plan, overlaying a new set of land allocations on the 1990 Forest Plan allocations, which apply to the National Forest in this Project Area.
- Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants Record of Decision (USFS 2005a). This decision set standards for preventing and managing invasive species, which informed mitigations for earth-disturbing activities for this project.
- Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (USDA and USDI 2001). This decision set standards and guidelines for managing certain plant and animal species, which apply to the National Forest in this Project Area.

Forest Plan Direction for the Mission Ridge Expansion Project

The Forest Plan established land management allocations for the Mission Ridge Expansion Project Area (Figure 1-3 and 1-4). Two sets of land management allocations overlay the project area, one from the Wenatchee National Forest Plan, and one from the Northwest Forest Plan. These are summarized below.

Wenatchee National Forest Land and Resource Management Plan (Figure 1-3)

Developed Recreation (RE-1)

This allocation is applicable to existing ski areas. The goal of this allocation is to provide high quality developed recreation facilities and opportunities, which should be managed to protect or enhance future values. New recreation sites should be constructed where demand is high and overuse problems are occurring at existing sites. Standards and Guidelines within RE-1 direct the Forest Service to:

1) Plan recreation activities and facilities to provide a diverse range of recreation opportunities,

2) Develop partnerships and encourage recreation development through permits, joint ventures, and cooperative agreements, and

3) Encourage development of recreation opportunities by private providers. Developed recreation would be provided in an Urban to Semi-primitive Recreation Opportunity Spectrum setting.

4) Potential sites allocated to this prescription will be managed to protect or enhance the future values and conditions desired.

The Visual Quality Objective (VQO) assigned to Developed Recreation (RE-1) is Retention. In areas designated to Retention VQO, all foreground landscapes shall have the visitor perception of natural appearing and will have "High" scenic integrity. High scenic integrity refers to landscapes where the valued Landscape Character "appears" intact. However, sites may be modified to accommodate recreational facilities and uses. A visual analysis is required to blend activities with the naturally established landscape.

Northwest Forest Plan (Figure 1-4)

Administratively Withdrawn (ADMWD)

Administratively Withdrawn Areas are identified in current forest and district plans or draft plan preferred alternatives and include: recreational and visual areas, back country, and areas not scheduled for timber harvest. ADMWD Areas have been designated for a wide range of objectives. The amended plans apply the most restrictive applicable standards and guidelines.

Riparian Reserves (RR) / Riparian-Aquatic Habitat Protection Zone (EW-2)

Riparian Reserves and Riparian Aquatic Protection Zones (EW-2) occur along streams, ponds, and other wet sites, and are designated to protect the aquatic system and its dependent species. Riparian-dependent resources receive primary emphasis here. EW-2 is a Wenatchee Forest Plan allocation that is not mapped, but determined on site specific conditions at the project level. Riparian Reserves overlay other management allocations and vary in width from 100 to 300 feet on each side of a stream, pond, or wet area depending on the feature's particular characteristics.

- *Fish-bearing streams* - the area on each side of the stream equal to the height of two site-potential trees, or 300 feet slope distance, whichever is greater;
- *Permanently flowing non-fish-bearing streams* - the area on each side of the stream equal to the height of one site-potential tree, or 150 feet slope distance, whichever is greater;
- *Lakes and natural ponds* - the body of water and the area to the outer edges of riparian vegetation, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance, whichever is greater;
- *Seasonally flowing or intermittent streams* - the area on each side of the stream to a distance equal to the height of one site-potential tree or 100 feet slope distance, whichever is greater;
- *Wetlands less than one acre* - to the outer edges of the riparian vegetation;
- *Unstable and potentially unstable areas* - the extent of unstable and potentially unstable areas.

There are no Inventoried Roadless Areas (IRAs), potential Wilderness Areas or classified Wilderness Areas within or adjacent to the Mission Ridge Expansion Project Area. The Mission Ridge Master Plan (USFS 2003) would be updated to include the proposed expansion.

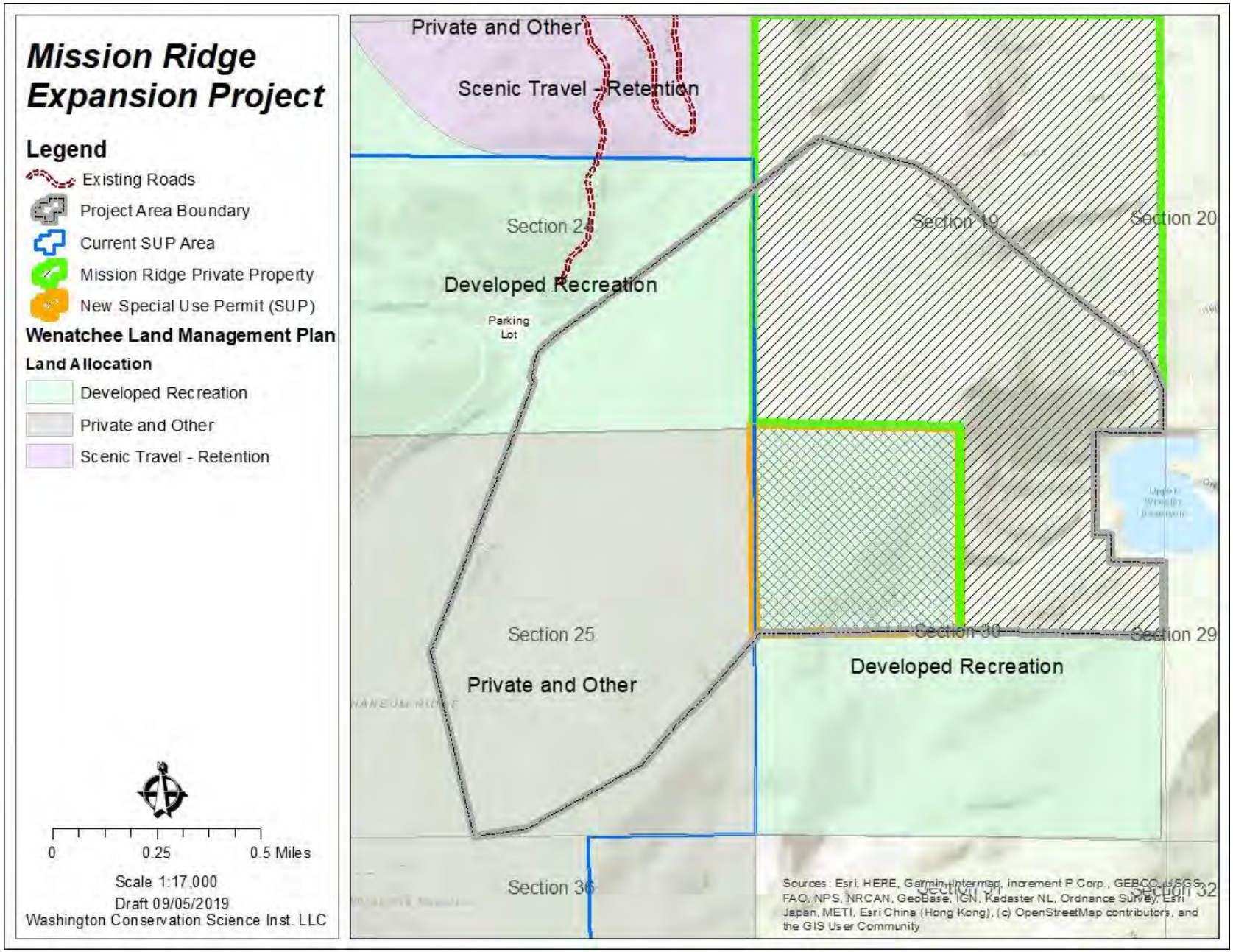


Figure 1-3. Wenatchee National Forest Land management allocations within the Mission Ridge Expansion Project Area.

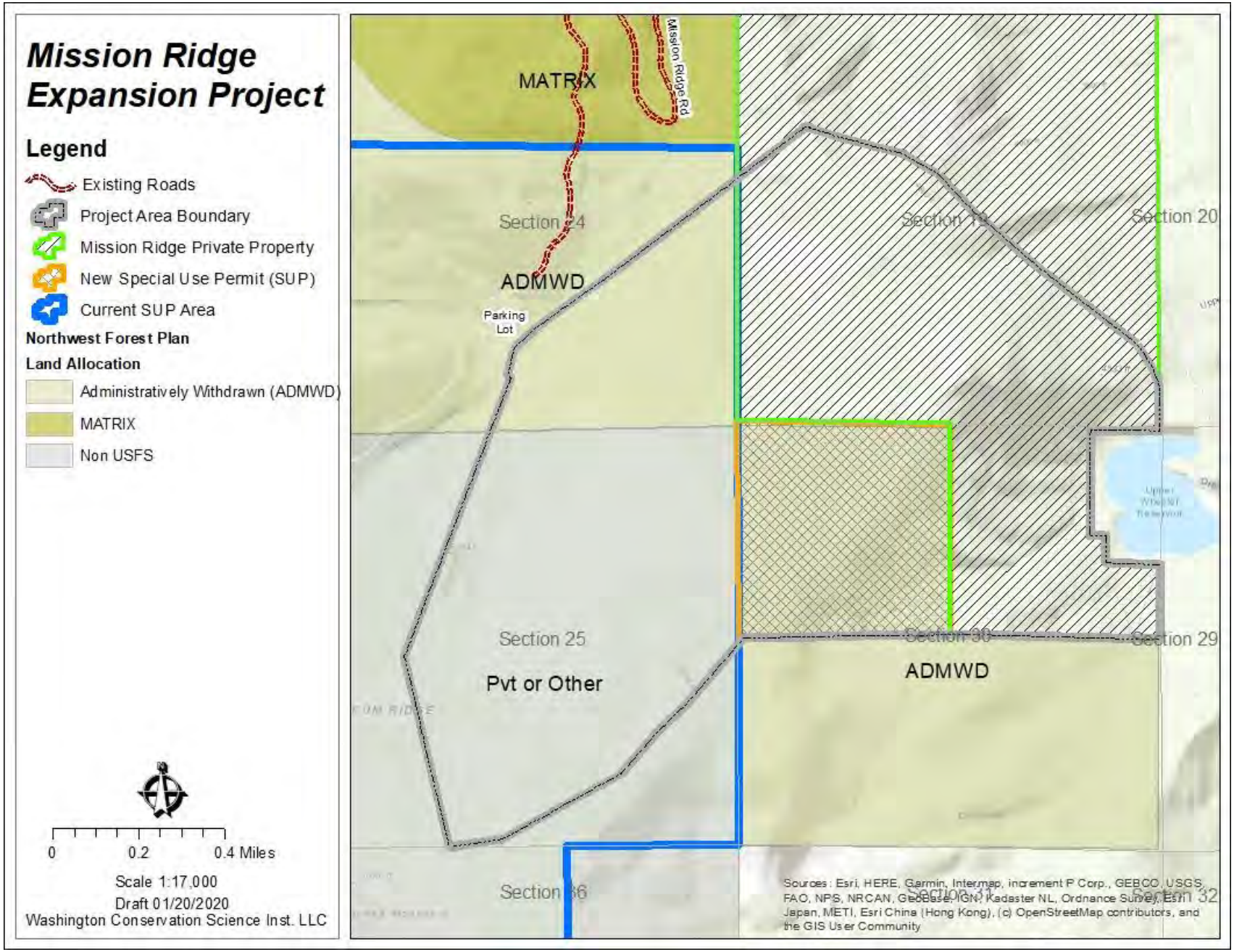


Figure 1-4. Northwest Forest Plan Land management allocations within the Mission Ridge Expansion Project Area.

Laws, Policies, and Guidance

Several additional laws, policies, agency manual and handbook direction, and assessments informed the EA for this Project Area and influenced project design. This analysis incorporates by reference the policies, recommendations, and analysis provided by these sources. Some of the key sources of policy, guidance and information include:

- Endangered Species Act, Clean Water Act, Clean Air Act, and National Forest Management Act
- Executive Orders 11990 and 11988 (protection of wetlands and floodplains)
- Section 106 of the National Historic Preservation Act (NHPA) of 1966 (amended in 1976, 1980, and 1992); 36CFR800 Protection of Historic Properties; 36CFR63 Determination of Eligibility to the National Register of historic places; 36CFR296 Protection of Archaeological Resources; Archaeological Resources Protection Act (ARPA) of 1979; Native American Graves Protection and Repatriation Act (NAGPRA) of 1990; Executive Order 13007 Indian Sacred Sites; American Indian Religious Freedom Act (AIRFA) of 1978; The 1997 Programmatic Agreement among the USDA Forest Service, Pacific Northwest Region (Region 6), Advisory Council on Historic Preservation (ACHP) and Washington State Historic Preservation Officer (SHPO) Regarding Cultural Resource Management on National Forests in the State of Washington.
    - Cultural Inventory Reports (Reiss-Landreau 2017) were completed for the Project Area
- Okanogan-Wenatchee National Forest Restoration Strategy (Restoration Strategy) (USFS 2012). This strategy uses adaptive ecosystem management to restore landscape resiliency and provides interim guidance for the management of large and old trees in dry and mesic forest restoration projects on the Okanogan-Wenatchee National Forest. Parts of the strategy were used to inform the vegetation management proposed for this project.
- Recreation Agenda (USFS, 1999). The primary goal of the Recreation Agenda is to provide quality recreation opportunities on National Forest system lands (such as skiing at Mission Ridge) in an ecologically sustainable manner. One of the purposes of this initiative is to promote local economic diversity by encouraging travel and tourism opportunities in collaboration with the private sector. Ski areas operated by the private sector provide a wide range of winter and summer outdoor recreation opportunities that can contribute to shaping local economies.
- Ski Area Recreational Opportunity Enhancement Act of 2011. This Act authorizes the issuance of ski area permits by the Forest Service for “the use and occupancy of suitable NFS lands for skiing and other snow sports and recreational uses”. The Act further states that a Special Use Permit “shall encompass such acreage as the Forest Service determines sufficient and appropriate to accommodate the permittee’s needs for ski operations and appropriate ancillary facilities.” This project proposed to increase the size of the Special Use Permit Area. The Forest Service is to provide recreational opportunities on National Forest System lands funded through private enterprise. Special Use Permits are to be administered for recreation uses that serve the public, promote public health and safety, and protect the environment (16 USC 497).
- Access for Skiers with Disabilities. Ski areas on National Forest System lands must comply with state, local, and federal regulations regarding accessibility for skiers with disabilities. The proposed action is designed to comply with all state, local, and federal requirements (Americans with Disabilities Act of 1990 and Section 504 of the Rehabilitation Act of 1973). Project facilities would be designed using recommendations from the Forest Service “Accessibility Guidebook for Ski Areas on Public Lands“ (USFS, 2016).

- Forest Service Policy (FSM2700 – Special Uses Management, Ch 2730 Road and Trail Rights-of-Way Grants, Amendment No.: 2700-2004-4, Effective Date: August 10, 2004) provides guidance relative to access to private property across National Forest land. The broad policy concerning the granting rights-of-ways for roads and trails across National Forest System lands is to provide access to requesters, consistent with Forest land and resource management plans and applicable laws and regulations. Access should be provided across National Forest land when the applicant:
    - Currently does not have access to the private property.
    - Cannot gain access across non-Federal land.
- Squilchuck Watershed Assessment (USFS, 1998a). This Assessment identified the need to upgrade and expand facilities and services at the Mission Ridge Ski Area to remain competitive and economically viable. Expansion should include additional lifts, additional slope clearing and grooming, lodge expansion, parking, and snowmaking.
- Mission Ridge Ski Area Master Plan Improvements Environmental Analysis and Decision Notice (USFS, 2003). This document was written to be a guide to development of winter recreational use and facilities within the existing permit area.
- Mission Ridge Ski and Board Resort Expansion. Mission Ridge has applied for a Master Planned Resort overlay and Development Agreement, SEPA checklist and supporting documentation with Chelan County (dated June 20, 2018 as amended) for development on private land.

This analysis incorporates by reference the Project Record (40 CFR 1502.21), which is available for review at the Wenatchee River Ranger District Office, 600 Sherbourne, Leavenworth, WA 98826.

Consultation and Public Involvement

Tribal Involvement

Tribal governments have a special and unique legal and political relationship with the United States government as reflected in the United States Constitution, treaties, statutes, court decisions, executive orders, and memoranda. This relationship imparts a duty on all federal agencies to consult, coordinate, and communicate with American Indian Tribes on a government–to-government basis. Because Indian Tribes can be affected by the policies and actions of the Forest Service in managing the lands and resources under its jurisdiction, the Forest Service has a duty to consult with them on matters affecting their interests. Because of this government to government relationship, efforts were made to involve local tribal governments and to solicit their input regarding the proposed action. A government-to-government consultation letter was mailed to the Business Council Chairman of the Confederated Tribes of the Colville Reservation, the Chairman of the Yakama Nation, and their staff on August 15, 2018. The Confederated Tribes of the Colville Reservation responded on October 26, 2018. Another notice was sent on January 17, 2020 to notify the CCT and Yakama Nation of the pending release of this Draft EA.

Chelan County

Since this Expansion Project involves proposals on federal, state, and private lands, project implementation would be dependent on the concurrent Washington State Environmental Protection Act (SEPA) process and Chelan County application process. A scoping letter was mailed to the Chelan County Commissioners on August 30, 2018.

Stemilt Squilchuck Recreation Plan

The Stemilt-Squilchuck Recreation Plan (Chelan County, 2019) is a planning effort that addresses the future of recreation in the upper Stemilt and Squilchuck Basins. This plan was written for and under the guidance of the Stemilt Partnership, in collaboration with WDFW and DNR. This plan takes a

comprehensive look at the existing and potential recreation opportunities in the planning area and seeks to balance these with wildlife habitat needs, agricultural infrastructure needs, and community protection elements. Recommendations in the plan are strictly voluntary and are not legally binding in any way to landowners and managers, but are meant to provide informed guidance on how lands in the Stemilt-Squilchuck basins can be managed to meet both recreational and conservation goals.

The plan identified desired conditions for the Expansion Project in Zone 2, which includes Squilchuck State Park, the Forest Ridge community, Mission Ridge Ski and Board Resort, Upper Wheeler Road and Upper Wheeler Reservoir. These desired conditions are:

- Recreation expansion on private land (Sections 19 and 30) leading to higher concentrations of use in those areas and on adjacent public lands with recreation being primarily non-motorized.
- Creation of designated trail linkages to adjacent trails and areas.
- Non-motorized recreation including: hiking, mountain biking, horseback riding, wildlife viewing, hunting, fishing, Nordic skiing, backcountry skiing and snowshoeing.

Recommended strategies for the Expansion Project in Zone 2 were identified as follows:

- Providing groomed Nordic trails in Sections 19 and 30.
- Improving the Clara Lake Trailhead at the Mission Ridge parking lot.
- Closing some trails seasonally to protect wildlife.
- Linking the Expansion Area with Squilchuck State Park and Scout-a-Vista Boy Scout Camp with non-motorized trails for summer and winter use.
- Designate non-motorized winter play areas in the Clara/Marion Lakes Area and south and west of Upper Wheeler Reservoir.

Public Involvement

A scoping letter and supplemental information were made available to adjacent landowners and interested members of the public on August 30, 2018, detailing proposed management activities within the existing Mission Ridge special use permit area and adjacent National Forest System lands in the Mission Ridge Expansion Project Area. This information was made available via email and hardcopy to the Wenatchee River Ranger District's (WRRD) mailing lists. The letter provided a brief background and information necessary to access supplemental details. The letter included a request for comments by September 28, 2018. An article by Tony Buhr appeared in the Wenatchee World Newspaper on August 30, 2018, providing a brief summary and directions on how to provide comments to the WRRD. All of the comments received during this comment period were considered and addressed by IDT members. Sixty-three responses were received. The main concerns expressed are summarized in Table 1-1. Responses are included in the project record. In addition, several pre-scoping meetings were held by Mission Ridge with adjacent landowners and recreational user groups over the two years prior to the development of the Proposed Action.

Consultation with Other Agencies

Consultation with US Fish and Wildlife Service was initiated on December 12, 2019, with an expected concurrence in spring of 2020. Consultation with the State Historic Preservation Officer (SHPO) was initiated in January 2020.

Issues

Issues are points of concern about environmental effects that may occur as a result of implementing the Proposed Action. The public generates some issues; others could be raised by the Interdisciplinary Team. Issues identified during scoping can either be addressed by developing alternatives to the Proposed Action or by adjusting the Proposed Action to resolve any conflicts (36 CFR 220.7(b)(2)(i)).

Some issues or concerns have been addressed as part of the project design, were outside the scope of the project, or are already decided by law or regulation. Disposition of all comments received during scoping is located in the Project File.

Based on comments received and internal review, the Interdisciplinary Team (IDT) identified preliminary issues for consideration in the Environmental Assessment (EA). Issues are of three types:

- Issues were used to develop or modify alternatives, design criteria, or mitigation measures to address the effects of proposed activities.
- Issues were analyzed in terms of environmental consequences but did not lead to a new, or modified alternative; or
- Issues were not analyzed in detail because generally they were addressed through project design; were outside the scope of the analysis; were already decided by law, regulation, the Forest Plan, policy, or program; or were mitigated by standard operating procedures for the proposed actions and activities.

Table 1-1. Mission Ridge Expansion Project Issues identified during public scoping and approach to address issue.

Issue	**Unit of Measure Used**	**Disposition of the Issue**
The number of residences built on private land may affect resources. Consider reducing the number of residences to be built on private property.	# Residences	Addressed the effects of residential development as a connected action (Chapter 3). However, this is outside the scope of the US Forest Service decision space as these actions occur on Private land.
In proposed expansion project area on all lands, construction of roads, structures and chairs could potentially affect scenic quality viewed from Mission Ridge Road, the existing ski area, city of Wenatchee and surrounding settlements for night lights, landscape character with the built environment and visual quality objective/scenic integrity resulting from construction.	Qualitative Analysis	Addressed how expansion project may affect visual quality objective/scenic resources in the effects analysis (Chapter 3).
Summer dispersed recreational use in the expansion area may affect resources.	Qualitative Analysis	Addressed how summer dispersed recreational use may affect other resources in the effects analysis (Chapter 3).
Extend length of Chair lift 6	Qualitative Analysis	This alternative was considered, but eliminated from detailed study (Chapter 2).
Increase existing parking and day lodge capacity	Parking spaces/Lodge sq. ft.	Increased parking and day lodge capacity are addressed in the Proposed Action (Chapter 2) and analyzed as a connected action on private land (Chapter 3).

Issue	Unit of Measure Used	Disposition of the Issue
Add accessible parking spaces to existing lot	# accessible parking spots	Accessible parking spots are provided in the existing parking lot and more are made available if needed (Chapter 3). Accessibility would be incorporated in the built facilities and infrastructure between common core areas and programs consistent with ABA (private facilities) and/or ADA (NFSL) as applicable.
The expansion area may affect backcountry access.	Qualitative Analysis	Backcountry access is addressed in project design (Chapter 2) and analyzed (Chapter 3). The current Outback route would be superseded by access from the Nordic or alpine trails system
Develop a comprehensive vegetation plan for entire ski area.	Vegetation Plan	A Vegetation Management Plan for the entire ski area is outside the scope of this project, because the Proposed Action only includes the Expansion Area. However the existing Mission Ridge Vegetation Management Program (Appendix C) is incorporated into the Proposed Action for the Expansion Area.
Overdevelopment of a residential community may present safety hazards concerning secondary access and wildfire risk.	Fire Protection Plan	Addressed in effects analysis (Chapter 3). A Fire Protection Plan is part of the Project Application to Chelan County.

Chapter 2: Alternative Description

Chapter 2 provides a description of alternatives considered, but eliminated, from detailed study and the alternatives analyzed in detail for the Mission Ridge Expansion Project. It also provides readers and the deciding official with a summarized comparison of effects of the alternatives.

Alternatives Considered but Eliminated from Detailed Study

An alternative was considered that would extend the length of Chairlift 6 by moving the top terminal further up the ridge to the South. This would gain more elevation and provide more lift-serviced terrain. However, the proposed Chairlift 5 (a foreseeable action) in the Mission Ridge Master Plan (USFS 2003) would access this same terrain. Additionally, a future Chairlift 5 would be able to access more of the terrain in this area than an extended Chair 6. It is also desirable to have Chairlifts 6 and 7 terminate in the same area instead of two separate areas to limit resource impacts and skier congestion to one area. In addition, the current proposed location for Chairlift 6 minimizes development on the WDFW Section 25, which is managed primarily for wildlife habitat. Therefore, this alternative was not analyzed further.

An alternative was considered that would not propose any new development on WDFW Section 25, which is managed primarily for wildlife habitat. However, the proposed Chair 6 location is essential to provide connectivity between the existing base area and the new terrain and Village. A Chair 6 top terminal location that would stay off Section 25 entirely would not provide the elevation and connectivity needed to ski from the Chair 6 top terminal to the top of Chair 8, the restaurant and to portions of the residential area, and would limit the new alpine terrain to largely beginner trails, which many skiers would not have an interest in skiing. Therefore, this alternative was not analyzed further.

An alternative was considered that would develop a smaller (not as many dwelling units) residential community on the private land. However, this is outside the decision space for this document because the Forest Service does not have jurisdiction on private land. By analyzing a higher density residential development, this document would be sufficient if the Chelan County process approves a lower level of development.

Alternative access routes to the Expansion Area were examined. The vehicular route alternatives evaluated three separate points of access; a road emanating from the existing Mission Ridge parking lot (Proposed Action), a road from the switchback near mile marker 10 on Mission Ridge Road (referred to as “Station 90”), and alignments originating from the Stemilt Basin or the east side of Section 19.

The access alternatives from the Stemilt Basin were not analyzed further for the following reasons:

- The routes would not provide the necessary link for vehicular access between the existing Mission Ridge Ski Area and the Expansion Area in Section 19.
- The routes would have a high resource impact from 5 miles of road construction.
- The routes would have a high cost due to the nearly 5 miles of new roadway construction needed.
- Washington Department of Fish and Wildlife management of Section 20 for wildlife habitat would likely conflict with a public paved roadway.
- The routes would create an entirely new impact zone for vehicular traffic approaching and leaving the resort complex.
- There would be a high maintenance cost.

The access from Station 90 was not analyzed further for the following reasons:

- The route does not provide the necessary link between the existing Mission Ridge Ski Area and the Expansion Area in Section 19.
- A new crossing of Squilchuck Creek would be required, significantly impacting aquatic resources.

- The route would not avoid impacts on National Forest land and would be longer than the Proposed Action.
- The route is steeper and would traverse more challenging terrain than the Proposed Action. Preliminary engineering showed the route to be feasible but no less impactful.
- The existing road beds in this area would be difficult to utilize given current Chelan County road standards.

Aerial tram and people mover alternatives were also considered as an alternative way to access the Expansion Area. These options were not analyzed further due to constraints such as:

- Extremely high cost of construction.
- Problems with locating suitable parking areas
- Difficulty in the ability to move people and goods to the Expansion Resort Area.
- Lack of ski opportunities associated with such a mode of access.
- High cost of operation/maintenance.

Alternatives Developed

Alternative 1, No Action – Current Management Practices

Under Alternative 1, the existing Special Use Permit would not be amended and the permit area would not be expanded. No additional infrastructure within the existing special use permit area would be constructed as part of this project. An access road to Section 19 would not be constructed; consequently, development of the private land in Section 19 and 30 would not occur. No new project-related ski facilities or ground disturbing activities would take place. The existing ski area would continue to operate on the National Forest and WDFW lands under the current Special Use Permit, which includes operation of four chairlifts, two rope tows, 33 ski trails, two day-lodges and other skier support facilities.

Alternative 2, Proposed Action

The Forest Service Proposed Action is to issue an amendment to the Mission Ridge Special Use Permit adding reasonable mitigations where needed to ensure consistency with federal laws, direction, and policy. The amendment would allow the applicant, Mission Ridge, to meet the Purpose and Need by: 1) Constructing new ski-related facilities and expanding operations within the existing special use permit area on National Forest land in Section 24, 2) Constructing road access across National Forest Section 24 to the private land in Section 19 and 30, 3) Expanding the Special Use Permit Area and constructing new ski-related facilities and ski area operations into the NW quarter of National Forest Section 30. Proposed connected actions to expand ski area operations on WDFW land in Section 25, which is administered by the USFS, and on private land in Sections 19 and 30, would require separate approval from WDFW and Chelan County. These proposed actions may be modified or changed subject to these approval processes. The actions proposed in WDFW Section 25 and private land Sections 19 and 30 are included here for context and so that effects of the entire Expansion Project can be addressed.

Identification of Project Area and Analysis Area

The Project Area includes National Forest land within Section 24 (T21NR19E) and Section 30 (T21NR20E), Washington Department of Fish and Wildlife land, which is administered by the U.S. Forest Service within Section 25 (T21NR19E), and private land within Sections 19 and 30 (T21NR20E) (Figure 1-3, Table 2-1). The Project Area encompasses approximately 1,090 acres. Depending on the resource, the Analysis Area may extend beyond the Project Area in order to assess direct, indirect and cumulative effects. This analysis will assess the effects of the entire expansion proposal, including those actions on WDFW and private land as connected actions.

Table 2-1. Project Area Land Ownership

Owner/Manager	Acres
US Forest Service	293
Washington Department of Fish and Wildlife	363
Private	434
Total	1,090

Proposed Project Details for National Forest and WDFW land

The proposal on the National Forest and WDFW land consists of the following three primary components (Figure 2-1):

1) Road Access: Construction of an access road, which would cross National Forest Section 24, connecting the existing Mission Ridge parking lot with the new Village Base Area, ski facilities, and community development on private land in Section 19.

2) Special Use Permit Area Expansion: The existing Special Use Permit Area on National Forest land would be expanded to include the NW ¼ of Section 30 to allow for development of ski facilities on approximately 160 acres of National Forest.

3) Infrastructure Development on National Forest and WDFW land under the Special Use Permit Administered by the USFS: This would include construction of two new chairlifts and associated alpine ski runs and outbuildings in Sections 24, 25 and 30 and Nordic ski trails in Section 30. The current snowmaking and night lighting systems would be expanded to serve the new alpine terrain.

The project is described in greater detail in the following sections. Best management practices (BMPs), additional design criteria and mitigation measures that would be incorporated into implementation are included in Appendix B.

Road Access

A new access road to the new Day Use parking lot would be routed through the existing Mission Ridge base area parking lot and would extend approximately 0.7 miles on National Forest land to the private property line in Section 19 (Figure 2-2). The access road would extend another 0.2 miles on private land in Section 19 to the day use parking lot. In order to construct the road, Chelan County would obtain an easement across Section 24 on National Forest land and Mission Ridge would apply for a construction permit. The road would be designed to Chelan County standards and would meet USFS Standards for a Maintenance Level 5 road (USFS 2005). This rural road design is based on the Chelan County Standard Plan PW-7 for a Rural Collector (Chelan County Code Chapter 15.30 - Development Standards), the Washington State Department of Transportation (WSDOT) Standard Plans and Specifications for Road and Bridge Construction, and the Washington State Department of Ecology (Ecology) Stormwater Management Manual for Eastern Washington. The OWNF would have final design and construction approval. The access road would be designed to minimize environmental impacts while providing for safety. The newly constructed road would be asphalt surfaced and suitable for passenger vehicles. Maintenance of the new access road would be the responsibility of Chelan County. The road would be open year-round.

The road would consist of: two lanes, each 12 feet wide, shoulders with ditches, about four feet wide, associated cut and fill slopes, and turn-outs. Guardrails would be installed where needed for safety, and would be non-reflective and earth toned in color. The right-of-way would be of variable width to accommodate variations in topography. To minimize disturbance and construction costs, the fill slopes would predominantly consist of retaining walls that would range in height from about 8 to 20 feet.

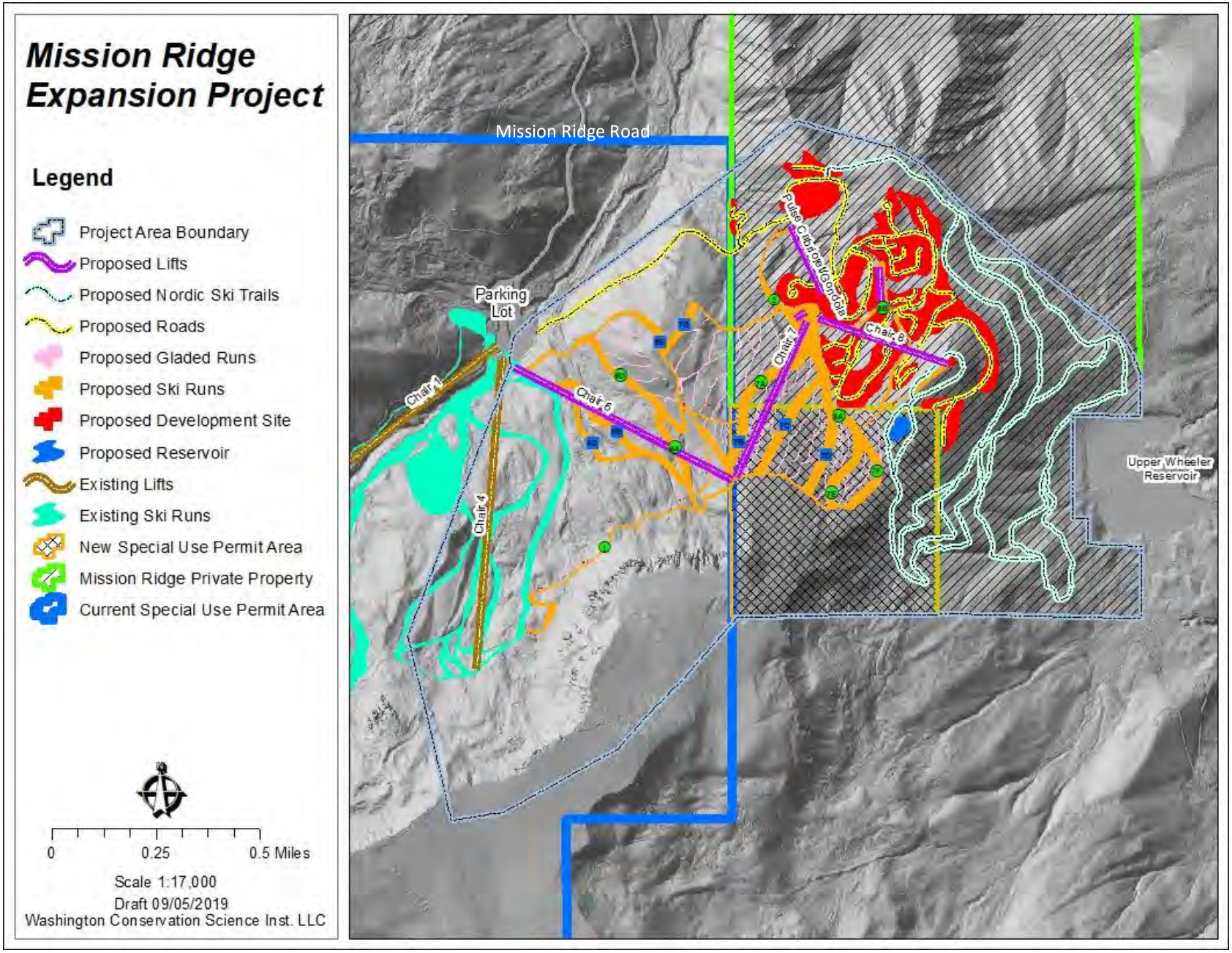


Figure 2-1. Overview of Mission Ridge Expansion Project Area and proposed development. Locations are approximate. Green circles denote beginner runs. Blue rectangles denote intermediate runs.

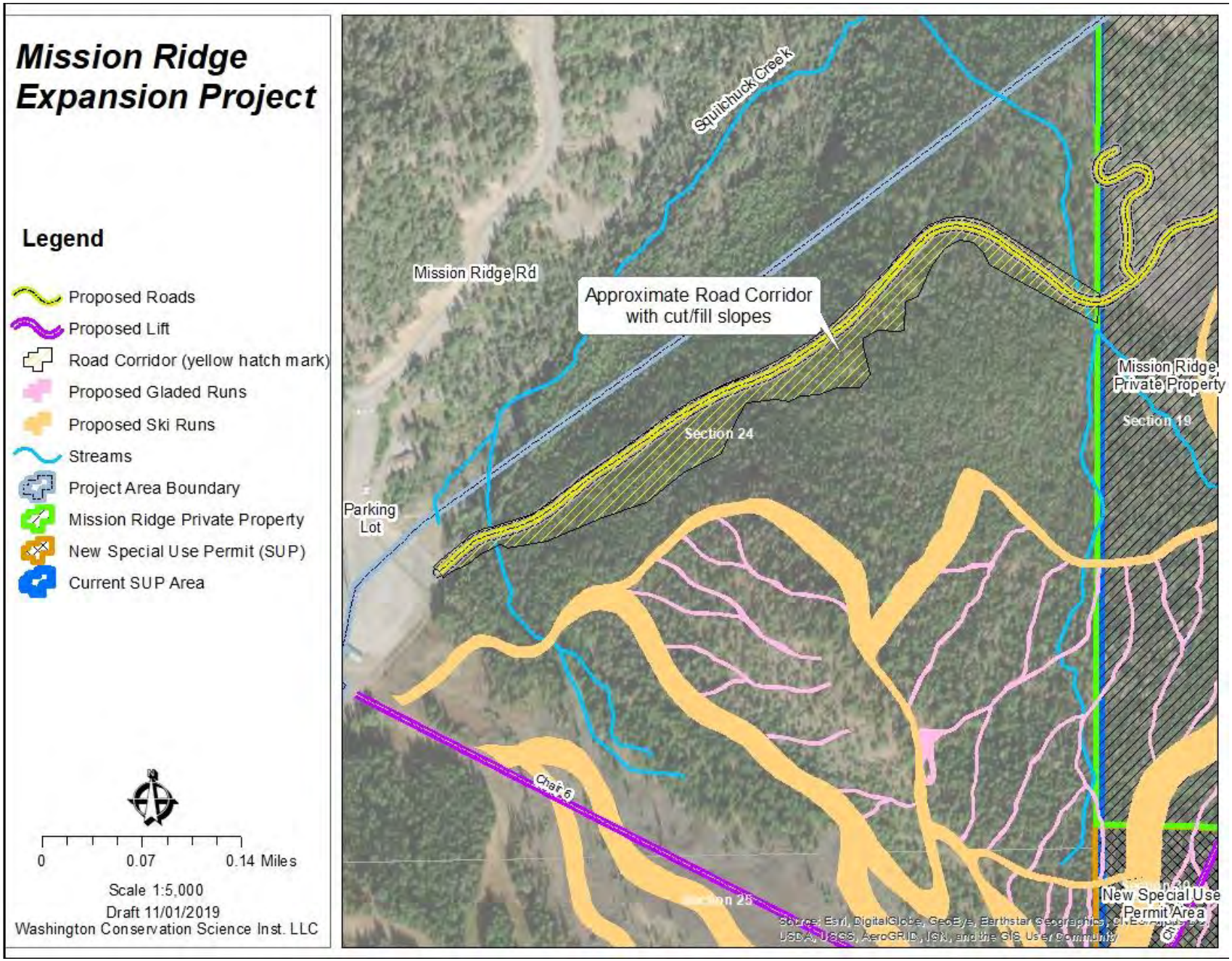


Figure 2-2. Approximate location of access road and cut and fill slopes from existing Mission Ridge Parking Lot to Section 19.

Preliminary design indicates the cut slope would be at a 1:1 ratio, and may reach heights of up to 180 to 200 feet. Disturbed areas would be shaped and stabilized as soon as possible to minimize erosion potential. The disturbed areas outside of the road bed would be rehabilitated by covering with organic material, seeding using native species, planting shrubs and trees where possible, and installing drainage features as necessary. The entire road corridor, including the roadbed, all cut and fill slopes and turnouts, would cover approximately 25 acres (Figure 2-2).

Design measures would be incorporated to reduce the visual impact of the cut and fill slopes viewed from the current base area and the Mission Ridge County Road. The steep landform and evenly textured coniferous vegetation contribute to a low visual absorption capacity of the landscape to accept changes that blend well. Final road design would incorporate such measures where feasible and may include: blending rock sculpting with natural rock cut slopes, adjusting road grades to reduce cuts, installing tree wells to save large trees, bin walls, textured retaining walls and other design criteria to reduce cut and fills and minimize visual contrast. Other design criteria may include: treating rock cuts with Natina or other coloring treatment (https://www.natinaproducts.com/), consideration of the color of retaining walls, bioengineering treatments for planting, and road features.

The access road would require two stream crossings on the National Forest, one at each end of the route. The creeks that would be crossed are both non-fish bearing perennial streams and are located within designated Riparian Reserves with a 150 feet wide management buffer. Crossings would be culverts or bridges, and determined with final road design.

Activity in the water would be restricted to periods of low to no flow. Squilchuck Creek is a perennial fish-bearing creek that flows along the western boundary of the Project Area. No activity would occur within Squilchuck Creek. Some activity may occur within the Riparian Reserve boundary, where it coincides with the creek crossing near the existing base area.

Stream crossings would be designed to meet the requirements of the Memorandum of Understanding (MOU) for Hydraulic Projects (17-MU- NFS 11062754-049) between the USFS and WDFW. Any work below the ordinary high water mark (OHWM) would be conducted during in-water work windows, and all erosion and pollution control Best Management Practices (BMPs) would be employed. All applicable permits for conducting work below or adjacent to the ordinary high water mark would be obtained from federal, state, and local regulatory agencies.

Special Use Permit

The existing Special Use Permit Area on the National Forest land would be expanded to include the NW ¼ of Section 30 to allow for development of ski facilities and ski area operations on approximately 160 acres of National Forest land. Development would include lift towers and terminals for Chairs 6 and 7, associated alpine ski runs and Nordic ski trails. The proposed development is further described below.

Infrastructure Development within Special Use Permit Area

Development on the National Forest and WDFW lands would consist of installation of two new chairlifts and associated alpine ski runs in Sections 24, 25 and 30 (Figure 2-3).

Chairlifts

Chair 6 would be constructed on the National Forest and WDFW land. Chair 6 would originate from near the existing Mission Ridge base area parking lot and terminate on a ridge in the expanded special use permit area in Section 30. The chair lift would be a fixed-grip, quad chair and approximately 3,220 feet long with a vertical rise of 755 feet (Table 2-2). It would serve new terrain in the Outback area and transport skiers from the existing base area to a point where they could ski to all the terrain and improvements in the proposed Expansion Area.

Chair 7 would be constructed on private land in Section 19 and on the National Forest in Section 30. Chair 7 would originate from the new Village Base Area in Section 19 and terminate on National Forest in the expanded special use permit area, near the top terminal of Chair 6. The chair lift would be a detachable, quad chair and approximately 2,262 feet long with a vertical rise of 620 feet (Table 2-2). About 995 feet of Chair 7 would be located on National Forest land and 1,267 feet would be on privately owned land in Section 19. Chair 7 would serve new ski terrain in the Expansion Area and transport skiers from the new Village Base Area to a point where they could ski down to the existing base area.

All chairlifts would include lift towers within the corridor. Underground electrical conduit would be buried along the lift line to bring power to the lift loading/motor room and top station sites. Each chairlift would include a bottom operation terminal (lift loading/motor room) and a ski patrol/lift operator station at the top. Fixed-grip chairlift terminal structures would be approximately 20 feet by 40 feet. Detachable-grip chairlift terminal structures would be approximately 30 feet by 80 feet. Installation of chair lifts would require tree removal along the lift line corridor approximately 80 feet wide and ground disturbance for installation of the lift towers. Other vegetation modifications, such as brush removal, would depend on existing terrain and site vegetation. Design measures would be incorporated to blend chairlifts and towers and associated facilities into the landscape character by using non-reflective colors and have scalloped or irregular lift line vegetative edges to avoid a straight line appearance viewed from Mission Ridge base area and other key viewpoints. Temporary pioneer roads, approximately 15-20 feet wide, would be built to each chairlift tower location and a hole approximately 20 feet by 20 feet would be dug for each tower. Pioneer roads would be decommissioned after tower installation. Precise locations of towers and pioneer roads are not known at this time. Topsoil on all pioneer roads and 20 x 20 ft chairlift tower holes would be removed prior to disturbance, stockpiled, reinstated, and revegetated with native species after tower installation, following guidance in Appendix B, Soils, Design Features 18a-f. These areas would then be re-vegetated by seeding with native species. A permanent 1.8 mile service road (Mountain Access Road), about 20 ft wide, would follow a beginner ski run and Nordic trail to the top of Chairs 6 and 7. This road would be for administrative use only. No public motorized use would be permitted at any time of the year within the alpine ski area. Chair 5 is a proposed addition to the existing Special Use Permit Area, as envisioned in the Master Plan (USFS 2003) and will be analyzed in a separate process.

Table 2-2. Chairlift Specifications on USFS/WDFW lands

Chairlift Number - Type	Length (feet)	Vertical (feet)	Capacity (people/hour)	Comfortable Carrying Capacity
6 – Fixed Grip Quad	3,220	755	2,000	880
7 – Detachable Quad	2,262	620	2,000	640
Total	5,482	1,375	4,000	1,520

Ski Runs

There would be approximately 43 acres of new ski runs in Sections 24, 25, and 30 (Figure 2-3, Appendix A); 29 acres on USFS land and 14 acres on WDFW land. Ski runs would be cleared (trees removed and stumps pulled) and graded as necessary to create a smooth surface. Scree slopes would also be smoothed as necessary to create a smooth surface. Vegetation along the edges of ski runs would be feathered and/or scalloped to avoid severe looking linear features. Ski run modifications would depend on existing terrain and site vegetation. Ski runs would also be designed to avoid a straight line appearance viewed from Mission Ridge base area and other key viewpoints by planting native vegetation to soften soil contrast. Topsoil on all contoured ski runs would be removed prior to disturbance, stockpiled, and revegetated with native species after tower installation, following guidance in Appendix B, Soils,

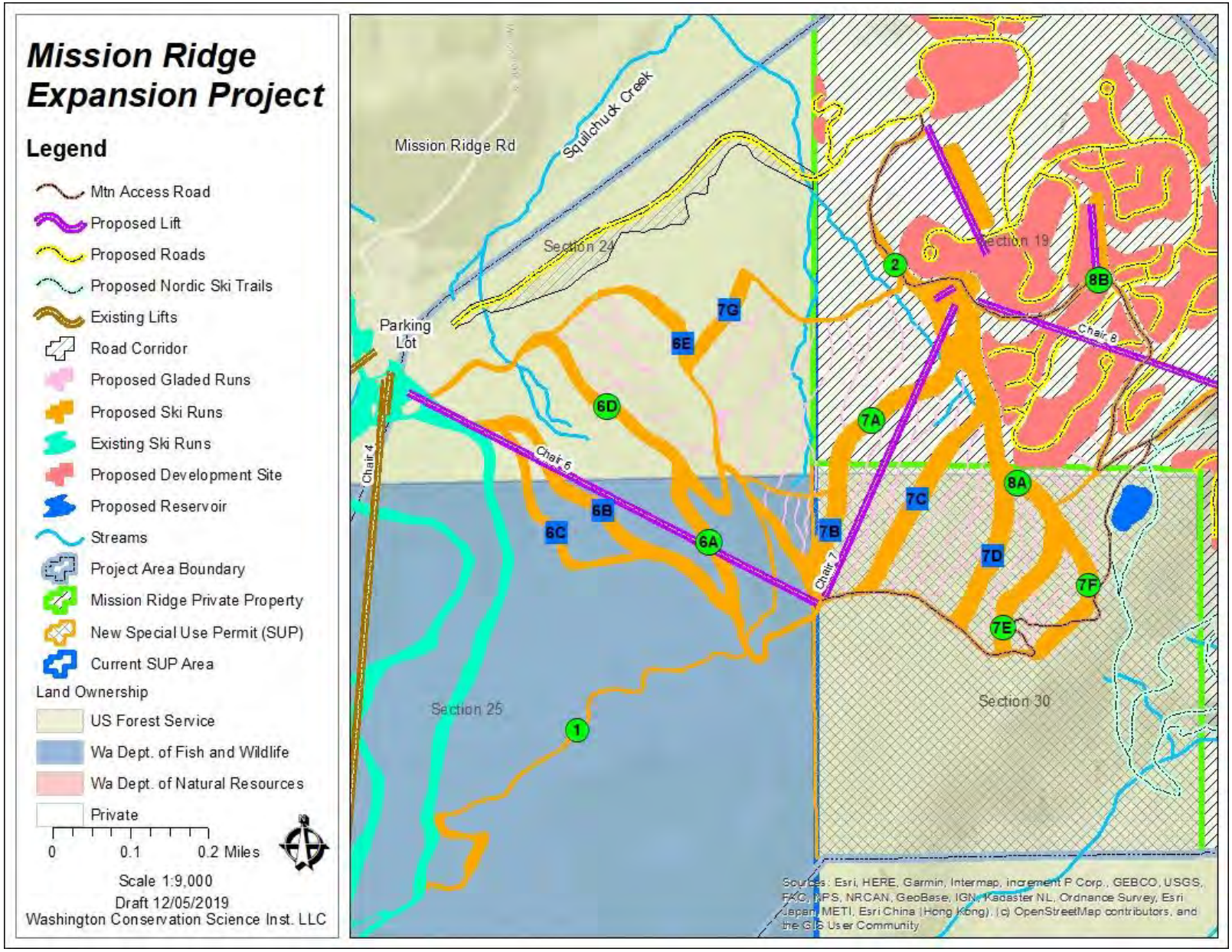


Figure 2-3. Proposed development on USFS and WDFW lands. Green circles denote beginner runs. Blue rectangles denote intermediate runs. The proposed pipeline for the new snowmaking would be located under the access roads, across Section 24 and south on Section 19 to 30.

Design Features 18a-f. All new alpine ski runs would have lighting to provide night skiing. Electrical conduit would be buried under runs and light towers erected along the side of runs, within the area already disturbed.

Some forested areas between the runs would be gladed. Glade areas or zones are created through the forest management practice of glade trimming, which is the spacing of trees between natural openings. Glading, as it is commonly referred to, spaces trees wide enough to allow skiers to descend and make turns through a forested setting. This includes the removal, thinning and trimming of vegetation to create passageways down the fall line of a skiable line, or ski corridor. The proposal illustrates conceptual ski lines; however, actual line establishment would be selected after detailed on-site analysis and consideration for individual tree and vegetation removal. Chainsaws and hand tools would be used to thin and prune trees and vegetation. Once created, these lines, which would be approximately 20 to 30 feet wide, would promote calculated regrowth and a diverse forest structure. Emphasis is typically placed on promoting uneven-aged forest conditions through a braided and island glade design method to provide for future regeneration and to protect existing habitat. Braided designs incorporate intersecting ski lines, whereas, islands ensure preservation of forest diversity through the protection of younger species of trees and/or other vegetation. Straight edges for the gladed lines would be avoided, and the width of the gladed lines varied to provide natural, uneven ski routes. Trees greater than 20” dbh would be not be cut.

Where glading is applied, mature trees would be cut, prioritizing removal of diseased and damaged trees, to provide the desired spacing. Trees over 20” in diameter would not be cut. Glading would be implemented on approximately 15-20% of the identified, gladed, skiable zones and would retain the majority of tree canopy to protect snow quality in winter and maintain wildlife habitat. This would occur on a total of about 18 acres (USFS 13ac, WDFW 1ac, private 4ac). The dripline between tree canopies would be as wide as 20 feet and the distance between tree trunks would be approximately 30 feet. The lower branches of trees along each gladed line would be pruned to a height of 12 feet so that skiers could ski under the lowest remaining branches. Branches would be cleared to provide approximately 8 feet of clearance above the typical natural snowpack.

Trees and coarse woody debris removed from chairlift corridors, ski runs and glades would be felled and whole-tree yarded over sufficiently frozen soil or deep snow to landings on the new ski runs. Merchantable trees <20” diameter would be decked for sale; boles over 20” in diameter would be left on site. Unmerchantable trees and coarse woody debris <20” in diameter would be chipped or pile burned. Burn piles would not be placed on top of traditional plants of concern. Chips may be used on site where beneficial or removed from the site. To meet visual quality objectives and avoid construction of straight line features, chairlift corridors would be blended into the vegetation on the mountainside by implementing the following design features: 1) lift corridors would blend with ski runs, and 2) chairs and chairlift towers would be similarly colored and blend in with the mountain backdrop setting by using a non-reflective galvanized steel of a darker color to blend in and avoid producing glaring shiny reflection light.

The current snowmaking system would be expanded to service the new alpine terrain. The existing water reservoir on the upper mountain would be enlarged (an action which is already approved), and water would be delivered to the existing base area. The water would then be pumped by a new pipeline to a new reservoir located in Section 30 (Figure 2-3) and to pump stations on private land in Section 19. The proposed pipeline for the new snowmaking would be located under the access road to the new base area (across Section 24) and then under the new Mountain Service Road (Sections 19 & 30). The new reservoir would be about one acre in size and hold 4,200,000 gallons. Mission Ridge owns water rights for this new use. All new alpine runs would have snowmaking coverage, which would involve burying pipe and electrical conduit under each ski run. Snowmaking would occur primarily in the early ski season and would conform to the dates in the annual Mission Ridge Operating Plan; generally November 1st to April

30th annually. The Alpine skiing Operating Season would conform to the dates in the annual Mission Ridge Operating Plan; generally the weekend before Thanksgiving to April 30th annually.

The Nordic skiing area would be located on the northwest quarter of Section 30 on National Forest land and on the northeast quarter of Section 30 and southeast quarter of Section 19 on private land. The Nordic trails would include some new construction and would utilize existing roadbeds and trails (Figure 2-4). There would be approximately 1.8 kilometers of trails on the National Forest and 8.7 kilometers on private land for a total of 10.5 kilometers. 5.8 kilometers would be located on existing old roadbeds and 4.7 kilometers would have a new trail template constructed. New construction for Nordic ski trails would include contouring and clearing of stumps and woody vegetation, depending on site characteristics. The Nordic trail system would be designed to accommodate skating and classic lanes, as well as snowshoeing and snow-biking (fat tire bikes), and would be approximately 18 feet wide. The different user groups may be scheduled at different times to reduce user conflicts on the Nordic trails. The trails would be groomed on operating days. In the winter, the Nordic trail system would be open to the public for a fee. During snow-free seasons, the Nordic trail system on private land and the National Forest would be open to the public with no fee. On the National Forest, only non-motorized use would be permitted on the Nordic trail system. Motorized use (motorcycles/ATVs) would be permitted on the trail on private land. Additional trails may be built on the private land to develop loop opportunities for the motorized users, so they would not have to “dead-end” at the National Forest boundary. Motorized use would be restricted to designated routes on private land. The Nordic trails would have a seasonal closure to protect elk calving habitat and to avoid erosion during wet conditions as needed. Enforcement would be with signing and patrols.

Access to backcountry areas, generally south of the Project Area on public lands, would be provided to the public in all seasons from the private property in Section 19 and would utilize the day-use parking lot and the Nordic trail system. Winter backcountry access would be by skinning up designated ski runs during non-operating hours for no fee or by utilizing the Nordic trails or Chair 7 during operating hours for a fee. Summer backcountry access would be via the Nordic trail system.

Within the Special Use Permit Area, dates of alpine and Nordic skiing on the new terrain would conform to the annual Mission Ridge Operating Plan; generally the weekend before Thanksgiving to April 30th annually. Other operational aspects of Ski Area operation on the new terrain would also conform to the annual Mission Ridge Operating Plan. No summer developed facilities (such as an Alpine Slide) or permitted activities would occur within the Special Use Permit Area.

All newly constructed buildings would be designed in a Cascadian Architectural style using design, materials, colors and landscape siting adopted by the USFS (USFS 2001c) that reflects the heritage of the surrounding landscapes, where the colors blend in with the natural surroundings of the forest and native foliage. All facilities would be developed and constructed in such a manner that the facility (or part of the facility) is readily accessible and useable by persons with disabilities.

Proposal for Development on Private Land (Sections 19 and 30)

Although the Forest Service would not be permitting actions on private land in Sections 19 and 30, proposed project details for this private parcel are connected actions and are included here to give context for the overall project (Figure 2-5). Proposed development on the private land would include: two chairlifts, two pulse gondolas, a platter pull, a magic carpet, and associated alpine ski runs, including beginner terrain, Nordic skiing trails (also available for snowshoeing and snow-biking), a winter snow-tubing area, access to backcountry ski-touring, parking lots, access roads, overnight accommodations, including a hotel/lodge, condominiums, townhouses, and single family homes, commercial retail, a day lodge, restaurants and other commercial/recreational services designed to accommodate overnight guests. Skier services, such as a ski school, ski patrol, first aid, daycare, ski rentals, ski repairs, and retail

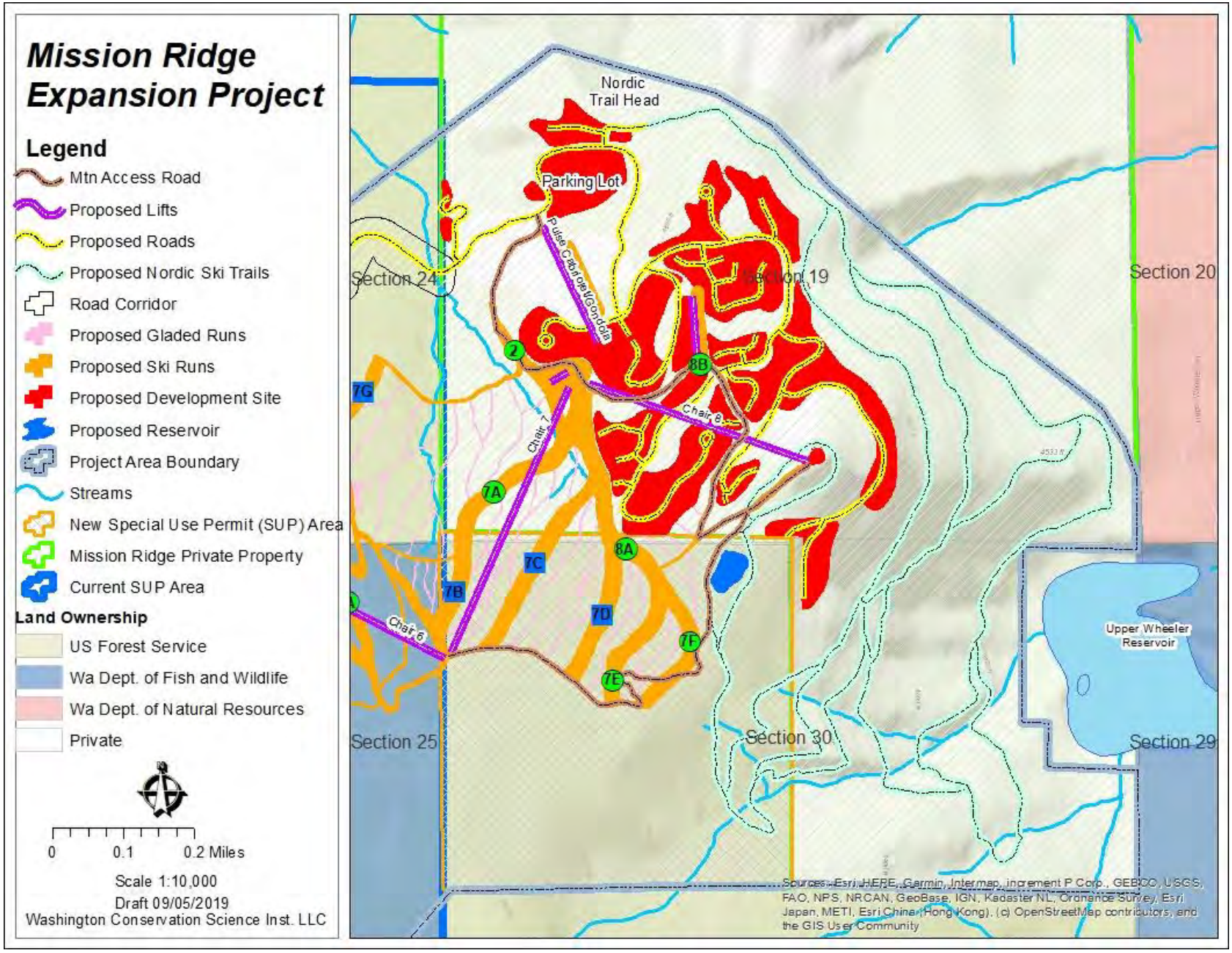


Figure 2-4. Proposed Nordic trail system within the Mission Ridge Expansion Project.

and meeting spaces would be provided on the ground floor of the various condominium buildings in the Village Base Area (Figure 2-5). Summer activities would include: non-motorized uses, such as biking, hiking, and horseback riding, and motorized use by ATVs and motorcycles on the Nordic trails. The Mission Ridge Road (County #711) would be extended 0.2 miles on private land in Section 19 beyond the National Forest Boundary to access the new Day Use Parking Lot.

Chair 7 would be located on both private land and the National Forest, as described above. Pulsed Gondola 8 would be constructed on private land in Section 19 and originate from the new Village Base Area in Section 19. This gondola would serve new beginner ski terrain and provide access to a restaurant and observation deck near the top terminal. Pulsed gondola 8 would be approximately 1,788 feet long with a vertical rise of 410 feet (Table 2-3). The lift line corridor would be approximately 80 feet wide. Temporary pioneer roads would be built to each tower location and a hole approximately 20 feet by 20 feet would be dug for each tower. Pioneer roads would be decommissioned after tower installation. The terminal structures would be approximately 30 feet by 80 feet. A permanent 1.8 mile administrative service road (Mountain Access Road) would utilize alpine ski run and Nordic trails to the top of Chairlifts 6 & 7. This road would provide summer access for administrative use only. No public motorized use would be permitted at any time of the year within the alpine ski area.

Table 2-3. Lift Specification on Private Land

Lift # / Type	**Length (feet)**	**Vertical (feet)**	**Capacity (people/hour)**	**Comfortable Carrying Capacity (Skiers at one time)**
Pulsed Gondola 8	1,788	410	700	260
Magic Carpet	156	20	1,200	50
Platter Pull	469	60	600	50
Transport Pulse Gondola	981	145	940	50
Total	3,394	635	3,440	410

There would be approximately 19 acres of new ski runs in Section 19 (Figure 2-4, Appendix A). Ski runs served by Chair 7 and Pulsed Gondola 8 on private land would be beginner trails that would be negotiable by beginner skiers on their first day. Many trails are adjacent to or wind through the residential development. Ski runs and the snow-tubing slope would be cleared (trees removed and stumps pulled) and graded as necessary to create a smooth surface. About 18 acres of forested areas between the runs would be gladed (See glading description above). Trees would be felled and whole-tree yarded over snow to landings on the new ski runs. Merchantable trees would be decked for sale. Unmerchantable trees would be chipped and the chips removed from the site or would be piled and burned on site. Remaining trees in the gladed areas would have branches pruned to 12 feet high.

A magic carpet and platter pull would serve beginner instructional slopes on about two acres for new skiers. The platter pull lift would also provide ski-in/ski-out opportunities to residences and additional terrain for beginner skiers. Both of these areas and a snow-tubing area would be lighted and have snowmaking coverage.

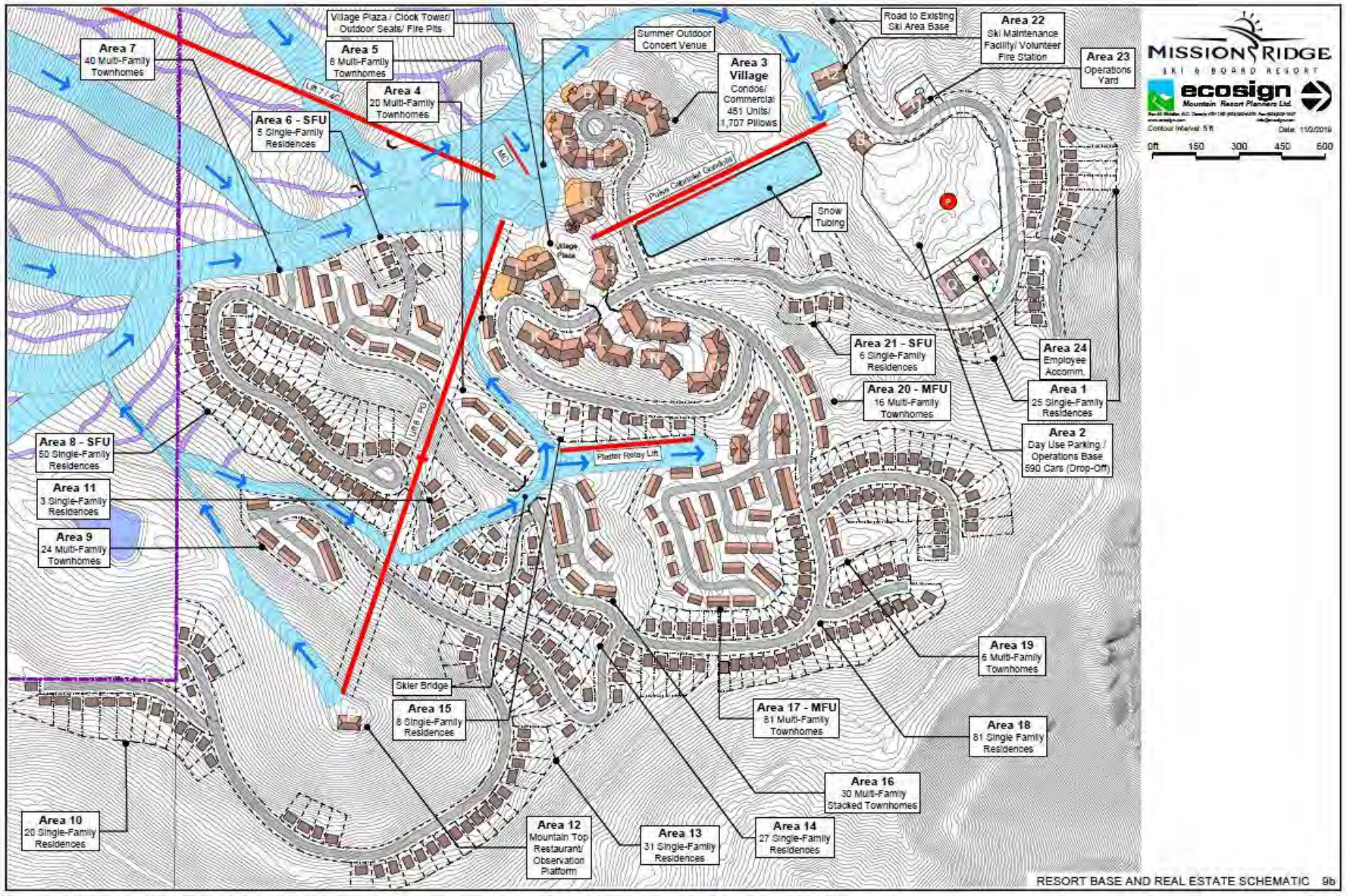


Figure 2-5. Proposed development on private land.

Figure 2-6. Overview of proposed development on private land relative to existing Mission Ridge ski area.

All new alpine ski runs would have lighting to provide night skiing. Electrical conduit would be buried and light towers erected along the side of runs. All new alpine runs would also have snowmaking coverage as described in Section 2.2.4. Ski area operational dates on the private parcel would be independent of USFS permitted operational dates.

A Day-Use parking area (4.3 acres) would be developed with a capacity of 590 vehicles. Parking for persons with disabilities would be available in the day use parking lots and in the Village. A Transport-Pulsed Gondola would take visitors from the parking lot to the Village and the base terminals of Chair 7 and Pulsed Gondola 8. Visitors could also drive to the Village and Chairs 7 and Pulsed Gondola 8 base terminals to drop off day-users. A snow tubing slope would be located next to the Transport Pulsed Gondola lift line and would be served by a Magic Carpet. The operations yard and facilities would be located just north of the Day Use Parking Lot along the new access road. A Ski Area Maintenance Facility and Volunteer Fire Station would be located at the bottom of Skiway 2, near the base of the transport Pulse Gondola. Employee accommodations would be located at the east end of the Day Use Parking Lot.

As described in Section 2.2.4, the Nordic skiing area would be located on the southeast portion of the private parcel in Sections 19 and 30 (Figure 2-4). There would be 8.7 kilometers of Nordic trail on private land, utilizing existing roadbeds and newly constructed templates. The Nordic trail system would be designed to accommodate skating and classic lanes, as well as snowshoeing and snow-biking (fat tire bikes), and would be 18-feet wide. The trails would be groomed daily on operating days. Use of the Nordic trail system would be open to the public for skiers and snowshoers for a fee. During snow-free seasons, the Nordic trail system on private land and the National Forest would be open to the public with no fee. On the National Forest, only non-motorized use would be permitted on the Nordic trail system. Motorized use (motorcycles/ATVs) would be permitted on the trail on private land. Additional trails may be built on the private land to develop loop opportunities for the motorized users, so they would not have to “dead-end” at the National Forest boundary. The Nordic trails would have a seasonal closure to protect elk calving habitat and to avoid erosion during wet conditions as needed. Enforcement would be with signing and patrols.

A community (Village), comprised of multi-family townhouses, condominiums and single-family residences, would be built in four phases over approximately 20 years (Figure 2-5 and 2-6). The proposed site plan includes 896 dwelling units (621 condominiums/multi-family townhomes, and 275 single-family residences), other support buildings, and approximately 4.2 miles of associated road access. Residential units are designed for full time living, vacation homes, and for short term visitor accommodations, which would be managed by the resort. A 57-unit hotel/lodge would also be built. 80 units of employee housing (primarily seasonal) would also be provided in dormitory or small unit format. The Forest Service has recommended utilizing the Cascadian Architectural style using design, materials, colors and landscape siting adopted by the USFS (USFS 2001c) similar to that on the National Forest land and existing ski area. Open spaces, pedestrian paths, and wildlife corridors would also be designed. The design would encourage pedestrian- friendly access to all common area amenities, as well as to the adjacent commercial uses. The hotel/lodge and Village condominiums would have underground parking, and the townhomes and residences would have associated parking at each dwelling. In addition, there would be two underground parking garages located underneath the Village Plaza (120 parking spaces) to accommodate commercial and other use in the Village.

The Village Base Area would consist of the hotel/lodge, condominiums, skier services and other spaces. Development of complementary support services at the new Village Base Area and within the private parcel would meet ski season and year-round recreational needs. In the Village, approximately 90,000 square feet of retail space on the ground floor of the condominium buildings would include: restaurants, bars, retail and specialty shops, office space, a ski school, a ski rental and repair shop, and facilities to host meetings and events. The Village Plaza would include a clock tower, outdoor seating, and fire pits.

A summer outdoor concert venue would be located near the Magic Carpet instructional slope. Skiing-related services would be located near the Chair 7/Pulsed Gondola 8 base terminals. A mountaintop restaurant and an observation platform, approximately 3,000 square feet in size, would be located at the top of Pulsed Gondola 8. Nordic ski trails would be utilized as multi-use trails, open to the public for use in the summer months in accordance with the description in Section 2.2.4, and would be posted and patrolled to restrict public use to the trail corridors as appropriate.

Mission Ridge would work with the USFS and WDFW to implement seasonal closures, if necessary, as adaptive management, to protect elk calving sites in the area. The proposed construction on private land in Sections 19 and 30 would potentially result in ground disturbance and/or vegetation modification on approximately 155 acres of the total 750 acres. The remaining land would be open space with a mix of classifications including ski runs, natural open space, managed open space and undesignated space.

Groundwater would be used to supply domestic needs of the expanded resort through wells. Disposal of wastewater produced would utilize drain fields scattered around the property. Chelan County Public Utility District No. 1 would provide electric power with sub-stations built on-site. Propane and solar power would also be utilized. Storm water runoff treatment would utilize on-site filtration and dispersion. About 4.2 miles of internal roads throughout the resort would be primarily private roads built to Chelan County private road standards. A Fire Protection Plan for the resort would include the following elements: 1) Structures would be built with ignition resistant materials, 2) Defensible space would be provided around all structures, and 3) There would be an evacuation plan with a community warning siren and fire evacuation signs on internal roads. All facilities would be developed and constructed in such a manner that the facility (or part of the facility) is readily accessible and useable by persons with disabilities.

Details of the Mission Ridge Expansion Resort can be found in the Mission Ridge Expansion Planned Resort and Development Agreements Application (Mission Ridge, 2018 as amended 2020) to Chelan County, which is incorporated by reference to this EA.

Design Criterion, Mitigation Measures and Best Management Practices

Specific features, such as design criteria, mitigation measures, and best management practices, are incorporated into the design of the Proposed Action Alternative to prevent or reduce potential resource impacts. These criteria are an integral part of the proposed action and are included as part of the effects analyses presented in Chapter 3. Monitoring would occur during implementation and to assess potential impacts caused by project activities, and mitigation measures would be implemented to reduce negative effects. Design criteria, mitigation measures, best management practices, and monitoring are detailed in Appendix B.

Timing and Implementation of Project Activities

Project implementation is anticipated to begin in the Fall of 2020 and would be completed within approximately 20 years. Mission Ridge would be responsible for funding and implementation of the Proposed Action with oversight and monitoring by US Forest Service, WDFW and Chelan County.

Phase A (1-3 years): First, the access road to the new Base Area and Community and Day Use parking lot would be built. Aerial and surface lift construction and ski run development would then occur, along with construction of the snowmaking reservoir, pump houses, and piping system, night lighting, and Nordic trails. Concurrently, Village and Base Area facilities would be constructed including: 50% of the Village condominiums, a Day lodge, commercial space with ski rental, retail, day care, and first aid, operations facilities, and about 10 multi-family townhouses and 50 single-family residences along the access road, main community road, and spurs.

Phase B: Community development (4-20 years): The residential community of multi-family townhomes, single-family residences and condominiums located in Section 19 would be built in four phases over approximately 20 years, and a 57-room hotel/lodge would be built in the first of these 4 phases.

Project implementation would be dependent on the concurrent Washington State Environmental Protection Act (SEPA) process and the Chelan County application process.

Comparison of Alternatives

When considering the alternatives eliminated from detailed study and the alternatives considered in detail, a reasonable range of alternatives is represented. There are no unresolved conflicts with issues identified during project scoping; therefore no further alternatives were developed. As a result of public scoping and resource analysis, the following incremental changes were made to the Proposed action:

- Alpine ski runs were re-located to avoid white-bark pine trees.
- Seasonal Nordic trail closures, in coordination with WDFW as necessary, were added to protect elk calving sites.

The following tables disclose how the No Action (Alternative 1), the Proposed Action (Alternative 2) and the connected actions on private land compare. A detailed analysis of the effects of each alternative on the Resource Indicators is provided in Chapter 3.

Table 2-4. Comparison of the Alternatives by Facilities

Facilities	**Alternative 1, No Action**	**Alternative 2, Proposed Action & Connected Actions** USFS/WDFW/Private	**Total: No Action, Proposed Action and Connected Actions**
Project Area (acres) USFS/WDFW/Private	NA	293/363/434 Total - 1,090	293/363/434 Total – 1,090
Permit Area (acres) USFS/WDFW/DNR	960/1,040/80 Total – 2,080	160/0/0	1,120/1,040/80 Total – 2,240
Skiable Terrain (acres) USFS/WDFW/DNR/Private	960/1,040/80/0 Total - 2,080	160/0/0/70 Total - 230	1,120/1,040/80/70 Total – 2,310
Ski Run Lineal Distance (miles)	14.7	7.2	21.9
Ski Run Vertical (feet)	19,575	5,950	25,525
New Alpine Ski Runs (Acres) USFS/WDFW/Private	0/0/0	29/14/19	29/14/19
Alpine Ski Runs-All Ownerships (acres)	204	62	266
Number of Alpine Ski Runs and Ski- ways	33	18	51
Ski Run Difficulty (%) Ski Run Difficulty (Acres) Beginner/Intermediate/Advanced	7/80/13 13/164/27	65/35/0 40/22/0	20/70/10 53/186/27

Facilities	**Alternative 1, No Action**	**Alternative 2, Proposed Action & Connected Actions** USFS/WDFW/Private	**Total: No Action, Proposed Action and Connected Actions**
Beginner Instruction Slope (acres)	1	2	3
Beginner Designated Runs (acres)	13	40	53
Gladed Terrain (acres)	200	13/1/4	113/101/4
Expansion Gladed terrain (# glades/total vertical/total length	NA	7/ 2,525'/ 9,685'	7/ 2,525'/ 9,685'
Nordic Trails (km) USFS/Private	0/0	1.8/8.7 Total – 10.5	1.8.8.7 Total 10.5
Nordic Trails (acres) USFS/Private	0/0	2/12 Total - 14	2/12 Total - 14
Snow-Tubing Area (acres)	0	2	2
Terrain Parks	3	0	3
Aerial lifts	4	4	8
Rope Tows	2	0	2
Magic Carpet	0	1	1
Platter Pull	0	1	1
Pulse Gondola	0	2	2
New Lift Corridors (Surface & Aerial) (lineal feet) * USFS/WDFW/Private	0/0/0	2,435/1,820/4,706 Total – 8,961	2,435/1,820/4,706 Total – 8,961
Aerial Lifts (Chairs 1, 2, 3, 4, 6, 7, Pulsed Gondola-8) Vertical (feet) **	4,494	1,785	6,279
All Aerial & Surface Lifts Vertical (feet) **	4,626	1,865	6,491
Aerial & Surface Lifts (lineal feet) **	18,372	7,980	26,352
Snowmaking (acres)	39	62	101
Lighted Night Skiing (acres)	26	62	88
Nordic Trail (miles/kilometers)	0/0	6.5 / 10.5	6.5 /10.5
Day Use Parking Lot Capacity (Vehicles / RV spots)	900 / 15	590 Day Use / 0 120 Village Undergrd Total - 710	1,610 / 15

Facilities	**Alternative 1, No Action**	**Alternative 2, Proposed Action & Connected Actions** USFS/WDFW/Private	**Total: No Action, Proposed Action and Connected Actions**
On-Mountain Permanent Access Road (miles)	5.9	1.8	7.7
Public Access Road to new Day-use Parking lot (miles) USFS/Private	0/0	0.7/0.2	0.7/0.2
Village Roads (miles)	0	4.2	4.2
Day Lodges	2	1	3
Mountain Restaurants	0	1	1
Skier Services Buildings (square feet)	22,732	90,000 (available)	112,732 (available)
Condominium/Townhouse Units	0	621	621
Single-family Residences	0	275	275
Total Dwelling Units	0	896	896
Hotel/Lodge rooms	0	57	57

*Includes the Transport Pulsed Gondola

** Does not include the Transport Pulsed Gondola because this is strictly a transport lift.

Table 2-5 – Comparison of the Alternatives by Social and Economic Indicators

Resource Indicator	**Alternative 1 No Action**	**Alternative 2 – Proposed Action**	**Total – Existing and Proposed**
Aerial Lifts (Chairs 1, 2, 3, 4, 6, 7, Pulsed Gondola -8) Capacity (Skiers/hour) **	4,774	4,700	9,474
All Aerial & Surface Lifts Capacity (Skiers/hr) **	6,624	6,500	13,124
Comfortable Carrying Capacity (# skiers at one time)	2,784	1,880	4,664

Chapter 3: Environmental Effects

This chapter presents information about current resource conditions in the Project Area and the direct, indirect, and cumulative effects of implementing each alternative. It also presents the scientific and analytical basis for the comparison of alternatives presented in Chapter 2. Further background information can be found in the Appendices that are a part of this document and in the Analysis File that is available at the Wenatchee River Ranger District, 600 Sherbourne, Leavenworth, WA. 98826. Resources that were not impacted or were analyzed elsewhere (SEPA documentation, which is incorporated by reference, Mission Ridge 2018) include: air quality, socioeconomics, minerals, land use, agriculture, roadless areas and noise.

3.1 Potential Effects

Each resource area discloses the direct, indirect and cumulative effects for that resource area. The impact analysis assumes all design criteria, mitigation measures and best management practices described in Appendix B would be carried out for Alternative 2, the Proposed Action. Design criteria and mitigation measures were developed specifically to ensure the project activities would be consistent with the Forest Plan and the Clean Water Act. The National Environmental Policy Act defines these effects as:

- Direct Effects -are caused by the action and occur at the same time and place.
- Indirect Effects -are caused by the action, but occur later in time or further removed in distance, but are still reasonably foreseeable.
- Cumulative Effects - are those that result from the incremental impacts of the action when added to other past, present, and reasonably foreseeable actions.

Potential effects are evaluated in terms of type (beneficial or adverse), context (local or regional), duration (short-term or long-term, seasonal or continuous), and intensity (none, negligible, minor, moderate, or major):

- Beneficial—a positive change in the condition of the resource or a change that moves a resource toward its desired condition.
- Adverse—a negative change in the condition of the resource or a change that moves a resource away from its desired condition.
- Short-term—an effect that would not be detectable after a short amount of time; generally after one season after the activity has been carried out, but can vary by resource.
- Long-term—a change in a resource that will not return to its condition prior to the project activity for the foreseeable future.

Intensity definitions describe the types of actions that could result in each level of effect (none, negligible, minor, moderate, or major). Intensity refers to the severity of the impact, in whatever context it occurs:

- Negligible - a change to a natural physical resource that would be so small that it would not be of any measurable or perceptible consequence.
- Minor - a change to a natural physical resource that would be small and localized and of little consequence; detectable, but localized and short-term.
- Moderate - a change to a natural physical resource, that would be readily apparent and measurable, localized, and possibly long-term.
- Major - a noticeable change to a physical resource that would be measurable and result in a severely adverse or major beneficial impact.

The project Interdisciplinary Team identified past, present, and reasonably foreseeable future actions that might have cumulative effects with the Proposed Action. These actions are described below. Each resource area considered different combinations of these actions, depending on the cumulative effects boundary for the resource area and resource affected. Only those past, present and reasonably foreseeable actions that overlap the geographic analysis area boundary for each particular resource area are considered, and only if those other actions are expected to have overlapping effects with the Mission Ridge Expansion project.

In order to understand the contribution of past actions to the cumulative effects of the Proposed Action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects.

The effects of past activities are represented in the baseline resource area consistent with the President's Council on Environmental Quality's Guidance on the Consideration of Past Actions in Cumulative Effects Analysis (June 24, 2005), which is incorporated by reference. The guidance states "agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions." This direction is followed in this project, though a general list is provided for reference. Some past actions may still be having effects on one resource, but not another. The following lists summarize information known about the project and Assessment Areas.

Past Actions

- Mission Ridge Ski Area development
- Road construction and maintenance
- Wildfire suppression
- Residential development on Forest Ridge
- Land purchases east of Project Area
- Timber harvest and fuels reduction
- Recreation – alpine skiing, Nordic skiing, snowshoeing, horseback riding, mountain biking, hiking, trail running, hunting, functions at Hampton Lodge.

Present Actions

- Mission Ridge Ski Area operations and maintenance
- County road maintenance, mountain service road maintenance
- Noxious weed treatments under the current Forest-wide Noxious Weed EA
- Recreation – alpine skiing, Nordic skiing, snowshoeing, horseback riding, mountain biking, hiking, trail running, hunting, driving for pleasure, functions at Hampton Lodge.
- Pipeline/Clara Lake trail maintenance
- Vegetation and fuels reduction treatments on state and county lands

Reasonably Foreseeable Activities

- County/Forest road and trail maintenance
- Noxious weed treatments
- Timber harvest on adjacent commercial timber lands
- Trail construction on adjacent lands
- Firewood collection along Forest Service roads; including cutting of snags
- Recreation – alpine skiing, Nordic skiing, snowshoeing, horseback riding, mountain biking, hiking, trail running, hunting, driving for pleasure, functions at Hampton Lodge, and, on the private parcel, summer motorized use of trails.
- Travel Management (TM) Plan for motorized recreation on the Okanogan-Wenatchee National Forest
- County/DNR hazardous fuels reduction plans

- Snowmaking for Chair 3 terrain
- Ski Area operating schedule expanding to seven days/week in 2019 season
- Chair 2 replacement
- Chair 1/Mimi Trail lighting and night skiing
- Chair 5 construction

Analysis Buffers

Ground disturbance is a primary area of consideration in this analysis. For analysis purposes, the following buffers were applied to linear features to account for the feature and potential disturbance outside of the feature as a result of construction.

- Lift line: 80 feet
- Permanent service road: 20 feet
- Pioneer roads: 20 feet
- Nordic ski trails: 18 feet
- Roads on private land: 50 feet

3.2 Effects Analysis by Resource

3.21 Aquatics and Hydrology

This section summarizes the existing condition and the direct, indirect and cumulative effects of the Mission Ridge Expansion Project on Aquatic Resources and Hydrology.

Methods

The analysis for Aquatic Resources included conducting two points of investigation to assess the existing environmental conditions of the Assessment Area and Project Area and the potential effects of the proposed Project to aquatic species, habitat and hydrology. The two points of investigation included the following: 1) a review of existing information; and 2) field site visits to the Project Area. Available information was reviewed to determine the presence of wetlands, streams, and riparian habitat and potential ESA listed fish species.

A combination of available species lists and spatial databases to identify species and habitats of concern that are known to occur or have the potential to occur in the Assessment Area was used to focus analysis to a list of those species and habitats that occur or potentially occur in the vicinity of the Project Area, which includes species that are currently on or under consideration for the ESA. Additional information on Washington State aquatic endangered, threatened, or species of concern is provided in the 2018 Supplemental to SEPA Checklist Aquatic, Wildlife and Botany Resources Report (WCSI, 2018). The sources that were included in the review are listed in Appendix D.

Site Visits

Since 2017, several site visits have been conducted to characterize the Assessment Area and the Project Area. These site visits focused on assessment and documentation of aquatic habitat including streams, Riparian Reserves, and wetlands. During these field visits, streams, Riparian Reserves, and wetlands were identified in the Project Area and their locations were documented to create a GIS layer to develop baseline aquatic resource maps. A preliminary assessment of existing conditions was also conducted for these areas.

Assessment Area

An Assessment Area and Project Area were defined for this analysis (Figure 3-1). The overall Assessment Area is the Squilchuck and Stemilt Subwatersheds, within Watershed Resource Inventory Area (WRIA) 40. The Assessment Area is the area to be affected directly, indirectly or cumulatively by

activities proposed to occur in the Project Area. The Assessment Area provides a basis for describing existing conditions and potential impacts at a scale and within a context appropriate for migratory aquatic species and their habitats and potential impacts to hydrology. The Squilchuck and Stemilt Subwatersheds encompass approximately 28 square miles (mi^2) and 33 mi^2, respectively.

Selection of Resource Indicators

Resource indicators for Aquatic Resources were selected to establish a baseline for existing conditions and analysis and to ensure the Proposed Action is consistent with Forest Plan standards and guidelines including the Aquatic Conservation Strategy. The selection of these resource indicators was informed by an interagency technical team, the best available science, and extensive collaboration with agency technical specialists.

Resource Indicator: Stream Flow, Storage and Water Quality

The Geomorphic Road Analysis and Inventory Package Lite tool (TerrainWorks, GRAIP-Lite; NetMap 2017) with a 10-meter resolution digital elevation model (DEM) was used to identify road segments that may be hydrologically connected to the stream drainage network in the Assessment Area and Project Area.

Resource Indicator: Erosion and Sediment Supply

The Geomorphic Road Analysis and Inventory Package Lite tool (TerrainWorks, GRAIP-Lite; NetMap 2017) was used to identify road segments that have the highest potential to deliver fine sediments to streams throughout the Assessment Area and Project Area. In addition, field surveys of road conditions identified areas with visual evidence of erosion of the road surface and other erosion issues, such as failed culverts, gullies, and landslides. The process for the selection of this Resource Indicator is further described in the Aquatic and Riparian Landscape Evaluation Process (Gaines et al. 2019).

Resource Indicator: Riparian Reserves

To assess the existing condition of habitat within Riparian Reserves, field site visits were conducted and Riparian Reserves were mapped for each stream and waterbody type in the Project Area. We validated streams and riparian areas versus flow paths that may have been mapped as streams. Areas of proposed ground disturbance were identified and mapped across the Project Area to evaluate impacts to Riparian Reserves and to develop Best Management Practices (BMPs), design criteria and mitigation measures.

Resource Indicator: Fish Species and Habitat

The Assessment Area contains habitat for fish species listed under the Endangered Species Act (ESA), Regional Forester's Sensitive Species, Management Indicator Species (MIS) and WDFW Priority Habitats and Species of Concern. For this assessment, ESA species lists and designated critical habitat maps were reviewed. Forest Service Sensitive Species Lists and State Priority Habitat and Species information was also reviewed. Survey data from WDFW, USFS, and others further informed distribution of listed fish species and critical habitat designations. Additionally, to determine potential for fish bearing streams, a stream gradient of greater than 20 percent, which is considered a threshold for fish use (FPB, 2002; Washington Administrative Code, WAC-222-031), was mapped for the Project Area.

Existing Condition

The following provides a summary of existing conditions for the Assessment Area and the Project Area. The summary generally focuses on the resource indicators identified above.

Assessment Area

The Assessment Area and smaller Project Area are within the Squilchuck Creek and Stemilt Creek Subwatersheds, which contain approximately 281 stream miles. These subwatersheds are part of the Alkali-Squilchuck WRIA 40. This northern portion of WRIA 40 is south of the City of Wenatchee, in Chelan County, Washington. There are 134 stream miles in the Squilchuck Creek Subwatershed and 147 stream miles in the Stemilt Creek Subwatershed. Squilchuck Creek and Stemilt Creek drain directly into the

Columbia River; approximately 10.5 miles and 12.4 miles respectively. The majority of the Project Area encompasses a portion of the Squilchuck Creek Subwatershed and a small portion of the Stemilt Creek Subwatershed. In the Stemilt Creek Watershed, the majority of the Project Area is on private land. Overall, the subwatersheds occupy 38,960 acres, and the Project Area encompasses 0.9 percent of the watershed's geographic area (Gaines et al. 2019). Figure 3-1 shows the location of the Project Area in WRIA 40. Table 3-1 provides information on the drainage system hierarchy of the Project Area. The following description of existing conditions is generally focused on Squilchuck Creek, since the Project Area is mostly situated in the Squilchuck Creek Subwatershed.

Table 3-1. Drainage system hierarchy within the Project Area

	Subbasin (HUC8)	**Watershed (HUC10)**	**Subwatershed (HUC12)**	**Subwatershed (HUC12)**
Name	Upper Columbia	Lake Entiat-Columbia River	Squilchuck Creek	Stemilt Creek
ID #	170200	17020010	17002000100309	17020001003310

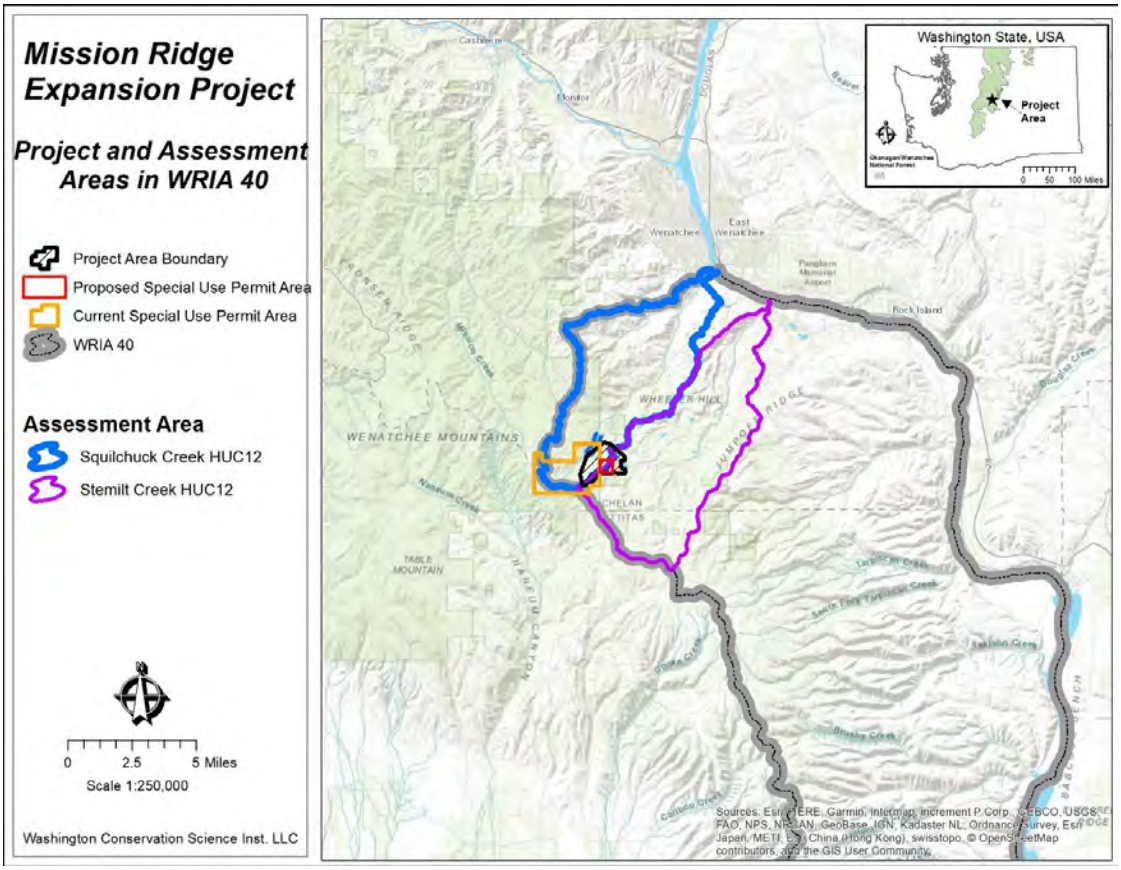


Figure 3-1. Map showing location of Assessment Area and Project Area.

From its headwaters, Squilchuck Creek flows just over 1.5 miles through federal lands, including the Mission Ridge Ski Area, and continues to flow for approximately 9 miles thru private and state lands to its confluence with the Columbia River. Squilchuck Creek flows from Mission Ridge Ski Area through mountainous forested areas, shrub-steppe, orchards and other agricultural, residential, and small industrial areas, and the larger developed City of Wenatchee. Major highways, roads, and railways exist in the watershed. Stemilt Creek flows through similar geography and land use areas. The Squilchuck

Creek Subwatershed includes less public land ownership than the Stemilt Creek Subwatershed. There are approximately 332 miles of road in the subwatersheds; 145 miles in the Squilchuck Creek Subwatershed and 187 miles in the Stemilt Creek Subwatershed. Existing road density in the Squilchuck Creek Subwatershed is 5.2 miles per square miles, while the Stemilt Creek Subwatershed road density is 5.7 miles per square mile. The overall road density in the subwatersheds is 5.5 miles per square mile. The stream drainage network influencing water flow across the Squilchuck Creek and Stemilt Creek Subwatersheds is 280 miles and 335 miles, respectively. Combined, the subwatersheds have a stream drainage network of 614 miles.

Average annual precipitation in the upper elevations of the Squilchuck and Stemilt Subwatersheds ranges from 20 inches to 28 inches, mostly in the form of snow from October through February. Average annual precipitation in the lower elevations is around 8 inches. The majority of stream flow in the mid to lower portions of the subwatersheds is due to runoff from snowmelt from April through July. Precipitation, mostly as snow, provides over 90 percent of the water to the subwatersheds (Trust for Public Land and CORE GIS 2008). Average annual estimated flows for Squilchuck and Stemilt Creeks is estimated to be 7.5 cubic feet per second. Average annual estimated flow in the upper portions of Squilchuck Creek is estimated at 2.0 to 3.0 cubic feet per second (RH2 WRIA 40A Water Quantity Assessment 2007).

The subwatersheds provide the majority of the domestic and irrigation water to communities in the lower reaches of the area. Snowpack in the higher elevations is critical for groundwater recharge and instream flow for streams and wetlands; particularly in the dry hot summer months when stream flows are low and groundwater resources are limited. Some reaches of Squilchuck and Stemilt Creeks are periodically dry in late summer and early fall, while flooding can occur during high snowmelt runoff or rain-on-snow-events (RH2 WRIA 40A Water Quantity Assessment 2007). Springs throughout the subwatersheds also contribute to the base flow in Squilchuck and Stemilt Creeks.

Historic mean August stream temperatures (1993 to 2011) range from approximately 59 degrees Fahrenheit in the lower reaches of Squilchuck Creek to 45 degrees Fahrenheit in the upper reaches of Squilchuck Creek near the Project Area; and 65 degrees Fahrenheit to 53 degrees Fahrenheit for Stemilt Creek (NorWeST 2018). Neither Squilchuck Creek nor Stemilt Creek is listed on Washington State Department of Ecology's (Ecology) 303d list for impaired waterbodies.

Perennial streams, found only in the upper watershed, are characterized by steep gradients in confined, stable channels with substrates mainly comprised of boulders and cobbles. According to the Salmon, Steelhead and Bull Trout Limiting Factors Report for WRIA 40 (WCC, 2001), Squilchuck Creek is characterized as a naturally low surface water producer with arid geology. While the mouth of Squilchuck Creek and its confluence with the Columbia River is expected to support rearing of Chinook salmon and steelhead trout, the upper extent of Squilchuck Creek habitat is limited for anadromous salmonids due to natural fish passage barriers, steep gradients, stream channel size, and insufficient flows. Other habitat limiting factors in Squilchuck Creek include: roads, floodplain and riparian habitat conversion to agriculture and residential development, water diversion for irrigation, reduced large wood recruitment and instream habitat complexity, flood control practices, such as berms disconnecting floodplain habitat from the stream channel, and stream channelization. Compacted fine sediment and gravel and high turbidity further limit habitat throughout the whole system.

Squilchuck Creek, a perennial fish-bearing stream, runs through National Forest land to the west of the Project Area and proposed access road, and runs through culverts under the existing Mission Ridge Base Area parking lot. The fish-bearing portion of Squilchuck Creek is outside of the Project Area, and no ground disturbance or in-water work would be conducted in or near it. Intermittent headwater streams in the Stemilt Creek Subwatershed portion of the Project Area flow to Wheeler Reservoir/Orr Creek, a

tributary of Stemilt Creek. Figures 3-3 and 3-4 provide an overview of the Project Area showing the location of streams, stream type classifications, stream gradients, and riparian buffers.

The Biological Strategy to Protect and Restore Salmonid Habitat in the Upper Columbia Region classifies the Squilchuck Creek and Stemilt Creek as Category 4 streams due to fish passage barriers and intermittent stream flows that limit the distribution of anadromous salmonids, and likely isolate populations of inland trout. Category 4 watersheds contain both functional and non-functional habitats that historically supported populations of one or more federally listed species. Exotic species may now be dominant in one or more subwatersheds and native species are typically not present in sustainable numbers (RTT, 2003).

The Assessment Area contains habitat for: fish species listed under the Endangered Species Act (ESA), including Essential Fish Habitat (EFH) designated under the Magnuson-Stevens Fishery Conservation and Management Act; Forest Service Region 6 (R6) Sensitive Species and Management Indicator Species (MIS); and WDFW Candidate and Sensitive Aquatic Species. These species include:

- Chinook salmon – Endangered, MIS, EFH (NMFS, USFS)
- Coho salmon – EFH (NMFS)
- Steelhead – Threatened, MIS (NMFS, USFS)
- Interior Columbia Basin redband trout – Sensitive (USFS)
- Westslope cutthroat trout – MIS, Sensitive (USFS)
- Pacific lamprey – R6 Sensitive (USFS)
- Pygmy whitefish - R6 Sensitive (USFS)
- Leopard dace – Species of Concern (WDFW)
- Mountain sucker – Species of Concern (WDFW)

Squilchuck and Stemilt Creeks, particularly the lower reaches near the confluence with the Columbia River, contain habitat for fish species listed under the ESA and species for which Essential Fish Habitat has been designated under the Magnuson-Stevens Fishery Conservation and Management Act. There is no designated critical habitat for Chinook, steelhead trout or bull trout in the Assessment Area. Chinook, coho salmon and steelhead trout are expected to use Squilchuck and Stemilt Creeks at the confluence of the Columbia River and in the lower elevations below fish passage barriers. Because of the natural limiting factors, bull trout are not expected to be found in either creek. Resident rainbow trout/interior redband rainbow trout and Westslope cutthroat trout are expected to be found throughout the system, but are expected to be isolated populations with limited productivity due to limiting factors and passage issues (RTT, 2003). The steelhead listing does not include rainbow trout/interior redband rainbow trout, the non-anadromous freshwater form of *Oncorhynchus mykiss spp.*, which are under the jurisdiction of U.S. Fish and Wildlife Service. However, interior Columbia Basin redband trout are a Forest Service Region 6 Sensitive Species (USFS 2019).

Project Area

The Project Area overlaps a portion of the existing Mission Ridge Ski Area and adjoins the northeast border of the existing ski area boundary. The portion of the existing Mission Ridge Ski Area that is included in the Project Area contains a chairlift and ski runs on WDFW lands. Additional infrastructure within the Project Area includes: existing service roads, 3.6 miles of existing old roadbeds on private land that are not currently being used, and a 0.7 mile, 16 feet wide temporary road on Forest Service land. This temporary road lies within the footprint of the proposed access road and was constructed for vehicle access to conduct geologic site assessments to determine feasibility of the proposed access road route.

Habitat and topography in the Project Area are similar to the existing ski area with a mix of alpine meadows, primarily subalpine forest with some small areas of Douglas-fir and ponderosa pine, basalt

rock outcrops and talus. The Project Area is located within the East Cascades Slopes and Foothills Ecoregion. Elevations of the Project Area range from 3,100 feet at the junction with the existing Mission Ridge Base Area to 6,700 feet along the highest ridges in the greater Assessment Area. Aspect varies across the Project Area. The terrain is steep, with slopes varying from 0 to 78 percent, and the majority of the slopes less than 60 percent. The majority of the soil types within the Project Area consist of Stemilt silt loam series, rubble and rock outcrops, loneridge very stony loam series and naxing very stony loam series.

Snow retention areas above 3,000 feet and priority water storage areas have been identified within and adjacent to the Project Area (Figure 3-2; Trust for Public Land and CORE GIS 2008). These areas have five variables that are conducive to accumulating and retaining snowpack including: elevation, aspect, vegetation, precipitation and crown closure. According to the Stemilt-Squilchuck Community Vision report, important high snow retention areas were in areas at elevations above 3,000 feet with high to moderate precipitation. These areas had mostly vegetated lands with canopy closures over 60 percent and slopes less than 25 percent with northeast, east, north and northwest aspects, which have less sun exposure (Trust for Public Land and CORE GIS 2008).

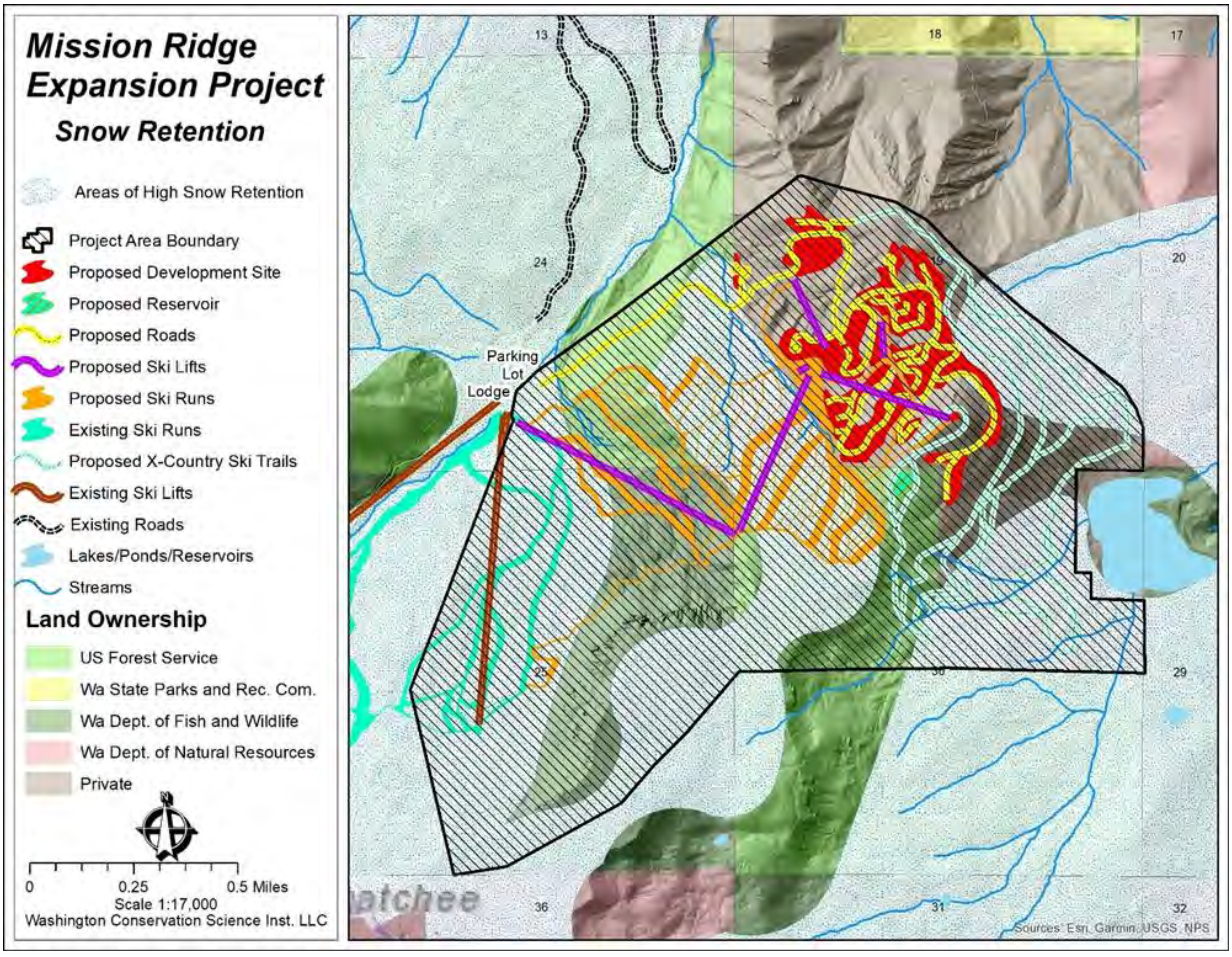


Figure 3-2. Identified areas of high snow retention in and adjacent to the Project Area.

The National Wetlands Inventory Map and Chelan County Wetland Inventory Map indicate Wheeler Reservoir and a number of intermittent streams within or in the vicinity of the Project Area. Wheeler Reservoir is located outside of the Project Area adjacent to the southeast corner of the Project Area. In early fall of 2017, a wetland inventory and delineation was completed for the Proposed Action. Two small

Category 3 emergent wetlands were identified and delineated on the northeast corner of the Project Area (Figures 3-3). Category 3 wetlands are wetlands with a moderate level of functions and can often be adequately replaced with a well-planned mitigation project.

The Project Area is generally dry with numerous ephemeral hydrologic drainage paths that terminate in perennial creeks on the west side of Section 19. There are approximately 90 acres of Riparian Reserve and riparian habitat associated with non-fish bearing perennial and intermittent streams and wetlands in the Project Area on National Forest land, WDFW land and private land. Riparian areas near streams consist of vegetation types such as elderberry (*Sambucus* spp.), bead lily (*Clintonia borealis*), sedges (*Carex* spp.) and mosses. A small, scattered aspen (*Populus tremuloides*) stand is located on the private parcel. A large (greater than 20 inches diameter at breast height (DBH)) tree and snag component is lacking. Much of the Project Area is even-aged, resulting from harvest activities in the mid-20th century. More than 250 acres are open, rolling, talus fields with little vegetation.

According to the Washington State Department of Natural Resources Forest Practices Application Review System (FPARS) mapping tool, field visits and the stream typing report conducted by Chelan County in 2017, two small non-fish bearing perennial streams are present within the Project Area. The creeks range from approximately two feet to five feet wide and less than one foot to two feet deep at the expected areas of both crossings. The majority of the other streams within the Project Area are considered steep, with gradients greater than 20 percent, which is considered a threshold for fish use (Figure 3-4; FPB, 2002; Washington Administrative Code, WAC-222-031).

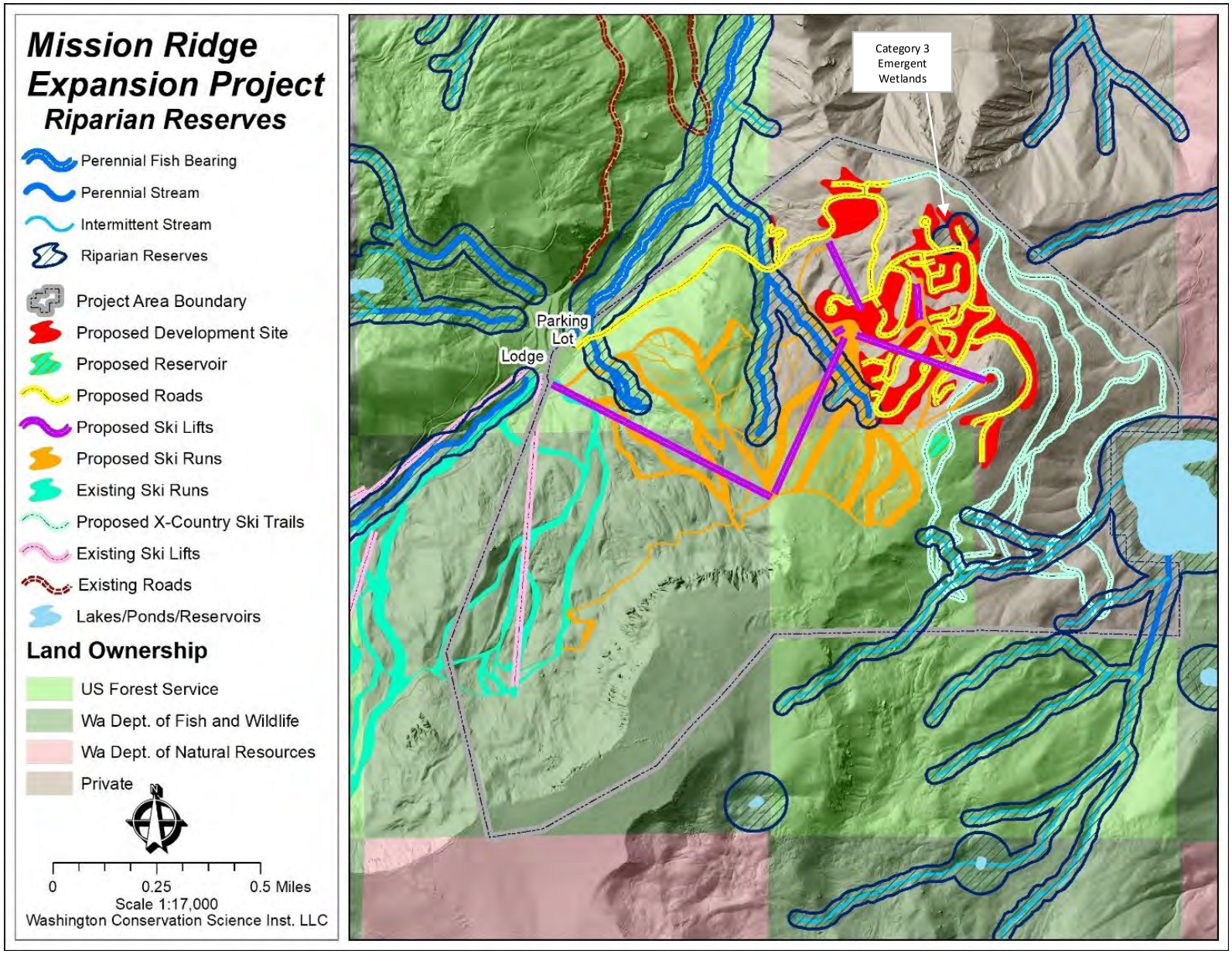


Figure 3-3. Riparian Reserves and Stream Types in the Project Area.

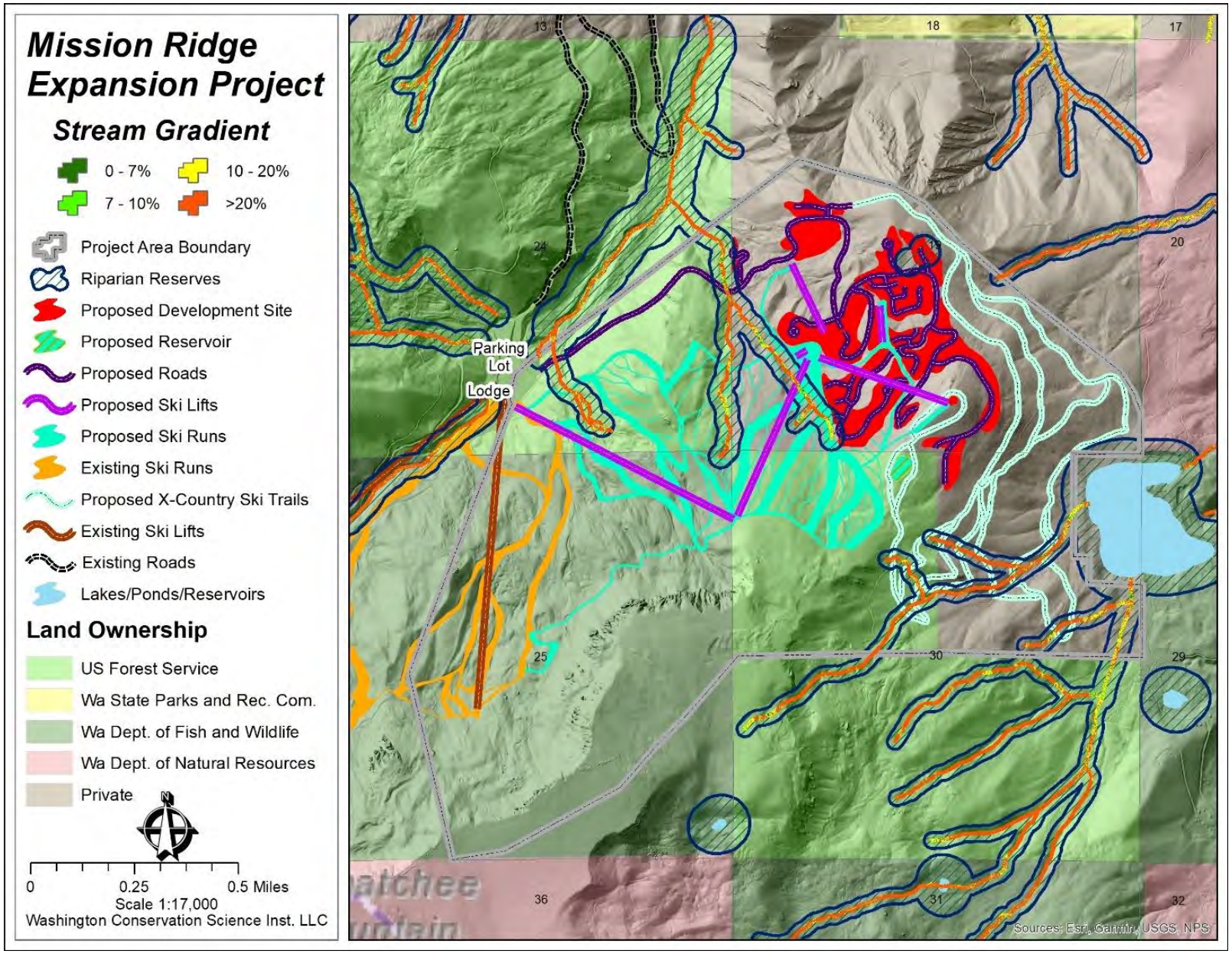


Figure 3-4. Riparian Buffers and Stream Gradients in Project Area.

According to the 2019 WDFW SalmonScape online mapping tool, both Squilchuck and Stemilt Creeks provide rearing habitats for Chinook salmon and steelhead at their confluences with the Columbia River, over 8 miles away from the Project Area. There is no designated critical habitat for Chinook, steelhead trout or bull trout in the Project Area or Assessment Area. There is no designated Essential Fish Habitat for coho and Chinook salmon in the Project Area or Assessment Area. There are no fish bearing perennial streams in the Project Area. Of the species listed above in the description of the Assessment Area, four may be found downstream of the Project Area in the fish bearing portion of Squilchuck Creek: steelhead, Westslope cutthroat, interior redband rainbow trout and mountain sucker. Steelhead would not be expected to be found near the Project Area boundary because of numerous fish passage barriers in the lower Squilchuck and a fish passage barrier culvert located over one mile downstream of the Project Area boundary on Forest Ridge Drive (WDFW, 2006, and Kelli Snodgrass, WDFW, personal communication 2019). Resident fish including Westslope cutthroat trout, interior redband rainbow trout and mountain sucker may be found in Squilchuck Creek within 400 feet of the Project Area boundary. Table 3-2 provides a summary of the species and designations that may be encountered in the vicinity of the Project Area.

Table 3-2: Species and federal and state status that may be in Squilchuck Creek downstream of the Project Area.

Common Name	Scientific Name	Population	Regulatory Agency Status
Steelhead	*Oncorhynchus mykiss*	Middle Columbia River Distinct Population Segment	NOAA / Threatened / MIS
Westslope cutthroat trout	*Oncorhynchus clarkii lewisi*	Washington	R6 Sensitive Species / MIS
Interior redband rainbow trout	*Oncorhynchus mykiss spp.*	Columbia Basin	R6 Sensitive Species
Mountain sucker	*Catostomus platyrhynchus*	Washington	WDFW / Candidate

<u>Steelhead (*Oncorhynchus mykiss*) - Threatened</u>

Steelhead are considered by many to have the greatest diversity of life history patterns of any Pacific salmonid species, including varying degrees of anadromy, differences in reproductive biology, and plasticity of life history between generations (Busby et al., 1996). Steelhead spend one to four years in freshwater and one to four years at sea; in Washington, a two year freshwater/two years at sea life history is most common (Steelquist, 1992). Because they can survive spawning, some can spawn a second or third time (Steelquist, 1992). Juvenile steelhead trout utilize estuaries as rearing and foraging habitat.

Steelhead are not expected to be found in the upper extent of Squilchuck Creek or the Stemilt Creek Subwatershed near or within one mile of the Project Area because habitat is naturally limited for anadromous salmonids in that area by steep gradients, stream channel size, and insufficient flows. While steelhead trout may be able to migrate past the full and partial fish barriers in the lower portions of Squilchuck Creek during high flow events, seasonal low flows and severely degraded habitat are expected to limit their productivity. In addition to numerous fish passage barriers in the lower portion of Squilchuck Creek, there is a fish passage barrier culvert on Forest Ridge Drive crossing of Squilchuck Creek over one mile downstream of the Project Area boundary (WDFW, 2006, and Kelli Snodgrass, WDFW, personal communication 2019). According to WDFW (2006), there are twenty-nine barriers downstream of this culvert and 10 barriers upstream of this culvert.

Interior redband rainbow trout (*Oncorhynchus mykiss*) – USFS R6 Sensitive Species
Interior redband rainbow trout are found east of the Cascades throughout the Columbia River basin and are considered a distinct species from coastal rainbow trout. Genetic analyses are the only methods to correctly identify them from coastal rainbow trout (Behnke, 2002). As with other trout populations, interior redband rainbow trout are expected to be in decline due to habitat degradation, pollution, altered stream flow, increased water temperatures and impacts from hatchery stocking of coastal rainbow trout throughout the Basin.

According to WDFW (2006), resident rainbow trout (the report did not distinguish between interior redband rainbow trout and rainbow trout) are found throughout the Squilchuck and Stemilt Creek Subwatersheds. The presence of interior redband rainbow trout in the upper extent of Squilchuck Creek downstream of the Project Area is unknown but they may be found in the upper extent of Squilchuck Creek 400 feet downstream of the Project Area boundary. However, there are no fish bearing streams in the Project Area; so they would not be found in the Project Area.

Westslope cutthroat (*Oncorhynchus clarkii lewisi)* -USFS R6 Sensitive Species / MIS
Westslope cutthroat trout are the native cutthroat trout species found east of the Cascades. There are three life history forms of Westslope cutthroat: resident (living in small streams), fluvial (migrating between small streams and large rivers) and lacustrine (living in lakes). Westslope cutthroat trout prefer streams and lakes with cold temperatures in areas not altered by extensive human development (Behnke, 2002).

According to WDFW (2006), Westslope cutthroat are found throughout the Squilchuck and Stemilt Creek Subwatersheds so they may be found in the upper extent of Squilchuck Creek 400 feet downstream of the Project Area boundary. However, there are no fish bearing streams in the Project Area; so they would not be found in the Project Area.

Mountain Sucker (*Catostomus platyrhynchus)* – WDFW State Candidate
Mountain sucker are found in high elevation mountainous areas in western North America. In Washington, Mountain sucker are only found in the Columbia River basin, east of the Cascade mountain range, in the Columbia River and its tributaries including the Cowlitz, Yakima, Wenatchee, and Palouse River basins (Wydoski and Whitney, 2003). Mountain sucker inhabit small mountain streams, generally less than 40 feet wide with summer water temperatures ranging from 12 to 21 degrees Celsius. They are small fish reaching up to nine inches in length and can live up to nine years. Preferred substrates are comprised of sand, gravel, and boulders. They can also be found in large rivers, lakes and reservoirs. In early to mid-summer, mountain sucker generally spawn in riffles below pools. Mountain sucker feed primarily on algae, diatoms and invertebrate larvae. They may provide a food source for other fish species, such a trout, and aquatic birds. In 1998, mountain sucker was listed as a state candidate species by WDFW because of lack of information on its distribution and status in Washington (Wydoski and Whitney, 2003).

The presence of mountain sucker in the upper extent of Squilchuck Creek downstream of the Project Area is unknown but may be found within 400 feet of the Project Area boundary. However, there are no fish bearing streams in the Project Area; so they would not be found in the Project Area.

Environmental Consequences
Direct, Indirect and Cumulative Effects

Climate Change and Aquatic Resources

For both alternatives (No Action and Proposed Action) discussed below, current and predicted climate change is expected to affect the hydrologic regime in the Cascade Mountains. Impacts from extreme weather events within the Project Area and larger Assessment Area would be adverse and could be short- or long-term causing minor to major impacts on Aquatic Resources.

Climate change in the Pacific Northwest is resulting in increasing air temperatures and nighttime warming, increasing frost-free season, decreasing snowpack, increasing stream temperatures, increasing heavy rain events or atmospheric rivers, rising sea levels, and increasing ocean acidification. Because of these changes, the ecosystems that salmonids and other Aquatic Resources rely on will be altered and populations may be negatively impacted (IPCC 2013; Snover et al. 2013; Mote et al. 2013; Crozier, L. 2013).

Heavier rains and decreasing snowpack, paired with declining spring snowpack melt and precipitation in summer months, will result in changes to seasonal stream flows that salmonids rely on for cool water, flood refuge, and habitat forming processes. Reduced summer flows, due to reduced water availability, will have negative impacts on rearing, foraging, and thermal refuge habitat provided by floodplains in pools, side channels, wetlands, and off-channel habitats. Reduced and increased flows may also impact migration timing for adult and juvenile salmonids, resulting in late upstream migration in adults and early downstream outmigration in smolts.

More intense and heavy rain events or atmospheric rivers will result in increased winter flood events with higher peak flows that can be harmful to many salmonid species during critical life history phases. Flooding can scour riverbeds and destroy eggs and developing fry. High flood flows can prematurely wash juveniles downstream before they are fully developed. These flood events will also increase the amount of sediments that are entering the river from glacial melt, landslides, and erosion.

Alternative 1 (No Action)

With No Action, the existing conditions of aquatic habitat and hydrology in the Project Area would not change and habitat found in Riparian Reserves would be expected to remain similar to the conditions described above and in the Section 3.22 Botany. Hydrology and water quality conditions would be expected to remain the same. There would be no change to critical habitat, essential fish habitat or ESA listed fish species.

Alternative 2 (Proposed Action)

For all of the following resource indicators, the following applies. Riparian Reserves and streams on National Forest and National Forest administrative lands, in both the Squilchuck Creek and Stemilt Creek Subwatersheds, would have established Riparian Reserve buffers to protect Aquatic Resources including: intercepting and slowing runoff, trapping and filtering sediment and contaminants to reduce erosion and sedimentation, and maintaining water quality, including stream temperatures. Riparian buffers would also be used to protect Aquatic Resources on private land. Stream crossings and ground disturbance would avoid all fish bearing streams regardless of land ownership. None of the streams in the Project Area or larger Assessment Area would be altered or rerouted to change drainage paths or capacity.

Resource Indicator: Stream Flow, Storage and Water Quality

Roads, trails and vegetation management in upland and riparian forests can influence the way water moves through a watershed and alter stream flow, storage, snow retention and water quality (Kittredge 1953, Ambach 1974, Golding and Swanson 1978, Stednick 1997, Sicart et al. 2004, NAS 2008, Varhola et al. 2010, Lawler and Link 2011, Lundquist et al. 2013). Research results vary, especially concerning how forest removal and thinning influence the timing and duration of snow retention and snow melt (Lundquist et al. 2013). Post project the road miles in the subwatersheds would increase from 332 miles to approximately 342 miles. Squilchuck Creek Subwatershed would increase by 0.3 miles per square mile to a road density of 5.5 miles per square mile and the Stemilt Creek Subwatershed would increase by 0.2

miles per square mile to a road density of 5.9 miles per square mile. The overall road density for both subwatersheds would go from 5.5 miles per square mile to 5.6 miles per square mile.

The existing stream drainage network (where roads can convey water to streams) influencing water flow across the Squilchuck Creek and Stemilt Creek Subwatersheds is 280 miles and 335 miles, respectively. Combined, the subwatersheds have an existing stream drainage network of 615 miles. Post project the stream drainage network in the Squilchuck Creek Subwatershed would increase by approximately 6 miles for a total of 286 miles and the stream drainage network for the Stemilt Creek Subwatershed would increase by approximately 4 miles for a total of 339 miles due to new roads. The total increase in stream drainage network in the subwatersheds due to new roads would increase by 10 miles for a total of 625 miles.

The Proposed Action would increase the total miles of road in the subwatersheds by approximately 10 miles, including the 0.9 miles of access road, 4.2 miles of resort roads, 2.9 miles of newly constructed Nordic trails (analyzed as if they are roads because of their width) and 1.8 miles of the new chair lift service road. The majority of the newly constructed roads would be in the Squilchuck Creek Subwatershed and could increase water flow and reduce water quality in the Project Area and upper portions of the subwatershed. Ground disturbance and vegetation alteration would also occur during development of ski runs and glades in the Squilchuck Creek Subwatershed on Forest Service, WDFW and Private land. Ground disturbance, vegetation removal and alteration, and increase in impervious area associated with the proposed resort development would be on Private land and mostly in the Squilchuck Creek Watershed and could have the potential to effect drainage to the west due to potential increase in stormwater runoff. When not covered in snow, use of unpaved Nordic trails could result in increased water flow and reduced water quality. Nonpoint source pollution due to the development and infrastructure could result in reduced water quality. These alterations of the landscape have the potential to increase water flow and reduce water quality across the Project Area and upper portions of the subwatersheds. Existing development in the Project Area, including the existing service roads, chairlift and ski runs on WDFW land, a 0.7 mile sixteen feet wide temporary road on the National Forest and existing roads on private land, have the potential to contribute to this increased water flow and reduction of water quality.

Portions of the Project Area have been identified for high snow retention (Figure 3-2). Priority water storage areas have been identified adjacent to the Project Area. These areas were also identified as important in the Stemilt-Squilchuck Community Vision report because of the routine snowmaking and snow compaction that occurs at the Mission Ridge ski area. Snowmaking and compaction of snow through grooming generally result in snowmelt occurring later then natural uncompacted snowpack, which could provide runoff and ground water infiltration to downstream areas later in the season. However, snow compaction and artificial snow can result in soil becoming and remaining colder and snowmelt occurring more rapidly (Fahey and Wardle 1998, Rixen et al. 2003). Rapid snowmelt could result in increased runoff and stream flow across the Project Area reducing storage and water quality. It is not expected that the Proposed Action would reduce the area of snow retention. Conversely, it may increase snow retention due to the increase in snowmaking. Snowmaking may increase the amount of snow available for melting which could increase runoff but snowmaking would be spread across multiple runs, as would snowmelt, and would not impact any one specific channel because it would disperse across the area.

Implementation of the Proposed Action would result in temporary short term effects to Aquatic Resources including vegetation and habitat loss and potential reduction in water quality during the time of construction and from 1 to 5 years after construction. Short term effects are further discussed below for each Resource Indicator. Permanent long term effects over 5 years would result from operations and infrastructure that remains in place; reducing the functionality of Riparian Reserve acreages in some

isolated areas as a result of the Proposed Action. Short term construction and long term operations and infrastructure impacts from increased stream flow and reduced storage and water quality would be ameliorated with the use of BMPs, design criteria and mitigation measures to reduce the risk of excessive runoff, erosion and sediment transport to streams, wetlands and Riparian Reserves. These measures would include, but are not limited to: developing and implementing a project specific stormwater prevention plan, including a spill prevention and response plan (SWPPP), use of silt fences, straw wattles, compliance with construction timing restrictions to work in low precipitation dry months, skidding downed trees over snow, and keeping excavated materials and equipment fueling and staging outside of Riparian Reserves. Seasonal closures on Nordic trails would prevent or limit trail rutting and erosion that can concentrate runoff and mobilize sediments resulting in increased flows and reduction in water quality in streams.

Additionally, all stream crossings would be designed with hydraulic capacity to pass the 100-year flood event and associated debris flow. Work conducted below the ordinary high water mark in these streams would be conducted during approved in-water work windows and the dry season. All roads and stormwater systems would be built and maintained to Chelan County road standards. Appendix B provides specific information for BMPs, design criteria and mitigation measures that would be employed to reduce impacts to Aquatic Resources. Design criteria, BMPs and mitigation measures were developed specifically to ensure the project activities would be consistent with the Forest Plan and the Clean Water Act.

Resource Indicator: Erosion and Sediment Supply

Aquatic habitats are structured by strong interactions among terrestrial and aquatic processes and climate (Bisson et al. 2003, Rieman et al. 2010). Increased and more frequent heavy rain events expected to occur with climate change can increase soil saturation, erosion and landslides. Erosion from road surfaces can increase streambed fine sediment, which affects aquatic habitat, macroinvertebrate populations, and fish spawning habitats (Luce and Black 1999, Wondzell 2001). Increased fine sediment can result in smothering of redds and juvenile salmon causing direct mortality or sub-lethal and behavioral effects similar to those caused by warm water temperatures. In addition, fine sediment from roads can make streambeds and banks more susceptible to erosion during high flow events (Luce and Black 1999, Wondzell 2001). Long term increased sediment loads can reduce channel capacity as a result of aggradation, which may increase stream bank erosion and flood risks.

There are approximately 322 miles of road in the subwatersheds (145 miles in Squilchuck Creek Subwatershed and 179 in Stemilt Creek Subwatershed). According to the 2018 Stemilt-Squilchuck Landscape Evaluation, the potential for sediment delivery from roads to streams within the Squilchuck Creek Subwatershed showed that 22 miles (15%) of road have a high potential to deliver sediment, 34 miles (24%) have a moderate potential, and 87 miles (61%) have a low potential. The potential for sediment delivery from roads to streams within the Stemilt Creek Subwatershed showed that 19 miles (10%) of road have a high potential to deliver sediment, 44 miles (25%) have a moderate potential, and 116 miles (65%) have a low potential. This analysis is similar to results for other subwatersheds showing that typically 10 to 15% of the road network has the greatest potential to deliver sediment to streams.

The Proposed Action includes the addition of new roads and trails in the Project Area. If no BMPs, SWPPP, or design criteria and mitigation measures were used, additional roads and trails would result in an increase of potential sediment delivery to the subwatersheds. Existing development in the Project Area, including the existing service roads, chairlift and ski runs on WDFW land, a 0.7 mile, 16 feet wide temporary road on National Forest land, and existing roads on private land, also have the potential to contribute to increased sediment delivery.

The majority of ground disturbance and habitat modification is proposed within the Squilchuck Creek Subwatershed. No work would occur on fish bearing perennial streams. Ground disturbance in the Stemilt Creek Subwatershed would not occur near or cross any fish bearing or non-fish bearing perennial streams, and proposed Nordic trails would not be near or cross any fish bearing or non-fish bearing perennial streams. Some Nordic trails would cross intermittent streams. Wheeler Reservoir is located adjacent to the southeast corner of the Project Area, well away from ground disturbance activities resulting from development and construction of roads. None of the 4.2 miles of smaller resort roads on private land would cross any type of stream or Riparian Reserve. All roads and stormwater systems would be built and maintained to Chelan County road standards.

Three stream crossings would be required over three non-fish bearing perennial streams in the Squilchuck Creek Subwatershed: two for the access road and one for the Chair 6 corridor and associated ski runs. The 0.9-mile access road (0.7 miles on National Forest land and 0.2 miles on private land) would require two stream crossings on two non-fish bearing perennial streams, one at each end of the route. Both of these crossings are on National Forest land. The riparian vegetation adjacent to the creek on the south end of the route is limited and restricted to a band within 25 to 50 feet of the stream at the point of the crossing. The crossing is approximately 400 feet upstream of the confluence with Squilchuck Creek. The riparian vegetation adjacent to the creek on the north end of the route is of higher quality and greater abundance and distribution. This crossing is approximately 1,500 feet from its confluence with Squilchuck Creek.

Ground disturbance associated with the Chair 6 corridor would include ski runs and creek crossings. The crossings for the Chair 6 lift corridor and associated ski runs is approximately 1,320 feet from the stream crossing on the north end of the access road. The Chair 6 lift corridor and associated ski run crossings are on a non-fish bearing perennial stream on private land. This stream is similar in nature to the streams along the access road. Vegetation removal and ground disturbance would occur during construction of chair lifts and grading of ski runs. Culverts would be installed on all ski run stream crossings.

Newly constructed Nordic trails would require crossings on four intermittent streams in the southeast corner of the Project Area on both National Forest and private land in the Stemilt Creek Subwatershed. Culverts would be installed on all Nordic trail stream crossings. Riparian vegetation along these intermittent streams is generally restricted to a band within five to 10 feet of the stream and includes herbaceous and woody vegetation surrounded by forested and open areas. Additional information on vegetation is provided in the Riparian Reserves section below and in Section 3.22 Botany.

None of the streams in the Project Area or larger Assessment Area would be altered or rerouted to change drainage paths or capacity. When not covered in snow, recreational use of unpaved Nordic trails could result in increased erosion and sedimentation.

Implementation of the Proposed Action would result in temporary, short-term effects to Aquatic Resources such as increased sediment delivery, erosion, and flow, decrease in water quality and loss of riparian vegetation and habitat during the time of construction and from 1 to 5 years after construction. Permanent, long-term effects over five years would result from operations and infrastructure that remains in place, reducing Riparian Reserve acreages in some isolated areas as a result of the Proposed Action. Short-term construction and long-term operations and infrastructure impacts from increased erosion and sediment supply would be ameliorated with the use of BMPs, design criteria and mitigation measures including, but not limited to: developing and implementing a project specific SWPPP, use of silt fences, compliance with construction timing restrictions to work in low precipitation dry months. Additionally, all stream crossings would be designed with hydraulic capacity to pass the 100-year flood event and associated debris flow. Work conducted below the ordinary high water mark in these streams would be conducted during approved in-water work windows and the dry season. Recreational use of Nordic trails

during wet periods could increase flows and erosion. Applying seasonal closures on Nordic trails would prevent or limit increase in flows, erosion and sediments, and reduction in water quality in streams. All roads would be built and maintained to Chelan County road standards. Additional information on impacts related to erosion and sediment supply are provided in Chapter 3.8 Soils. Appendix B provides specific information for BMPs, including meeting Washington State water quality criteria at compliance points both upstream and downstream of construction sites, design criteria and mitigation measures that would be employed to reduce impacts to Aquatic Resources.

Resource Indicator: Riparian Reserves

Intact forested riparian ecosystems are rich in biological diversity; however, many riparian ecosystems have been degraded by past management activities (Pollock and Beechie 2014). Forest management activities, such as timber harvest, fuels reduction treatments, roads, recreation and grazing that occur within Riparian Reserve and stream buffers can all influence the condition of riparian ecosystems. There are four major structural attributes associated with riparian forests that are essential to many aquatic and terrestrial species: large live trees, large snags, large down wood on the forest floor, and down wood in streams (Merten et al. 2013, Pollock and Beechie 2014). Riparian Reserves provide shade along streams to cool water temperatures. Riparian Reserves intercept runoff and trap and filter sediment and contaminants. Riparian Reserves intercept precipitation and slow runoff, which is critical for shallow groundwater recharge and wetland functions to provide sufficient baseflow conditions in streams during hot summer months.

There are approximately 90 acres of Riparian Reserve and riparian habitat in the Project Area. Riparian Reserves and riparian habitat in the Project Area are associated with non-fish bearing perennial and intermittent streams and wetlands on National Forest land, WDFW land and Private land. Technically Riparian Reserves are a federal land designation under the Northwest Forest Plan and riparian habitat acres on non-federal land can be analogous to designated Riparian Reserves in that they would be managed similarly and impacts to them would be mitigated using methods employed for designated Riparian Reserves on National Forest land, including: intercepting and slowing runoff, trapping and filtering sediment and contaminants to reduce erosion and sedimentation, and maintaining water quality and stream temperatures. Riparian buffers would also be used to protect aquatic resources on private land.

There are approximately 1.2 miles of non-fish perennial streams, 1.4 miles of intermittent streams and two Category 3 wetlands, both under one acre, in the Project Area on private land. Category 3 wetlands are wetlands with a moderate level of functions and can often be adequately replaced with a well-planned mitigation project. Mitigation for impacts to the Category 3 wetlands would be covered as part of the SEPA process. As a result of the Proposed Action, approximately 17.2 acres of Riparian Reserve would be impacted (7.2 acres on public land and 10 acres on private land; Table 3-3 and 3-4). This includes areas of Riparian Reserves impacted by the 0.7 mile sixteen feet wide temporary road on National Forest land because it is within the corridor of the proposed access road.

Table 3-3. Existing acreage of Riparian Reserve in the Project Area by ownership and estimated post project acreages of disturbed Riparian Reserve (permanent roads, pioneer roads, ski runs and glades, Nordic trails, ski lift infrastructure and resort development in Riparian Reserves).

Riparian Reserve Type (buffer width)	USFS	WDFW	Private	Total Pre Project	Total Post Project
Non-fish perennial (150 feet)	25.9 (5.8)*	1.4 (0.3)	27.1 (6.4)**	54.4 (12.5)	41.9
Intermittent (100 feet)	9.9 (1.1)	0	23.2 (1.4)	33.1 (2.5)	30.6
Wetlands <1 acre (100 feet)	0	0	2.5 (2.2)	2.5 (2.2)	0.3
Total	35.8 (6.9)	1.4 (0.3)	52.8 (10)	90 (17.2)	72.8

*Numbers in parentheses show estimated acreages of ground disturbance in Riparian Reserves.

**This disturbance includes 0.7 acres of the pioneer road on Chair 6 that would be decommissioned after use.

Table 3-4. Project Area ground disturbance acreages in Riparian Reserve by action and ownership.

Riparian Reserve Type	USFS	WDFW	Private	Total
Ski Lift Corridor (NFP)	0	0	0.7	0.7
Ski Run (NFP)	0.7	0.2	5.1	6.0
Glades (NFP)	0.7	0.1	0.6	1.4
Nordic existing (I)	0.6	0	0.7	1.3
Nordic new (I)	0.5	0	0.1	0.6
Access Road (NFP)	4.4	0	0	4.4
Resort Roads (I)	0	0	0.6	0.6
Resort Development Footprint (C3W)	0	0	2.2	2.2
Total Disturbance	6.9	0.3	10	17.2

NFP = non-fish bearing perennial streams
I = intermittent streams
C3W = Category 3 Wetlands less than one acre

Implementation of the Proposed Action would result in short-term effects to Riparian Reserves due to removal of vegetation and ground disturbance in or adjacent to Riparian Reserves. Long-term effects would occur in areas where vegetation would be permanently removed to accommodate resort development, the access road, resort roads, ski lift service road, ski runs, lift towers and piping, electrical, lift service and patrol buildings, glades, and Nordic trails. Long-term effects would occur in areas where vegetation in Riparian Reserves would not be restored or allowed to regenerate.

To maintain Riparian Reserve and riparian habitat condition and function, efforts would be made to site permanent infrastructure outside of Riparian Reserves when practical. Stream crossings and ground disturbance would avoid all fish bearing streams regardless of land ownership. In areas where vegetation would be permanently removed or not be able to fully recover, resulting in a permanent loss of Riparian Reserve, a restoration to disturbance acre ratio of 2:1 would be implemented to mitigate impacts to those

areas on public land resulting in approximately 14 acres of restored Riparian Reserve. Mitigation of permanently disturbed riparian habitat on private land would be mitigated per Chelan County code.

Implementation of the Proposed Action would result in temporary short-term effects during the time of construction and from 1 to 5 years after construction due to ground disturbance and vegetation removal. Permanent long-term effects over 5 years would result from operations and infrastructure that remains in place reducing the functionality of Riparian Reserve and riparian habitat acreages in some isolated areas as a result of the Proposed Action. Short-term construction and long-term operations and infrastructure impacts from increased erosion and sediment supply would be ameliorated with the use of BMPs, design criteria and mitigation measures including but not limited to: developing and implementing a project specific SWPPP, monitoring, and compliance with construction timing restrictions to work in low precipitation dry months. The functionality of Riparian Reserves, riparian habitat and streams would be protected by providing for erosion control during construction and operations by such methods as silt fencing, drainage relief, monitoring, and prompt, effective rehabilitation. Mitigation measures would include: seeding with native grasses, riparian vegetation plantings and implementing measures to reduce sedimentation into streams.

Additionally, all stream crossings would be designed with hydraulic capacity to pass the 100-year flood event and associated debris flow. Work conducted below the ordinary high water mark in these streams would be conducted during approved in-water work windows. Seasonal closures on Nordic trails would limit impacts from increased sediment delivery to Riparian Reserves. All roads and stormwater systems would be built and maintained to Chelan County road standards. Additional information related to impacts to riparian vegetation and function is provided in Section 3.22 Botany. Appendix B provides specific information for BMPs, design criteria and mitigation measures that would be employed to reduce impacts to Aquatic Resources.

Resource Indicator: Fish Species and Habitat

No fish bearing streams exist in the Project Area. No ESA listed fish, designated critical habitat or essential fish habitat exists in the Project Area. No in-water work or ground disturbance would occur in fish bearing streams or Riparian Reserves associated with fish bearing streams.

Implementation of the Proposed Action could result in short-term effects to Squilchuck Creek downstream of the Project Area due to potential sedimentation and increased turbidities resulting from construction of the access road and its two stream crossings on non-fish bearing perennial tributary streams, although most of these impacts would be mitigated with the application of BMPs, mitigation measures and design criteria. Potential turbidity reaching Squilchuck Creek is unlikely because of BMPs, design criteria and mitigation measures. Potential impacts would be further diminished because of fish passage barriers that would preclude steelhead and other fish species from entering the Assessment Area downstream of the Project Area. Work conducted below the ordinary high water mark in streams in the Project Area would be conducted during approved in-water work windows, and all erosion and pollution control BMPs, including construction methods required to meet Washington State water quality criteria at compliance points both upstream and downstream of construction sites, design criteria and mitigation measures, and a project specific SWPPP would be employed. Long-term effects, such as permanent removal of riparian vegetation and habitat, would be mitigated by the restoration of degraded Riparian Reserve acreages (2:1 ratio) designed to help off-set direct impacts to Riparian Reserves from the Proposed Action. Mitigation of permanently disturbed riparian habitat on private land would be mitigated per Chelan County code. Additionally, all stream crossings would be designed with hydraulic capacity to pass the 100-year flood event and associated debris flow. All roads and stormwater systems would be built and maintained to Chelan County road standards.

There would be no effect on steelhead because there are no fish bearing streams in the Project Area and steelhead are not expected to be encountered within one mile of the Project Area boundary due to fish passage barriers and degraded habitat. There would be no effect to steelhead designated Critical Habitat because it is over eight miles away from the Project Area.

Westslope cutthroat trout (R6 Sensitive Species) may be encountered in the upper extent of Squilchuck Creek 400 feet downstream of the Project Area boundary. The Proposed Action may impact individual fish and habitat (MIIH) due to increased sediment or reduced water quality within one mile, but not at a level that would contribute to a trend towards federal listing or loss of viability to the population or species. Westslope cutthroat are also a Forest Service MIS. The Proposed Action may result in a small negative impact (SNI) within one mile downstream of the Project Area resulting in a small negative trend of habitat, but insignificant at the scale of the OWNF. Interior Columbia Basin redband rainbow trout (R6 Sensitive Species) may be encountered in the upper extent of Squilchuck Creek 400 feet downstream of the Project Area boundary. The Proposed Action may impact individual fish and habitat (MIIH) within one mile of the Project Area boundary, but not at a level that would contribute to a trend towards federal listing or loss of viability to the population or species. The Proposed Action may have a similar impact determination to mountain sucker because they may be encountered 400 feet downstream of the Project Area boundary.

Direct, Indirect and Cumulative Effects Summary

The spatial boundary for analyzing the direct, indirect and cumulative effects to Aquatic Resources is the Squilchuck Creek Subwatershed and the Stemilt Creek Subwatershed, including public and private lands. The temporal boundary is from the time of implementation of the Proposed Action to fifty years into the future; the time when build-out of the resort would be complete and active use, operation and maintenance would occur. No fish bearing perennial streams are in the Project Area. Therefore, there would be no cumulative impacts to fish or fish habitat in the Project Area. Region 6 Sensitive Species fish and fish habitat within one mile may be impacted, but not at a level that would contribute to a trend towards federal listing or loss of viability to the population or species. For Forest Service Management Indicator Species, a small negative impact may occur within one mile downstream of the Project Area, resulting in a small negative trend of habitat, but insignificant at the scale of the OWNF.

When not covered in snow, use of unpaved Nordic trails, roads and ski runs could result in increased sediment transport and runoff to streams through erosion and sedimentation. BMPs, including developing and implementing a project specific SWPPP, and seasonal closures would limit or prevent sediments from reaching streams. Additional roads, trails and bare earth results in an increased stream drainage network conveyed through culverts and ditches, reducing opportunities for infiltration. This could increase high stream flows during snowmelt and storms and reduce water quality and groundwater recharge, which can reduce stream flows in hot summer months. BMPs, including developing and implementing a project specific SWPPP, and seasonal closures would limit or prevent increased runoff from reaching streams.

The Project Area constitutes 0.9% of the subwatersheds geographic area and contains approximately 90 acres of Riparian Reserve and riparian habitat. There are approximately 37 acres of Riparian Reserve on public land and approximately 53 acres of riparian buffers on private land. The Proposed Action would potentially result in ground disturbance and vegetation loss on approximately 17.2 acres of riparian habitat: 7.2 acres of Riparian Reserve on public land and approximately 10 acres of riparian habitat on private land. Although these areas fall within riparian designations (Riparian Reserve on public land and Riparian Buffer on private land) not all habitat within the buffer would be classified as riparian due to the topography and swift transition to upland habitat types in some areas. The Proposed Action would not result in a substantial change in stream flow, storage, erosion, sedimentation, water quality or Riparian Reserve acreage in the subwatersheds. Short-term construction and long-term operations and

infrastructure cumulative impacts would be minimized with the use of BMPs, design criteria and mitigation measures summarized in this document and provided in Appendix B. Design criteria and mitigation measures were developed specifically to ensure the project activities would be consistent with the Forest Plan and the Clean Water Act. Impacts to Riparian Reserve on public land would be off-set by restoration of other Project Area Riparian Reserve acres (2:1 ratio) that are currently degraded. Mitigation of permanently disturbed riparian habitat on private land would be mitigated per Chelan County code.

Regarding cumulative effects, there are ongoing and foreseeable projects, not associated with the Mission Ridge Expansion Project, occurring throughout the Squilchuck Creek and Stemilt Creek subwatersheds on private, county, state and federal lands that may add to the direct and indirect effects of the Proposed Action. These projects include the following: Mission Ridge Ski Area operations, maintenance, snow making and grooming, commercial and residential development, vegetation and fuels reduction treatments, road and trail construction and maintenance, noxious weed treatments, timber harvest, firewood collection, trail construction, recreation, and hazard fuels reduction plans. The Travel Management Plan for motorized recreation on the Okanogan-Wenatchee National Forest would also result in cumulative effects to Aquatic Resources in the subwatersheds.

See Section 3.1 Potential Impacts and Section 3.7 Recreation for a comprehensive list and description of Past, Present and Reasonably Foreseeable Future Actions that would contribute to cumulative effects for Aquatic Resources in the Project Area and larger Assessment Area.

Forest Plan Consistency

Northwest Forest Plan Aquatic Conservation Strategy Riparian Reserves

National Forest Lands within the Northwest Forest Plan area are to be managed to attain nine Aquatic Conservation Strategy (ACS) objectives (1994 ROD page B-11). The Project Area encompasses approximately 37 acres of Riparian Reserves on public land of which 7.2 acres would be impacted by the Proposed Action. Riparian Reserves are an important component of the ACS in the Northwest Forest Plan. In Riparian Reserves, management is to emphasize the protection and restoration of riparian dependent resources, functions, and processes. The Proposed Action BMPs, design criteria and mitigation measures were designed so the project would be consistent with the ACS at the Project Area and Assessment Area scales. No work would occur on large fish bearing perennial streams. Construction associated with the Proposed Action would occur in specific areas of small non-fish bearing perennial and intermittent streams and associated Riparian Reserves. In areas where vegetation would be permanently removed or not be able to fully recover, resulting in a permanent loss of Riparian Reserve, a restoration to disturbance acre ratio of 2:1 would be implemented to mitigate impacts to those areas on public land, approximately 14 acres. Design criteria and mitigation measures were developed specifically to ensure the project activities would be consistent with the Forest Plan and the Clean Water Act and would not result in the streams being listed on Washington State Department of Ecology's (Ecology) 303d list for impaired waterbodies. The project as proposed would not measurably retard or prevent attainment of the nine ACS Objectives. Consistency with ACS objectives is described in Appendix D.

3.22 Botany

Methods

For analysis of the botanical resources affected by the Mission Ridge Expansion Project, the entire Project Area was analyzed for direct and indirect effects. Connected actions on WDFW and private land were also described. Of the 1,090-acre Project Area, National Forest comprises 293 acres, WDFW 363 acres, and private land 434 acres (see Figure 2-3). However, botanical field surveys were only conducted on National Forest and WDFW land.

Current vegetation types were obtained from mapping completed for the Stemilt-Squilchuck Landscape Evaluation, which involved the interpretation of recent, high-resolution imagery (Gaines et al. 2019). Field surveys confirmed these data.

The Northwest Forest Plan requires pre-disturbance surveys and protection of certain plant, bryophyte, lichen, and fungi taxa known as Survey and Manage taxa. These species are largely dependent on old-growth or late-successional forest stands. The Stemilt-Squilchuck Landscape Evaluation (Gaines et al. 2019) and field surveys found no potential habitat for these species in areas planned for ground disturbance, so Survey and Manage taxa were not further considered in this analysis.

Prior to field surveys, a list of rare plant and fungi taxa (threatened, endangered, Region 6 Sensitive, and Survey and Manage) and habitat areas of concern that may occur in the Forest Service managed and other public lands in the Project Area vicinity was prepared (Appendix F). The list was created by consulting a combination of species lists and spatial data sets and evaluating the suitability of potential species' habitats based on in the Washington Natural Heritage Program's Rare Plant Field Guide (Table 3-5; https://www.dnr.wa.gov/NHPfieldguide).

Table 3-5. Species lists and spatial data sets consulted to create list of potential plant and fungi species and habitats of concern in vicinity of the Project Area.

Data Set	Criteria
Forest Service Region 6 Regional Forester Special Status Species List. Published February 25, 2019	Species detected or suspected in Okanogan-Wenatchee National Forest
Arnett, Joseph. 2012. Review of Endemic Plants of the Wenatchee Mountains and Adjacent Areas.	Species with a habitat similar to that of Project Area
Washington Natural Heritage Program. Current Element Occurrences. ESRI shapefile. Downloaded Feb 28, 2019.	Occurrences found within 10 miles of Project Area
Washington Natural Heritage Program. List of Known Occurrences of Rare Plants and Mosses in Washington. Compiled on April 3, 2018.	Species in Chelan County
USDA PLANTS database. Advanced Search. Accessed April 4, 2019.	Species with a state or federal status and with range including Chelan County
Washington Department of Fish and Wildlife Priority Habitat and Species. Map and Report. Accessed April 11, 2019. (http://apps.wdfw.wa.gov/phsontheweb/)	Priority habitats and species within 1,000 feet of Project Area
Wetlands of High Conservation Value Map Viewer. Accessed 2019 Feb 28. (https://www.dnr.wa.gov/NHPwetlandviewer)	Wetlands within 0.5 miles of Project Area
Washington Natural Heritage Program information request. Requested May 3, 2019.	Species with 5 miles of Project Area

To inventory plants and fungi, botanical field surveys by qualified botanists were completed in a 50-foot buffer around all areas where vegetation disturbance is proposed, including: alpine ski runs, gladed areas between ski runs, Nordic trails, chairlift lines, chairlift terminals, water reservoir, and roads. Surveys were

conducted on National Forest and WDFW lands in the Project Area. Botanists conducted focused/intuitive controlled surveys, in which the surveyor walked through and around the entire survey area to find and intensively target potential suitable habitat of sensitive species. These areas included: rock outcrops, cliffs, talus slopes, exposed ridges, streams, bogs, meadows, seeps, and other unusual microsites. Botanists identified all species encountered, searching especially for species on the prepared list of potentially-present plant and fungi species. When listed or sensitive species were found, botanists mapped occupied habitat using GPS units. Mapping of occurrences was guided by Habitat-based Plant Element Occurrence Delimitation Guidance (NatureServe 2004). Surveys were conducted between May 30 and July 12, 2019.

Selection of Resource Indicators

Four indicators for botanical resources were selected to ensure the Mission Ridge Expansion Project is consistent with Forest Plan standards and guidelines and in response to project scoping.

Resource Indicator: Rare Species

The first, rare species, was selected because federal law and applicable Forest Service plans and manuals require the protection of threatened, endangered, proposed and sensitive species with any management activity. By surveying for and monitoring the abundance and condition of rare species, it can be ensured they will not be detrimentally impacted by proposed activities. In some cases, species can be better protected by enhanced awareness of their proximity to proposed activities.

Resource Indicator: Unique Habitat

Unique habitat was also selected as a resource indicator because of the Forest Plan directive to maintain biodiversity in the National Forest. Unique habitats support plant, lichen, and fungus species that do not thrive in more common habitat. They thus contribute to biodiversity in a Project Area and considering impacts to them will inform project outcomes regarding biodiversity goals.

Resource Indicator: Large Trees

Large trees was selected as a resource indicator because of the Large and Old Tree Forest Policy enacted in 2010 (USFS 2010) that directs the Forest to restore large and old tree structure by retaining trees >20 inches diameter at breast height in quantities varying by plant association and structure class. Such trees exist in the Project Area.

Resource Indicator: Traditional Plants of Concern

Finally, traditional plants of concern was included in response to a scoping letter from the Confederated Tribes of Colville Reservation requesting consideration of culturally-important plants. Surveying for and considering these native taxa can help protect these native taxa traditionally used by the Confederated Colville Tribes.

Existing Condition

General Vegetation Characteristics

The Project Area at Mission Ridge is located on the eastern slopes of the Cascade Mountains in central Washington. It is located in the Yakima Plateaus and Slopes Level 4 Eco-region within the Eastern Cascades Slopes and Foothill Level 3 Eco-region (U.S. Environmental Protection Agency 2011). While these Eco-regions, such as ponderosa pine, are generally characterized by vegetation adapted to a dry, continental climate, and frequent fire, the northerly aspect and topographic location of the Project Area result in more mesic and subalpine variations in the plant community and a different historical fire regime.

The Project Area is also located within an area of high botanical diversity called the Wenatchee Mountains. The Wenatchee Mountains contain many species endemic to the state of Washington and are of particular interest to botanists and conservationists.

The 1090-acre Project Area consists of 73% cold forest and 27% talus on ridges, slopes, and drainages (Gaines et al. 2019).

Forest overstory species and characteristics are driven by aspect and elevation. The majority of the forested area has a northeast to northwest aspect and is dominated by western larch and Douglas' fir. Areas with this same aspect but lower in elevation have a substantial component of lodgepole pine. These forests are quite dense with a nearly closed canopy and have very high amounts of downed woody debris and little shrub and herbaceous understory. They have an understory re-initiation or young forest multi-story structure and large trees of the 16-25" size class. No cut stumps indicating historical timber harvesting were observed in the National Forest, suggesting a history of stand-replacing wildfire sometime in the last century. In contrast, stumps and old logging roads on the private parcel suggest the forest there was harvested between 50 and 100 years ago. Elsewhere, forests on south or west-facing slopes are dominated by ponderosa pine and Douglas' fir and have a more open canopy with much less downed woody debris. Shrubs and herbs are moderately abundant and diverse. Grassy meadows are interspersed with this forest type in the far eastern portion of the Project Area, where the largest trees have diameters larger than 25". Evident mistletoe brooms in a portion of Douglas' fir trees throughout the Project Area suggest widespread, moderate infection by dwarf mistletoe (a parasite), likely an outcome of the forest species composition and stem densities resulting from recent fire exclusion (Hadfield et al. 2000).

Talus areas consist primarily of slopes of variously sized, basalt-derived rocks that have sloughed from nearby cliffs. While most of these areas lack vegetation, there are numerous small pockets of vegetation that include *Abies lasiocarpa* (subalpine fir), *Purshia tridentata* (bitterbrush), *Potentilla glandulosa* (sticky cinquefoil), and *Arnica latifolia* (mountain arnica).

Throughout the Project Area, stream drainages, rock outcrops, and ridges add variation to the plant communities described here (Figure 3-5). For example, an exposed ridge running northeast through the Project Area supports plant species adapted to dry, open conditions with shallow, sandy soils. As such, the herbaceous community on the ridge is very different than that in the forest or on talus. Other unique habitats are described in Resource Indicator: Unique habitat.

Along with the forest and talus, these plant communities make the Project Area more botanically diverse than may be suggested by satellite imagery or the vegetation types of the landscape evaluation. Indeed, 207 vascular plant taxa were observed during field surveys, with 96 observed on the exposed ridge (not a complete census of the flora; species list in Project Record).

Resource Indicator: Rare Species

One rare species was found during botanical field surveys in the National Forest and WDFW land of the Project Area: whitebark pine (*Pinus albicaulis*). As of this writing, whitebark pine is a Forest Service sensitive species and a candidate for federal listing as threatened or endangered.

Surveyors observed 73 whitebark pine stems on National Forest and another 88 on adjacent WDFW land (Figure 3-Botany-new-WBP). It is unknown if whitebark pine is present on the private parcel. These include all stems that emerge from the ground, regardless of proximity to others, and all stems growing approximately vertically that branch below breast height (1.3 m). Many observed stems grew in clusters. As the result of the Clark's nutcracker's seed-caching habits, clustered stems are typically full siblings, half siblings, or self-pollinated, while neighboring clumps are not closely related (Fryer 2002).

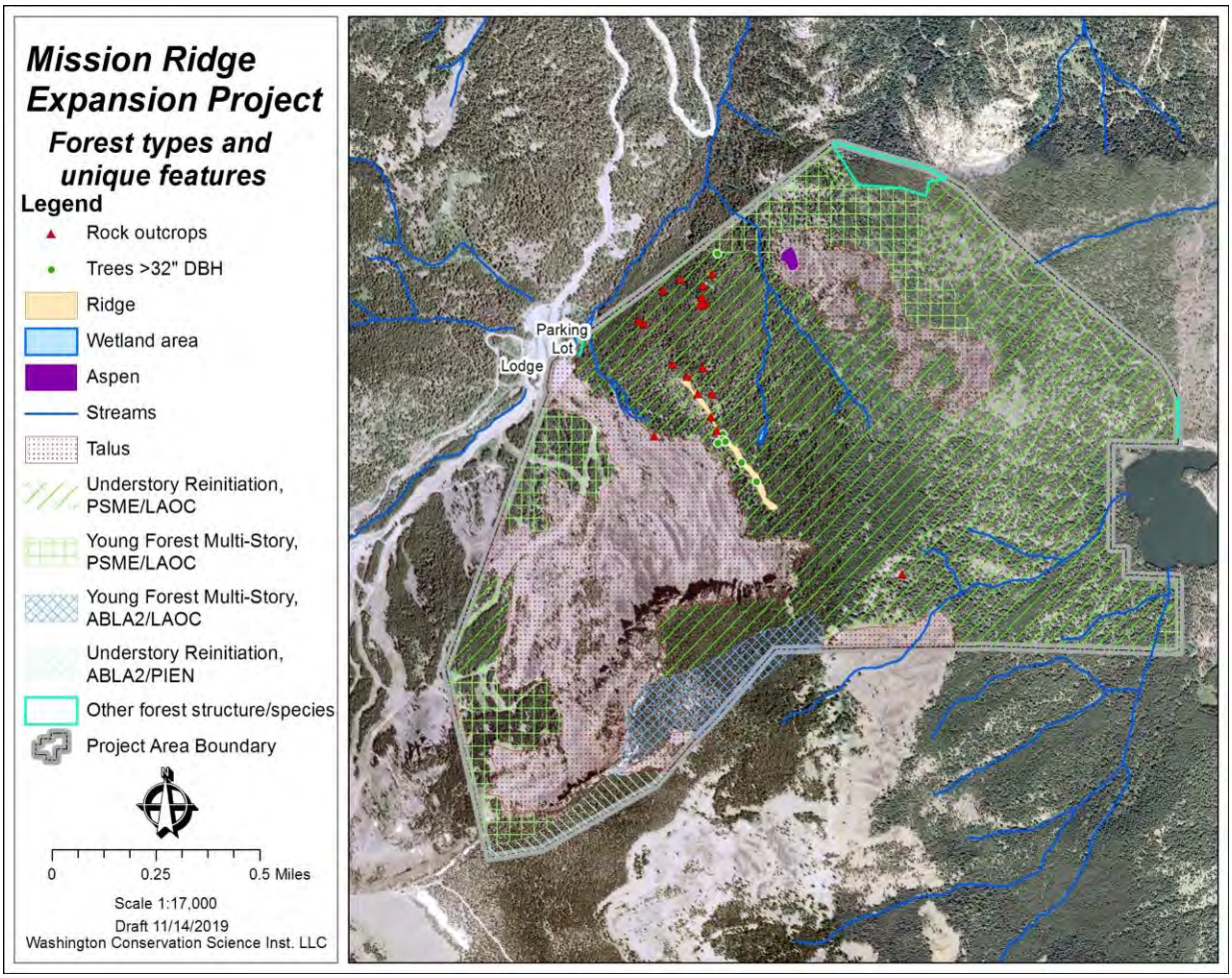


Figure 3-5. Forest type, talus, and unique plant community features in the Project Area. Forest type includes forest structure and dominant overstory species. Rock outcrops, a central ridge, a wetland area, aspen, and riparian zones along streams represent areas of unique biological diversity in the largely forested Project Area. Documented trees >32" in diameter at breast height are also displayed. Vegetation types obtained from Stemilt-Squilchuck Landscape Evaluation by Gaines et al. (2019).

Stems ranged in size from seedlings to trees up to 19.1 inches in diameter at breast height. None of the stems closely inspected (12% were not inspected) bore female cones in the year of observation, but cones are not typically produced annually (Arno and Hoff 1989, Fryer 2002). A mast cone crop observed elsewhere in the National Forest in recent years suggests that 2019 was not a cone-producing year for the trees Just over half of stems were assessed as “healthy” (>90% green needles, <25% dead branches, <3 wounds), 22% “moderately healthy” (>40% green needles, <50% dead branches, <5 wounds), and 11% “unhealthy” (exceeding “moderately healthy”), with 12% not assessed. About 8% had apparent cankers and 20% flagging likely due to white pine blister rust. Current threats to the existing trees include blister rust, fire exclusion, climate change, wildlife damage, and, for those in the existing ski area, damage from snow-grooming equipment (USFWS 2016).

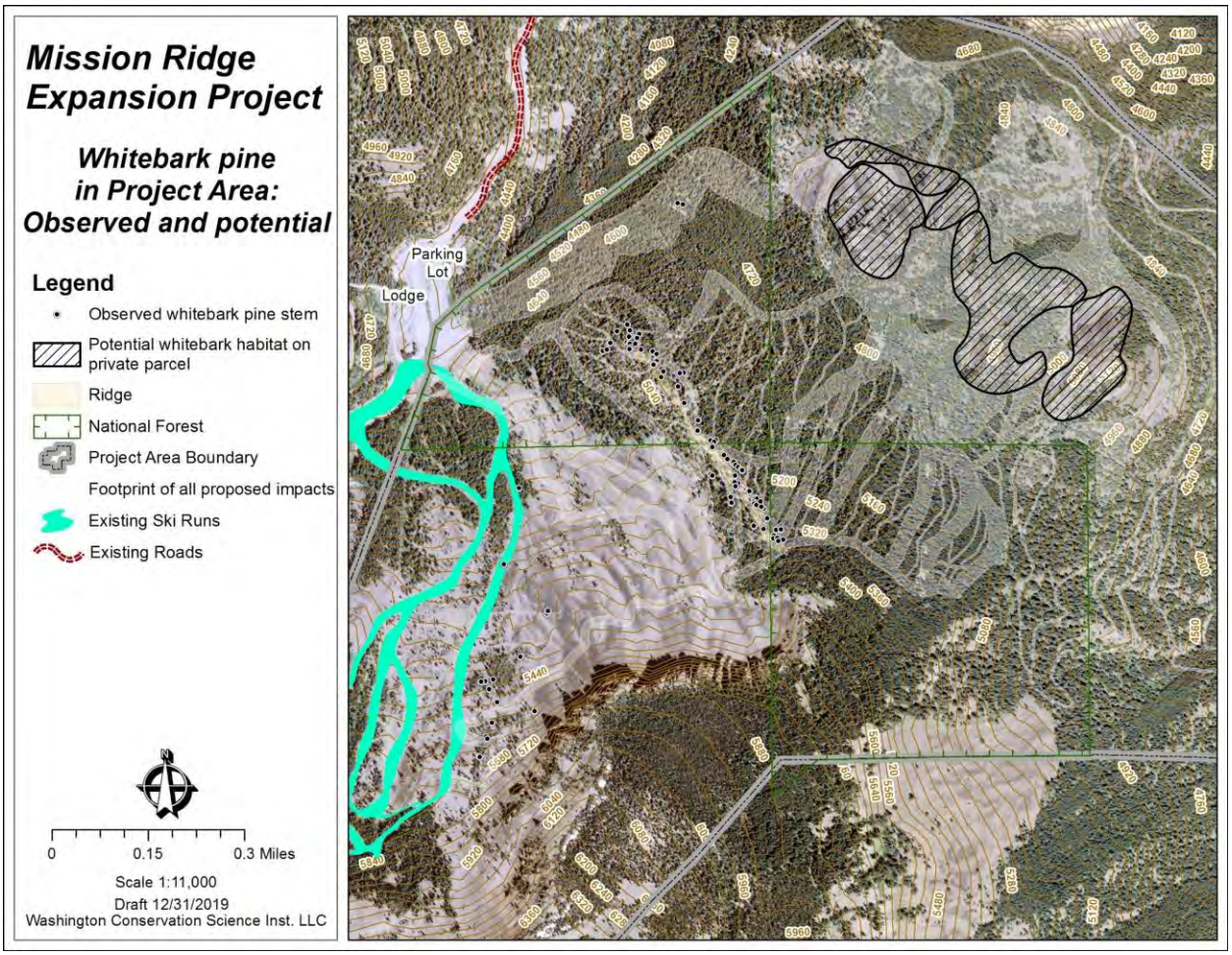


Figure 3-6. Whitebark pine stems observed during surveys of the National Forest and WDFW land, and suspected areas of potential whitebark pine habitat on the private parcel at Mission Ridge.

Whitebark pine were observed in exposed locations at elevations lower than reported in the literature. In the nearby Stuart Range, whitebark pine are common between 5,300 and 8,000 feet (Arno and Hoff 1989), and a 2006 analysis of Forest Service Current Vegetation Survey data showed a lower elevational limit of 4,800 feet in the Cascades (Ward et al. 2006) . In the Project Area, stems were found between 4,502 feet and 5,620 feet (Figure 3-7). Stems at low elevations such as these have also been reported in the Chelan, Entiat, and Methow Districts by Forest Service personnel (Brigitte Ranne, pers.comm.). It may be that these relatively low-elevation whitebark pine stems are rarely documented and are more common in the region than reported in the literature.

Surveyors found whitebark pine on an exposed ridge, rock outcrops in forest, and talus (Figure 3-6). On the ridge, where 84% of the stems were found, they were primarily located along the shoulder of the northeast-facing hillslope. This growing area was about 4.9 acres in size. The ridge itself consists of rock outcrops and sandy, decomposing rock with short-statured herbaceous and woody plants, and quickly transitions to dense forest of Douglas' fir and western larch as the hillslope descends. An inventory of all vascular plants within 50 feet of all observed whitebark pines revealed 96 species that included species tolerant of both the sandy ridge and dense forest (list in Project Record). Away from the ridge, stems were found in small vegetated patches among talus and on rock outcrops in forest. Stems amidst the talus were of various sizes, while those on rock outcrops were seedlings.

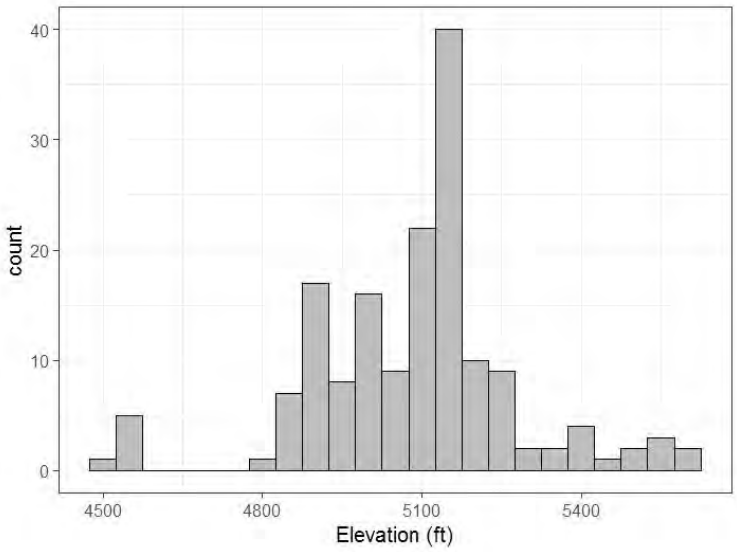


Figure 3-7. Histogram of elevations at which whitebark pine were observed in the Project Area. The species was observed at elevations lower than typical for the region. All 161 stems are represented.

Based on topography, vegetation patterns, and drone footage, it is highly likely that whitebark pine is also present on the private parcel. Drone footage shows what appear to be fairly large 5-needle pine trees (footage is not detailed enough to identify the species with certainty) in vegetated patches among talus and along the northwest-oriented shoulder and slopes of a small 5,130-foot summit (Figure 3-6). These locations are similar to those of documented stems, though slightly lower in elevation. Stems appear to be medium to large trees; the presence of smaller trees, saplings, and seedlings is also likely. Stems appear sparse and localized and are estimated to number 20-60.

In addition to the stems in the Project Area, whitebark pine is known to be abundant on the plateaus and slopes above the existing ski area. The habitat area is about 1,300 acres and includes National Forest and land managed by WDFW. On-going Forest Service monitoring reports that the population is extensive and relatively healthy, with a 27% blister rust incidence on live trees and sporadic mountain pine beetle activity. Cone collections and tests have revealed several “elite” trees for rust resistance. These trees are favored for restoration work.

Regionally, whitebark pine is scattered throughout the Cascades in Washington on peaks and ridges (Ward et al. 2006). In addition to the Mission Ridge population described above, there is another small population 6 miles west. These two populations are somewhat isolated from the main Cascade distribution, which lies 17 miles northwest of Mission Ridge. The whitebark pine in the Project Area is unique in its low elevation in relation to the species’ general distribution and its low apparent susceptibility to blister rust.

Whitebark pine is in decline throughout its range in high-elevation ecosystems in western North America, including in the Washington Cascades. Mortality is due to white pine blister rust infection and mountain pine beetle outbreaks, with fire exclusion and a warming climate exacerbating the problem (Fryer 2002).

Resource Indicator: Unique Habitat

Several habitat types different from the common forest and talus in the Project Area were observed during botanical field surveys: a central ridge, rock outcrops, a wetland area, and riparian zones. No rare species other than whitebark pine were observed in these areas.

The sandy ridge running near the center of the Project Area differs in plant community and soil characteristics from the surrounding forest and talus (Figure 3-5). Overstory trees are sparse along the ridgeline, resulting in a largely open canopy. The open canopy, combined with the decomposing sandstone parent material with a nearly absent organic layer, results in a plant community adapted to shallow soils and drought conditions. Taxa uncommon to closed forests, such as species of *Poa* and wheatgrass, *Chaenactis douglasii* var. *douglasii* (Douglas' dustymaiden), *Purshia tridentata* (antelope bitterbrush), and *Juniperus communis* (common juniper), are characteristic.

Twenty rock outcrops were documented found along the central ridge and scattered on forested slopes (Figure 3-5). They appear to be exposed basalt bedrock. Most harbor taxa of plants and lichen adapted to open canopy and shallow soils similar to the central ridge, including, on occasion, whitebark pine (see Resource indicator: Rare species). Other outcrops are shaded by forest canopy and harbor *Acer glabrum* (Douglas' maple), *Potentilla glandulosa* (sticky cinquefoil), and *Polemonium californicum* (low Jacob's ladder).

One wetland area on National Forest was documented during field surveys near the center of the Project Area (Figure 3-5). This palustrine (i.e., inland and shrubby) emergent wetland (identified based on preliminary observations because a formal wetland delineation was not conducted; Federal Geographic Data Committee 2013) exists in a broad depression around a stream flowing down a north-facing, forested slope. There are two small elk wallows and signs of previous human activity including two cut stumps and an old fence post. Herbaceous vegetation such as *Equisetum arvense* (field horsetail), *Senecio triangularis* (arrowleaf ragwort), and *Dodecatheon dentatum* (white shootingstar) dominates, while some woody species are present in lower abundance, including *Rhododendron albiflorum* (Cascade azalea), *Ribes lacustre* (prickly currant), and *Salix* sp. (willow). Two orchid species, *Platanthera dilatata* var. *dilatata* (scentbottle) and *Platanthera stricta* (slender bog orchid) were observed. A list of all observed species can be found in the Project Record.

Riparian zones surrounding streams were observed throughout the Project Area (Figure 3-5). Riparian species such as *Ribes lacustre* (prickly currant), *Saxifraga odontoloma* (brook saxifrage), and *Salix* sp. (willow) are common in these areas, where surface water flows through rocky and sandy substrates.

On the private parcel, there are two small wetlands and a 0.9-acre aspen stand. The wetlands were delineated in September 2017. These emergent wetlands have seasonal hydrology and are dominated by sedges. They are surrounded by ponderosa pine forest. The aspen stand is located in upland habitat and grows on talus at least 16 inches deep. Aspen (*Populus tremuloides*) typically support a diverse understory of shrubs and herbs, provide habitat for a variety of insects, birds, and mammals, and have a high aesthetic value (Debyle and Winokur 1985, Hadfield and Magelssen 2004).

All of these unique habitats contribute substantially to the botanical and biological diversity of the Project Area. They provide habitat for species that cannot survive or do not compete well in the heavily shaded forests and talus slopes common in the Mission Ridge area.

Resource Indicator: Large Trees

Seven trees greater than 32 inches (81 cm) in diameter at breast height were measured and documented in the western portion of the Project Area (Figure 3-5), though all trees of this size were not mapped in full throughout the Project Area. The largest, at 43.7 inches (111.0 cm) diameter, is a ponderosa pine located on a spur or nose slope of sandstone in the northern part of the Project Area where the existing temporary access road rounds a corner. Five more ponderosa pine trees, from 32.5 to 38.8 inches, and a 36.0-inch western larch grow on or very near the central ridge shown in Figure 3-5.

Several more trees at least 20 inches in diameter were observed on both the central ridge and nose slope but were not mapped. Other trees over 32 inches in diameter were observed in the eastern portion of the National Forest in the Project Area.

These large and very large trees are remnants of historical forest structure that has been altered by decades of fire exclusion and land use change. They contribute to the ecosystem in their resistance to fire and role post-fire recovery, insect and wildlife habitat as live trees and snags, and unique attributes related to bark thickness, crown structure, and heartwood content (USFS 2010). It appears these trees are the survivors of past wildfire that initiated the establishment of the current forest cohort.

Resource Indicator: Traditional Plants of Concern

Thirty-one traditional plant taxa of concern were considered for this assessment, based on a list provided by the Confederated Tribes of the Colville Reservation to the Okanogan-Wenatchee National Forest. Eight of these taxa of concern were directly observed during botanical field surveys, which occurred on the National Forest and WDFW land and targeted potential habitat of rare species (Table 3-6). An additional nine are fairly likely to be present in the Project Area, based on potential habitats of the species and observations of the Project Area.

Most taxa observed are distributed sporadically in the Project Area. Abundance varied with abiotic and biotic features such as topography, soil type, soil depth, and forest type. For example, *Goodyera oblongifolia* is widespread and abundant within the dense forests of the Project Area, which cover the majority of the area. *Vaccinium myrtillus* is also widespread in the forests but is more abundant in open gaps. *Lilium columbianum*, *Osmorhiza berteroi*, and *Rhododendron columbianum* are less abundant and tend to be present in moist sites, such as near streams. *Amelanchier alnifolia*, *Juniperus communis*, and *Pinus albicaulis* are more abundant in drier and less competitive sites such as vegetated patches amongst the talus, exposed ridges, or rock outcrops. More information on the distribution of *P. albicaulis* can be found above in Resource Indicator: Rare Species.

Table 3-6. Traditional plant taxa of concern observed or fairly likely to occur in the Project Area.

Observed			
	Amelanchier alnifolia	Serviceberry	Flowering shrub
	Goodyera oblongifolia	Rattlesnake plantain	Flowering herb
	Juniperus communis	Low/ground juniper	Tree
	Lilium columbianum	Tiger lily	Flowering herb
	Osmorhiza berteroi	Sweet cicely	Flowering herb
	Pinus albicaulis	Whitebark pine	Tree
	Rhododendron columbianum	Western labrador	Flowering shrub
	Vaccinium myrtillus	Low blueberry	Flowering shrub
May occur			
	Claytonia lanceolata	Indian potatoes	Flowering herb
	Cypripedium montanum	Mountain lady's slipper	Flowering herb
	Ligusticum canbyi	Canby's lovage	Flowering herb
	Perideridia gairdneri	Yampah	Flowering herb
	Prunus virginiana	Chokecherry	Flowering shrub
	Rubus idaeus	American red raspberry	Flowering shrub
	Vaccinium membranaceum	Tall huckleberry	Flowering shrub

	Vaccinium scoparium	Grouseberry	Flowering shrub
	Vaccinnium caespitosum	Dwarf huckleberry	Flowering shrub

Summary of Existing Condition

Table 3-7 summarizes the existing condition of botanical resource indicators, described in detail above.

Table 3-7. Summary of existing condition of botanical resource indicators.

Resource Indicator	Existing condition
Rare species	161 stems of whitebark pine found on National Forest and WDFW land; private land was not surveyed but stems are likely present. The species is Forest Service sensitive and a candidate for T&E listing. 50% “healthy”, 20% with signs of blister rust. No female cones at time of survey, but are produced in other years. Found between 4,500 and 5,200 feet on shoulder of exposed ridge, rock outcrops, and talus. Extensive and healthy population is known to exist on plateaus and slopes above the existing ski area.
Unique habitat	A central ridge, rock outcrops, wetlands, aspen, and riparian zones exist amidst dense forest and talus. These habitats harbor unique plant communities that contribute to the biodiversity of the Project Area.
Large trees	Seven trees 32-44 in. DBH (6 ponderosa, 1 larch) measured and mapped on central ridge and sandstone nose slope. Other trees >20 in. also observed. These contribute to fire recovery, wildlife habitat, and structural diversity.
Traditional plants of concern	Eight taxa observed during field surveys, and an additional nine are fairly likely to occur in the Project Area. Observed taxa are distributed sporadically in Project Area, with abundance dependent on factors such as topography, soil type, soil depth, and forest type.

Environmental Consequences

Direct and Indirect Effects

Alternative 1 (No Action)

With no action, the rare species, unique habitats, large trees, and traditional plants in the Project Area would remain largely unaffected by development. The whitebark pine trees would not be impacted and continue to be susceptible to blister rust, fire exclusion, climate change, wildlife damage, and, for those in the existing ski area, damage from snow-grooming equipment. The plants, lichen, and fungi growing on the ridge, rock outcrops, wetland area, and riparian zones would continue to contribute to the biodiversity of the area. The large trees would not be impacted, retaining their structural attributes and ecological functions. Traditional plants would retain their current distribution and abundance patterns in the short-term, with climate change and fire exclusion playing a role in their long-term distribution and management needs.

Alternative 2 (Proposed Action)

Resource Indicator: Rare Species

Alternative 2 would have long-term but minor adverse impacts to whitebark pine. The proposed footprint of activities would potentially be in conflict with 45 of the 161 (28%) documented whitebark pine stems in the Project Area, with 17 on National Forest and 28 on WDFW land (it is unknown if stems are present on private land). Sixteen (36%) of the 45 stems are trees with diameters over three inches; the remainder are seedlings and saplings. While none of these trees bore female cones during observation in 2019, trees over 20 years old likely produce cones in other years (Fryer 2002). They range in size from 3.7 to 15.9 inches diameter at breast height (Figure 3-8). Eleven are healthy (see health category descriptions in Existing Condition), none have apparent cankers, and seven have flagging likely from blister rust.

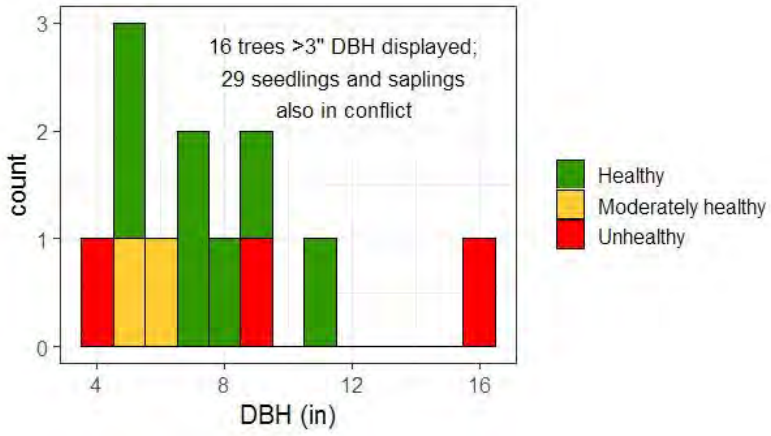


Figure 3-8. Histogram of the diameter at breast height of whitebark pine stems >3” in diameter that are in conflict with proposed activities. 16 stems are displayed; 29 additional seedlings and saplings with diameters <3” are also in conflict. Bars are colored by the health of individual trees, which was assessed in the field based on green needles, dead branches, and wounds.

Alpine ski runs, the access road, and chairlift construction would require the removal of at least some of these whitebark pine stems. Design features would encourage retention, particularly of larger and healthier trees. Trees that are not removed in proposed ski runs would be in danger of damage from snow grooming equipment and skiers, though protective, temporary snow fencing around them and increased awareness of the species and would likely help equipment operators and the public take more care around the trees.

In addition to cutting existing trees, alpine ski runs, chairlifts, and the access road would effectively eliminate the possibility of whitebark pine regeneration in these areas. Not only would construction disturb the soil, harming seeds and likely negatively impacting germination site potential, but continued maintenance would require the cutting of any stems that do grow. These activities would permanently impact roughly 40% (1.9 acres of 4.9 acres) of the growing area of whitebark pine on the central ridge and nine rock outcrops near the access road where whitebark pine could potentially grow.

For whitebark pine stems that remain after ski area construction, the likelihood of fire being excluded from their habitat would increase. Controlled fire would not be prescribed and wildfire would likely be suppressed to protect the ski area infrastructure and nearby private homes. Fire exclusion is detrimental to whitebark pine because it allows succession to shade-tolerant species, stresses mature trees, and limits seedling establishment (Fryer 2002).

It is unknown if whitebark pine stems are present in the private parcel. If they do exist in the potential locations described above in Existing Condition, connected actions on the private parcel would likely adversely affect about half the stems.

Mission Ridge has made efforts to promote the conservation of whitebark pine. First, Mission Ridge is pursuing the Whitebark Pine Friendly Ski Area certification with the Whitebark Pine Ecosystem Foundation. The certification is rigorous and includes education for employees and visitors, conservation planning and monitoring, and actively managing, planting, or studying local whitebark pine. Additionally, during the planning process, Mission Ridge adjusted the footprint of soil contouring for alpine ski runs to protect whitebark pine trees documented during recent surveys. These efforts demonstrate the permittee's interest in long-term conservation of the species.

Additionally, project implementation would require compensatory planting to mitigate for impacts to existing whitebark pine. Following the completion of construction of the roads, lifts and ski runs, Whitebark pine seedlings would be planted at the rates outlined in Table 3-8. This would result in up to 1305 seedlings being planted. On-site planting in the Project Area would be favored, though locations have not yet been determined. Seedlings would be grown from parent trees in the Mission Ridge vicinity. To maximize seedling survival at Mission Ridge, recently-published planting guidelines by McCaughey (2009) would be followed. Seedling survivorship would be monitored for five years, and if survivorship falls below 25% in this time, additional seedlings would be planted. The collection, growing, and planting of seedlings would occur in collaboration with the Forest Service.

Table 3-8. Rates for the outplanting of whitebark pine seedlings as mitigation for the cutting of existing whitebark pine stems. Outplanted seedling numbers depend on the size of the stem cut. Stems in conflict are those that spatially overlap with proposed activities at the time of this writing, but not all stems may be cut. Design features guiding the outplanting can be found in Appendix B, Botany, Design Feature #4.

Stem type	Stem size (DBH = diameter at breast height)	Number of existing stems in conflict with proposed activities	Outplanted mitigation seedlings per stem	Total outplanted mitigation seedlings, if all stems cut
Seedling	< 4.5' in height	17	5	85
Sapling	> 4.5' in height and < 3" DBH	12	10	120
Tree	3 - 7.9" DBH	10	50	500
Large tree	> 8" DBH	6	100	600

This mitigation planting plan incorporates knowledge of seedling survivorship, growth rates, and seed dispersal; no research was found at the time of this writing that specifically recommends replacement planting rates. Ten-year survival of planted seedlings in two studies ranged from 2 to 86% depending on physiographic location, fire history, and site moisture (Scott and McCaughey 2006); survivorship of 30-50% would be acceptable for mitigation (Pete Weir, pers. comm.). Whitebark pine trees require 60-100 years to reach peak cone production (Fryer 2002); approximately the same amount of time would be required to replace each >8-inch diameter tree, which are the most valuable for reproduction. Additionally, to maintain visitation by Clark's nutcrackers, thresholds of stand area and cone production must be met (McKinney et al. 2009). The existing trees surveyed in the Project Area do not meet these thresholds on their own, but it is likely nutcrackers are maintained by the nearby whitebark population atop the plateaus above the existing ski area. It is thus important to maintain as much whitebark in the Project Area as possible, and in strategic locations, so as to encourage visitation by nutcrackers in cone crop years.

The consequences of these impacts and mitigation measures on the local whitebark pine population can be considered in the context of whitebark pine's genetic variability. Most genetic variation occurs within whitebark pine populations, while differentiation among populations is low compared to other pine species (Ward et al. 2006). However, this pattern is less distinct in the Cascades, where populations are relatively small and isolated because they are restricted to narrower climatic and elevational bands than in the Rocky Mountains or Sierra Nevada (Ward et al. 2006). Further, blister rust resistance is a genetic trait (Fryer 2002). Thus, maintaining the within-population genetic diversity of the Mission Ridge population, which is particularly resistant to blister rust, is important to the regional conservation of the species.

Overall impacts to the entire local population would be minor. The Mission Ridge population of whitebark pine includes both the documented stems in the Project Area and those known in the 1300-acre habitat on the plateau above the existing ski area. The effects of Alternative 2 on this population, including cutting up to 28% of the documented stems, loss of 40% of potential ridge habitat, and mitigation outplanting of up to 1305 seedlings, would likely result in a minor loss of genetic variation and a negligible effect on the long-term viability of the population as a whole. (Note that it is difficult to predict population-level outcomes without more detailed genetic or demographic data.) Using local parent trees for outplanted seedlings would help mitigate the loss of genetic variation due to the cutting of trees. The variable planting ratio, coupled with following planting guidelines to maximize survival, would likely maintain the number of trees needed for sufficient local genetic diversity, though it would take 20-30 years for seedlings to begin producing cones and 60-100 years to reach full cone production (Fryer 2002). The only un-mitigated loss would be a portion of the ridge habitat where the trees currently grow, as disturbances there would not permit outplanting.

It is important to note that while project activities may not have a large, direct impact on the long-term viability of the Mission Ridge whitebark pine population, climate change and other threats would continue to contribute to its long-term decline. Increasing temperature and more frequent summer drought as the result of climate change are generally expected to exacerbate stresses of blister rust infection, fire exclusion, and bark beetle infestation (Fryer 2002). Restoration strategies in light of climate change include planting as many rust-resistant seedlings as possible, while managing fire and mycorrhizae to promote their survival (Keane et al. 2017). The mitigation outplanting of this project aligns with this strategy.

Resource Indicator: Unique Habitat

Roughly half of the unique features of the Project Area would experience long-term adverse effects under this alternative. These features include rock outcrops, ridges, wetland areas, riparian areas, and an aspen stand, plus effects on forest biodiversity.

Ten of the 20 documented rock outcrops (all on National Forest) would be impacted by activities under this alternative (Figure 3-9). The currently-anticipated road impact corridor for the main access road would require modification of nine rock outcrops (45%). This modification, likely entailing destruction by blasting, would permanently remove all vegetation, lichen, and fungi growing on these outcrops. Elsewhere, one outcrop on the central ridge would be affected by snow grooming and snow making for an intermediate ski run; see paragraph below regarding effects on this outcrop.

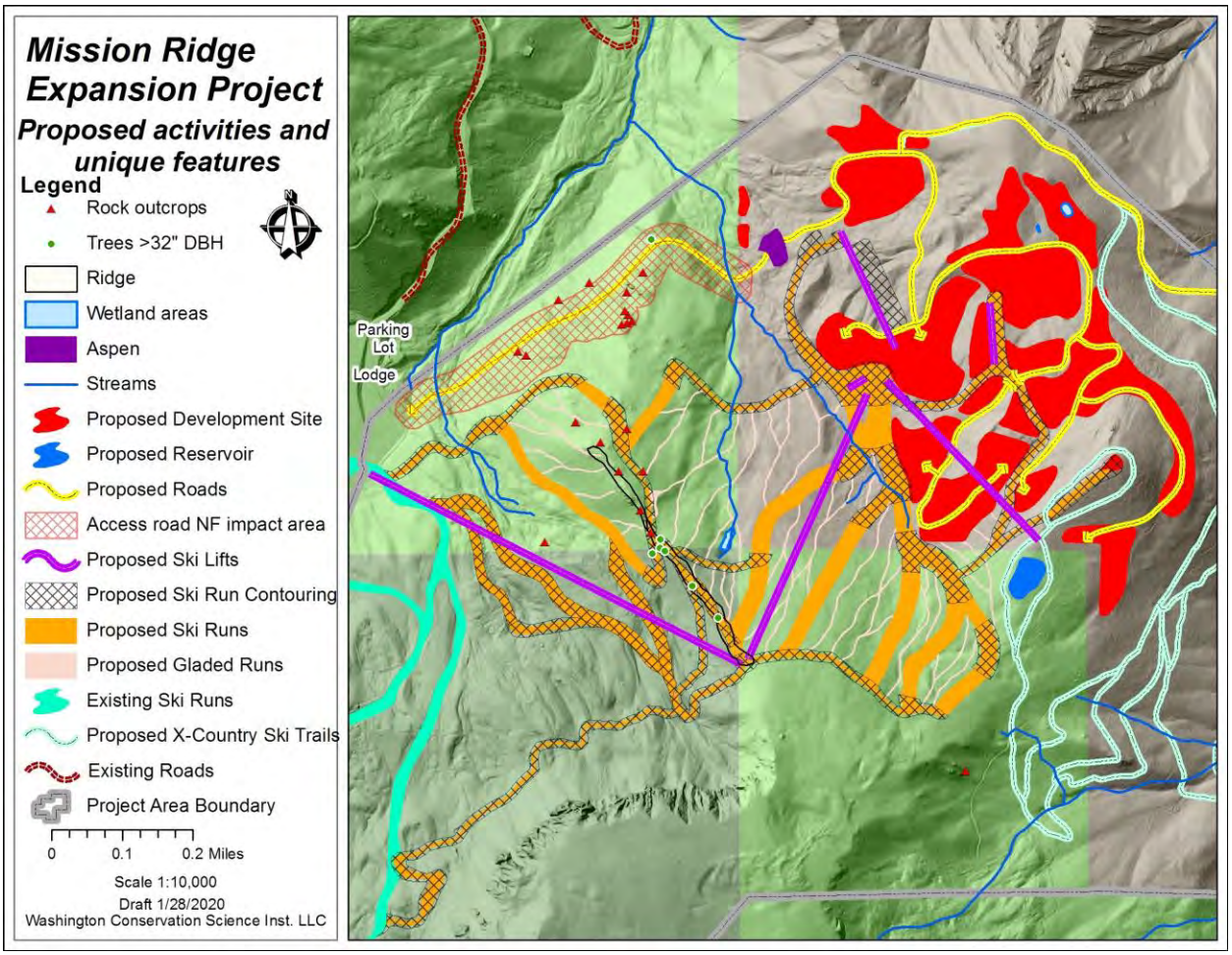


Figure 3-9. Proposed activities and unique habitats in and adjacent to the Project Area. Rock outcrops, the ridge, wetland areas, riparian zones, and forested areas would be impacted by the proposed activities, which include road construction, alpine and Nordic ski run construction, snow making and grooming, chairlift lift construction, and glading between ski runs.

One substantial impact to the vegetation on the central ridge would be soil contouring for alpine ski runs. Approximately 59% of the ridge area (17% on National Forest and 42% on WDFW) is proposed to be contoured for ski runs (Figure 3-9), the construction of which would move soil and, at least temporarily, remove all woody and herbaceous vegetation. Recovery of ridge-adapted vegetation in these areas would be limited. Even with revegetation efforts, machine-grading of ski runs has been shown to increase bare ground, reduce productivity and species diversity, and change species composition (Wipf et al. 2005, Burt and Rice 2009). Artificial seeding would not replace all the species currently present on the ridge, and the intense soil disturbance and mixing would limit germination of naturally-dispersed seeds. However, salvaging and reinstatement of topsoil should maintain a portion of the seed bank and enhance growing conditions, allowing for re-growth of some species.

On new alpine and Nordic ski runs and snow tubing areas, snow grooming and snowmaking would alter existing vegetation while possibly enhancing revegetation efforts. Groomed areas would exist on the ridge, one rock outcrop, riparian zones, and in the forest, with about 55% of these areas also receiving artificial snow (Figure 3-9). Effects to vegetation would occur due to the occasional direct disturbance of snow grooming machines on plants or the soil surface, and to the indirect effects of snow compaction from grooming and additional water input from artificial snow. Snow compaction and artificial snow result

in the soil becoming and remaining colder, and snowmelt occurring later and more rapidly (Fahey and Wardle 1998, Rixen et al. 2003). These affect plants in a number of detrimental ways: later snowmelt slows the growth and reduces the seed viability of species that flower in early spring; deep frozen soil can kill the root structures of some perennial species; ice layers can inhibit oxygen from entering the soil, leading to oxygen deficiencies; and lower temperatures result in plants being more prone to disease and damage (Fahey and Wardle 1998). However, later snowmelt also results in more moisture later in the spring, which can enhance the germination and growth of some species, particularly grasses (Brigitte Ranne, pers. comm.). In the end, some species would benefit and others would suffer, leading to changes in composition such as fewer woody and early-flowering species and more legumes (Wipf et al. 2005). Plant cover would decline in some areas and increase in others. While disturbed areas undergoing revegetation would largely benefit from the increased moisture, undisturbed areas with plant communities adapted to natural conditions would shift in a neutral or detrimental way.

Another ridge in the eastern portion of the National Forest would be impacted by installation of the reservoir. This ridge supports less unique vegetation than the central ridge: it is a dry forest dominated by ponderosa pine with no whitebark pine and fewer species adapted to shallow soils. Nevertheless, 1.4 acres of the ridge would be permanently converted to a reservoir, with some additional ground disturbance occurring in the area during construction. This would constitute about 14% of the roughly 10.9-acre ridge, of which 51% is on National Forest and 49% on the private parcel.

The wetland area on National Forest would not be impacted by ski run construction or glading, but it would be subject to off-run skiing. While design features would require signage to discourage use of this sensitive area, it is possible some off-run skiing would occur through this open area. Skiing would compact snow over the sensitive wetland soils, resulting in similar detrimental effects as those for snow grooming described above, such as reduced growth of early-flowering species, frozen soil killing root structures of perennials, and increased likelihood of disease (Fahey and Wardle 1998). Unless signage protections are highly effective, it is possible that wetland diversity would be reduced. The Proposed Actions on private land would likely eliminate the two Category 3 wetlands delineated on private land (Wetland Delineation Report – Beich and Tomassi 2017). Mitigation is pending as these actions are subject to Chelan County SEPA and permitting process.

Riparian areas would also be detrimentally affected by proposed activities. While efforts would be made to maintain no-impact buffers around streams, it is inevitable that some alpine ski runs, Nordic ski runs, and roads would need to cross riparian zones in the Project Area. Impacts would occur to 17.2 acres of Riparian Reserves (7.2 on National Forest, 10 on private). The effects would be similar to those described above for alpine ski run construction and regular snow grooming, such as decreased vegetative cover and diversity. Design features such as re-planting of riparian areas with native species and minimizing crossings by heavy equipment would mitigate adverse effects (Appendix B, Aquatics, Design Features 15 and 32). More information on the existing condition of and effects to Riparian Reserves can be found in Section 3.21 Aquatics and Hydrology.

Connected actions on the private parcel would eliminate the two wetlands and a portion of the 0.9-acre aspen stand. Per Chelan County code, mitigation for the lost wetland would occur. The aspen stand would be affected by the main access road, which is proposed to travel through the center of the stand. Disturbance required to construct the road would require removal of all aspen in a roughly 0.2-acre swath through the center of the stand (Figure 3.8). This would reduce the area of the stand by 21% and likely affect the suitability of the stand as wildlife habitat because it would be fragmented by a road.

The remaining aspen would be affected by the reduced likelihood of fire burning the stand. Fire would not be prescribed and wildfire would likely be suppressed due to the nearby homes and ski infrastructure. While neither the historic role of fire nor the desired management practices for this aspen stand have

been ascertained, elsewhere fire has been shown to re-invigorate growth and sprouting and, in some cases, discourage conifer encroachment (Utah Forest Restoration Working Group 2010, Krasnow and Stephens 2015). Long-term fire exclusion may result in the stand being replaced by other vegetation (Mueggler 1985).

In addition to the above-described impacts to unique features in the Project Area, biodiversity in the forested areas would be affected. Impacts would be both detrimental and beneficial. Impacts would occur over roughly 182 acres of forest (66 acres on National Forest, 6 acres on WDFW, and 109 acres on private) that would be permanently converted to open or disturbed habitat for roads, alpine and Nordic ski runs, chairlifts, and residential development. Snow grooming and, on 62 acres, snow making would also occur on alpine and Nordic ski runs. Direct impacts would be similar to those described above for the same activities on the ridge, including loss of plant cover and diversity. In addition, the access road would make the forest more easily accessible to recreationalists in all seasons. The frequency and quantity of summer uses by hikers, mushroom hunters, animal hunters, firewood collectors, and off-road vehicle and bicycle users would likely increase, as would that by backcountry skiers, snowshoers, and snowmobilers. Increased use would increase the likelihood of plant and fungus removal, trampling, and other physical damage. Adverse effects would be particularly likely in the spring and summer, when many species are blooming and are more sensitive to physical damage.

While effects to forest vegetation from construction and increased recreation would be detrimental, those from thinning for gladed skiing and clearing for some alpine ski runs (without contouring) may benefit plant diversity. In the Sierra Nevada, Burt and Rice (2009) found higher species and functional group diversity on cleared ski runs than on unimpacted runs in forested areas, which they attributed to the intermediate-disturbance hypothesis (areas with moderate levels of disturbance support the greatest variety of species). Cleared runs would cover 22.2 acres in total (15.5 National Forest, 0.75 WDFW, and 6.0 private) This hypothesis may also apply to the roughly 18 acres of forest (13 acres on the National Forest, 1 acre on WDFW lands, and 4 acres on private) between ski runs that would be thinned and cleared of woody debris for gladed skiing. While responses of understory abundance and diversity to thinning are mixed (Abella and Springer 2015), it seems likely that the currently depauperate understory at Mission Ridge would only benefit from a reduction in tree density.

In summary, this alternative would cause long-term, detrimental effects to the unique features and biodiversity of the Project Area. The central ridge and rock outcrops would be most heavily impacted, with permanent loss or compositional change of vegetation on 58% of the ridge and half the rock outcrops. The wetland area and riparian areas would experience minor losses of vegetation and diversity, while part of the aspen stand on the private parcel would be eliminated. Some acreage of the widespread forest would be detrimentally impacted, while other areas would benefit from thinning of the dense trees.

Resource Indicator: Large Trees

Large trees would be adversely affected by the proposed alternative. Some of the trees >32 inches in diameter that were mapped in the Project Area, as well as some of the large trees observed but not mapped, would be cut. Four of the seven mapped trees conflict with proposed activities. The 44-inch tree in the access road corridor (Figure 3-9), along with the 24-inch tree near it, would be cut. It is also likely that the 36-inch tree in the center of a beginner ski run on the ridge would be cut. Design features would encourage the preservation of the other two trees in conflict, as well as those nearby, but their preservation cannot be ensured. Additional trees may be cut for safety purposes. Cut logs would remain on site. Trees larger than 20 inches would not be cut for glading purposes, and all logs larger than 20 inches would remain on site.

As a result of losing these trees, there would be a long-term negative impact to this largest cohort of the forest and the structural diversity of the Project Area. The ecological contributions these trees provide to

fire resistance and recovery, persistence and reproduction through environmental stress exacerbated by climate change, and insect and wildlife habitat would be lost. However, several very large trees nearby and in the eastern portion of the Project Area would remain, and all logs larger than 20 inches would remain on site.

Resource Indicator: Traditional Plants of Concern

Traditional plants of concern present in the Project Area would experience minor, long-term adverse impacts as well as some minor benefits. Objectives that require the removal of woody and/or herbaceous vegetation, such as contouring for ski runs and the construction of chairlift terminals and roads, would harm existing plants in the short-term. Contoured ski runs and areas under lift lines would be re-vegetated with native species, re-instating plant communities that could support traditional plants adapted to or tolerant of open habitats, such as *Amelanchier alnifolia, Juniperus communis,* and *Vaccinium myrtillus*. On the other hand, areas such as chairlift terminals, roads, and the reservoir would not be re-vegetated and would permanently lose the ability to support traditional plants of concern. Connected actions on the private parcel to develop residential and commercial areas would also lead to permanent loss of some existing traditional plants.

There would also be indirect adverse effects to traditional plants of concern. Because of ski area infrastructure, fire would continue to be excluded throughout the Project Area. This would adversely affect native species historically adapted to frequent fire, including nearly all the traditional taxa observed or suspected to occur in the Project Area. Furthermore, ongoing climate change would likely adversely affect traditional taxa by increasing environmental stress and competition with non-natives, though the precise outcomes for each species are difficult to predict.

Protections to traditional plants of concern to minimize these adverse effects include design features that minimize impacts in riparian zones and wetlands, avoid pile burning atop traditional plants, and require salvaging of topsoil for re-vegetation. Considerable efforts would also be made to conserve whitebark pine (*Pinus albicaulis*), a candidate species for listing as threatened or endangered as well as a traditional taxa of concern. For example, between 5 and 100 seedlings would be planted for every whitebark pine tree removed. These actions are detailed above in Resource Indicator: Rare Species.

Benefits to traditional taxa would include forest thinning for gladed skiing, which would benefit some species in the long-term by thinning the forest canopy and imitating some effects of fire. *Vaccinium mytrillus* in particular, which thrives in forest openings, may see a boost in growth.

Summary of Direct and Indirect Effects

Table 3-9 summarizes the effects of Alternative 2 on botanical resource indicators, described in detail above.

Table 3-9. Summary of direct and indirect effects of the Proposed Action on botanical resource indicators.

Resource Indicator	Effects of Alternative 2
Rare species	Activities conflict with 45 of 161 (28%) whitebark pine stems documented on public land of Project Area; some or all would need to be cut for project objectives. Potential for regeneration would be permanently lost on 40% of growing area on the ridge (1.9 acres) and on 9 rock outcrops. Fire exclusion would have a long-term negative effect. Large component of local population atop plateau above existing ski area would not be affected. Mitigation would require outplanting of up to 1305 seedlings from local seed sources, depending on the stems cut. Education and protective fencing would encourage protection

	of remaining stems in ski runs. Mission Ridge would continue to pursue Whitebark Friendly Ski Area certification. The local population would very likely remain viable, with minor impacts to genetic diversity.
Unique habitat	Long-term, minor, adverse effects to biodiversity in the Project Area. The central ridge and rock outcrops would be most heavily impacted, with permanent loss or compositional change of vegetation on 58% of the ridge and half the rock outcrops. The wetland area on National Forest and riparian areas would experience minor losses of vegetation and diversity, while 21% of the aspen stand on the private parcel would be eliminated. The two Class 3 wetlands on the private parcel would be eliminated and mitigated for per Chelan County code. Increased backcountry recreation access in the spring and summer may damage flowering plants. 182 acres of forest would be converted to open or disturbed habitat. Benefits would be that ~40 acres of dense forest would be cleared for alpine ski runs or thinned for gladed skiing and likely have an increase in understory diversity.
Large trees	4 of 7 mapped trees >32” DBH are in conflict with proposed activities and may be cut, along with other trees >20”. The ecological contributions of this cohort would be reduced. Design features would encourage preservation where possible, and logs of cut trees would be left on site.
Traditional plants of concern	Minor adverse effects from vegetation removal and long-term fire exclusion. Re-vegetated areas would support traditional taxa adapted to open habitats. Protective design features include minimizing riparian disturbance, avoiding pile burning atop traditional plants, salvaging topsoil, and conserving whitebark pine. Some taxa would benefit from forest thinning for gladed skiing.

Cumulative effects

Cumulative effects on botanical resources include consideration of current conditions and foreseeable activities in the Stemilt and Squilchuck watersheds for the next twenty years, with a broader spatial and temporal context for species of interest. The watersheds occupy 38,960 acres (Gaines et al. 2019); the Project Area constitutes 2.8% of the watershed’s geographic area. Activities most relevant to botanical resources include: noxious weed treatment, commercial timber harvest, increased recreation, the Travel Management Plan, and the continued operation of the existing ski area.

For rare species, foreseeable activities in combination with proposed activities and mitigations would result in very minor, adverse cumulative effects on existing whitebark pine in the watersheds. Commercial timber harvest in the watershed is unlikely to have an effect, because land at elevations where whitebark pine may be present is publicly owned and not available for commercial timber harvest. Continued operation of the existing ski area would continue to have a minor, adverse effect on whitebark pine, as isolated trees in existing runs were observed to be damaged by on-going snow grooming activities; however, it is unknown the extent to which whitebark pine is present in the existing ski area and thus the extent of this ongoing impact.

Other botanical resources – unique habitats, large trees, and traditional plants of concern – would experience both positive and negative effects from foreseeable activities in the watersheds. Increased recreation would adversely affect unique habitats and traditional plants by increasing soil disturbance and

trampling in some areas. Continued operation of the ski area would impact all botanical resources similarly to the proposed activities: cutting of tall, woody vegetation on ski runs (minor, adverse); alteration of temperature and moisture regimes with snow making (minor, both adverse and beneficial); occasional damage from snow grooming equipment (minor, adverse); and monitoring and control of noxious weeds (moderate, beneficial). Noxious weed control elsewhere in the watersheds as well as the Travel Management Plan would benefit botanical resources by promoting the diversity of native species and restricting soil disturbance and trampling.

Forest Plan Consistency

Regulatory Framework

Regulatory direction regarding botanical resources is provided by sections IV-66, IV-78 and IV-104 of the Wenatchee Forest Plan (1990), Forest Service Manual 2600 (1990), the Large and Old Tree Forest Policy (2010), and the National Historical Preservation Act (1966).

The 1990 Forest Plan Standards and Guidelines directs the Forest Service to inventory for and evaluate the effects on threatened, endangered or sensitive species for “all proposed projects that may involve significant habitat disturbances or changes, or have the potential to alter habitat” of these species (I-78). It also provides management direction such that “habitat for existing federally-classified threatened and endangered species shall be managed to achieve objectives of recovery plans” and, for sensitive species, that “all necessary actions will be taken to assure that management activities do not jeopardize the continued existence of a sensitive species through adverse modification of their essential habitat until their status is determined” (I-78).Section IV-104 gives direction “to maintain or enhance biological diversity by providing or developing an ecologically sound distribution and abundance of plant and animal communities and species at the forest stand, subdrainage, and Forest level. This distribution must contribute to the goal of “maintaining or enhancing all native and desirable introduced species and communities”. The most critical components of diversity are identified as old growth, and wildlife and plant habitat for rare species.

FSM 2600, an amendment to the 1990 Forest Plan, reinforces and elaborates on the above Standards and Guidelines. Among its Objectives and Policies, it directs the Forest Service to manage "habitats for all existing native and desired nonnative plants, fish, and wildlife species in order to maintain at least viable populations of such species” and to avoid actions "which may cause a species to become threatened or endangered" (2670.12). Regarding threatened or endangered species, it directs to “avoid all adverse impacts on threatened and endangered species and their habitats, except when it is possible to compensate adverse effects totally,” and to “avoid adverse impacts on species proposed for listing during the conference period and while their federal status is being determined” (2670.31). Regarding sensitive species, it directs to “analyze, if impacts cannot be avoided, the significance of potential adverse effects on the population or its habitat within the area of concern and on the species as a whole. (The line officer, with project approval authority, makes the decision to allow or disallow impact, but the decision must not result in loss of species viability or create significant trends toward federal listing.),” and to “Establish management objectives in cooperation with the states when projects on National Forest System lands may have a significant effect on sensitive species population numbers or distributions. Establish objectives for federal candidate species, in cooperation with the FWS or NOAA Fisheries and the states” (2670.32).

The objective of the Large and Old Tree Forest Policy enacted in 2010 is to “restore large and old tree structure.” It provides specific directives to move toward the desired density and spatial patterning of these large and old trees, such as retaining “old” trees (defined by a Van Pelt rating system), determining stand-specific objectives, monitoring, and managing young and understory trees.

Section 106 of the National Historical Preservation Act of 1966 requires federal agencies to assess the effects of activities on Native American cultural resources and to consult with Tribes on the impacts to these resources. The 1990 Forest Plan requires the same, and to "assure the development of measures to avoid or mitigate any adverse effects" (IV-66) to "significant cultural resources," suggesting measures for protection such as adopting methods to minimize disturbance to a site.

Resource Indicator: Rare Species

Forest Plan consistency for rare species is based on directives around whitebark pine, a Forest Service sensitive and candidate species. Specifically, policy instructs the Forest Service to maintain a viable population of the species and avoid activities that may cause it to become threatened or endangered.

Project outcomes would very likely maintain a viable local population of whitebark pine. While a quantitative evaluation of population viability is not feasible for this project, research and expertise point to the continued self-sufficiency of the local population, as described in Direct and Indirect Effects above. With design features and mitigations requiring the planting of up to 1305 seedlings, avoidance of disturbing whitebark pine stems where possible, educating snow operators, and erecting protective snow fencing, the impacts to local whitebark pine genetics and population structure would be kept to a minimum. Large, reproductive trees would remain and many seedlings from local seed sources would be planted. In combination with the 1300-acre contingent of the population on the plateau above the existing ski area, the total local population would very likely maintain sufficient Clark's nutcracker visitation for seed distribution during cone crop years (McKinney et al. 2009).

Project activities are very unlikely to contribute to whitebark pine becoming threatened or endangered. The widespread decline of whitebark pine is due to factors beyond expansion of the Mission Ridge ski area. The minor effects of the projects on the local population would not exacerbate the decline of the species as a whole, and mitigation measures such as outplanting and the pursuance of conservation certification by Mission Ridge would maintain the local genetic diversity.

Resource Indicator: Unique Habitat

Regarding unique habitats and biodiversity, the 1990 Forest Plan directs the Forest Service to maintain plant communities so that they "contribute to the goal of maintaining or enhancing all native and desirable introduced species and communities." On the scale of the Project Area, biodiversity would be slightly reduced, particularly because a portion of the ridge plant community would be lost to a ski run and the main access road would eliminate several rock outcrops and 22 acres of forest, in addition to heavy development on the adjacent private parcel. On a regional scale, however, these plant communities are not exceedingly rare, and the species unique to them would very likely be maintained.

Resource Indicator: Large Trees

The Large and Old Tree Forest Policy directs the Forest Service to retain trees >20 inches diameter at breast height in quantities varying by plant association and structure class. Because not all trees of this size have been mapped in the Project Area, compliance with this policy cannot be determined with certainty. However, based on field observation, it is clear there are not a great many trees of this size in the Project Area, and their density varies with topography, disturbance history, and plant community. To encourage preservation of large trees, wildlife and botany design features require avoiding cutting live and dead trees over 20" wherever possible and to leave cut boles on site.

Resource Indicator: Traditional Plants of Concern

Forest Service policy requires consultation with tribes and the consideration of effects on cultural resources, as well as minimization of impacts. For this project, the Confederated Tribes of the Colville Nation were consulted, and effects to traditional plants of concern were evaluated in this report. Further, design features were proposed that would minimize disturbance to traditional plants. Thus, this project complies with requirements for culturally-important botanical resources.

3.23 Cultural Resources

The following section summarizes the existing condition of cultural resources in the Mission Ridge Expansion Project Area, along with the direct, indirect and cumulative effects of the Proposed Action alternative as analyzed in Cultural Resources Report RLR Report 2014-400-27e (Reiss-Landreau 2017). The full report is in the analysis file.

This analysis, including cumulative effects, focuses on cultural resources identified within the Project Area boundary. The Proposed Action would have no known indirect effects (i.e., visual, auditory, atmospheric) on cultural resources that are located outside of the analysis area.

Methods

A cultural resource inventory survey of the entire Project Area was conducted in September 2017. To evaluate the potential of this Project Area for traces of the past, archival research and a visual field survey were conducted. This area is considered low probability on the Washington State predictive model. Most of the area is in very steep 18-70% extensive slope. The land surface and vegetation are classic cascade and cascade verge fir and pine forest. To facilitate the steep slopes of the resort, a top down approach was utilized with multiple excursions to the tops of slopes via summer road/tracks, and walking to the bottom.

Resource Indicators

The resource indicator used to assess impacts to cultural resources was the number and location of any known or discovered cultural features.

Existing Condition

The Project Area lies within the traditional territory of the Wenatchi Tribe. One of the largest Wenatchi villages was located at the mouth of Squilchuck Creek and the Project Area was used for hunting and gathering. A review of the Okanogan-Wenatchee archaeological site and survey files revealed that seven surveys have occurred within the Project Area since 1990. Each dealt with an aspect of ski area development and operation and included the development of ski area facilities, ski area expansion, and water system improvements. Pedestrian surveys conducted by professional archaeologists ranged in size from just under one acre to 500 acres. The focus of these inventories was generally on areas of high and moderate site probability. To date only one site, a lithic scatter consisting of three artifacts has been recorded within the permitted area of the Mission Ridge Ski Area. The lithic scatter site is physically separated from all areas where any ground disturbance is anticipated, and the Forest Archaeologist, in consultation with the State Historic Preservation Officer, recommended complete site avoidance. Copies of all survey reports are available at the Wenatchee River Ranger District.

No pre-contact or historic cultural resources were identified during the course of the 2017 inventory. In the event of a site discovery however, all activities in the vicinity of the find would cease and the Forest Archaeologist would be notified.

The area falls within a vast area ceded by American Indians to the Washington Territory in 1855. Under Article 3 of the 1855 Yakama Treaty, enrolled tribal members of the Yakama Indian Nation secured: The exclusive right of taking fish in all streams, where running through or bordering the [Yakama Indian Nation Reservation] ... and also the right of taking fish at all usual and accustomed places, in common with citizens of the territory, and of erecting temporary buildings for curing them; together with the privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land. Although not a signatory of the 1855 treaty, the federally recognized Confederated Tribes of the Colville Reservation also retain a vested interest in Forest Service activities within their traditional use area. As this includes the Project Area, they are recognized and participate as interested parties under 36 CFR 800. Scoping letters for the Mission Ridge Expansion Project were initially sent to representatives of the

Yakama Indian Nation and the Confederated Tribes of the Colville Reservation in August 2018. No responses were received from the Yakama Nation. The Confederated Tribes of the Colville Reservation responded with recommendations for considering cultural plants. If cultural plants are identified during project implementation, Mission Ridge would consult the District biologist to reduce impacts. Government-to-government letters have been sent to both tribes for solicitation of concerns and comment prior to scoping and release of the Draft EA.

Environmental Consequences

Direct and Indirect Effects

Alternative 1 (No Action)

Under Alternative 1, there would be no direct or indirect effects on cultural resources located in the Mission Ridge Expansion Project Area. Any unidentified cultural resources present would continue to degrade naturally or be protected and buried by vegetation and soils.

Alternative 2 (Proposed Action)

The pedestrian survey on a predominately steep (18-70% slopes) Project Area for the Area of Potential Effect (APE) of this project did not identify any historic or precontact cultural features or materials. Some modern debris was noted. As such, no cultural resources would be disturbed by the proposed activities. The Forest Archaeologist in consultation with the Washington State SHPO has determined that the project would have no effect on sites eligible or potentially eligible for the National Register of Historic Places. As such, no further management/protection of the site(s) would be required during project implementation, and there would be no effect to cultural resources.

Cumulative Effects

Past and future forest management projects had/have the potential to cumulatively impact National Register listed or eligible cultural resources within the Project Area. Ongoing and future monitoring and inspections of newly identified cultural resources in the Project Area would trigger adjustments in management practices to ensure that effects to National Register eligible cultural resources are considered in project planning and mitigated, as necessary, prior to project implementation. There would be no cumulative effects because there are no direct or indirect effects.

Forest Plan Consistency

Federal laws direct and guide the Forest Service in identifying, evaluating and protecting cultural resources. The Forest Plan tiers to these laws, therefore the proposed alternative meets Forest Plan Standards and Guidelines for cultural resource management. The proposed project has complied with Section 106 of the NHPA by considering effects to cultural resources in the planning area. Therefore, the proposed project is consistent with the Forest Plan, Section 106 of the NHPA, all relevant laws and regulations.

3.24 Invasive Plants

This section summarizes the existing condition and the direct, indirect and cumulative effects of the Mission Ridge Expansion Project on Invasive Plants.

Methods

The spatial extent of the direct and indirect effects analysis of invasive species is the entire 1,090-acre Project Area, including connected actions on the private parcel.

Prior to field surveys of invasive species, a list was prepared of species recorded in the Forest Service Current Invasive Species spatial data layer (accessed Feb. 6, 2019) within 5 miles of the Project Area. This list was used to anticipate the species more likely to be found during field surveys. However, all invasive species were surveyed for.

Field surveys for invasive species were conducted on National Forest and WDFW land within the Project Area. Surveys were conducted in May and June 2019 in conjunction with surveys for rare plants. Botanists looked for invasive plants in areas with known past soil disturbance, such as the existing parking area, in addition to all areas visited for rare plant surveys. Botanists recorded a GPS waypoint when an infestation was found, noting the species and approximate number of individuals.

A species was considered invasive if it was listed on the Forest Service Region 6 Invasive Plant List (<https://www.fs.usda.gov/detail/r6/forest-grasslandhealth/invasivespecies/?cid=stelprdb5302157>, accessed 1 Dec 2018) or if it was known by surveyors to be a potentially invasive species.

Selection of Resource Indicators

Resource indicators were chosen to address the purpose and need of the project, issues brought up during project scoping, and Forest Service regulations.

Resource Indicator: Establishment of Infestations

This indicator considers how existing infestations compare to those that would exist following project completion. It allows for consideration of habitat for invasives (e.g., disturbed ground) and control of infestations.

Resource Indicator: Pathways for Invasive Species Spread

This indicator considers avenues by which invasive propagules can move, with a focus on human-mediated pathways, such as motorized use of roads and backcountry travel.

Existing Condition

Resource Indicator: Establishment of Infestations

Invasive infestations on and adjacent to the public land of the Project Area were found in the existing base area and highway (Figure 3-10). The most common invasive species was *Centaurea diffusa* (diffuse knapweed), a Class B noxious weed (Washington State Noxious Weed Control Board 2019). Surveyors found a nearly continuous, sparse to moderately-dense population of *C. diffusa* around the perimeter of the parking area, among the buildings, and along the Mission Ridge Road (Chelan County Road 711), in addition to occasional individuals in the existing ski runs near the base area. *Cirsium arvense* (Canada thistle), a Class C noxious weed, was also relatively common, with small to large patches found around the parking area perimeter. Approximately one-quarter of all observed plants were wilting, presumably from chemical treatment.

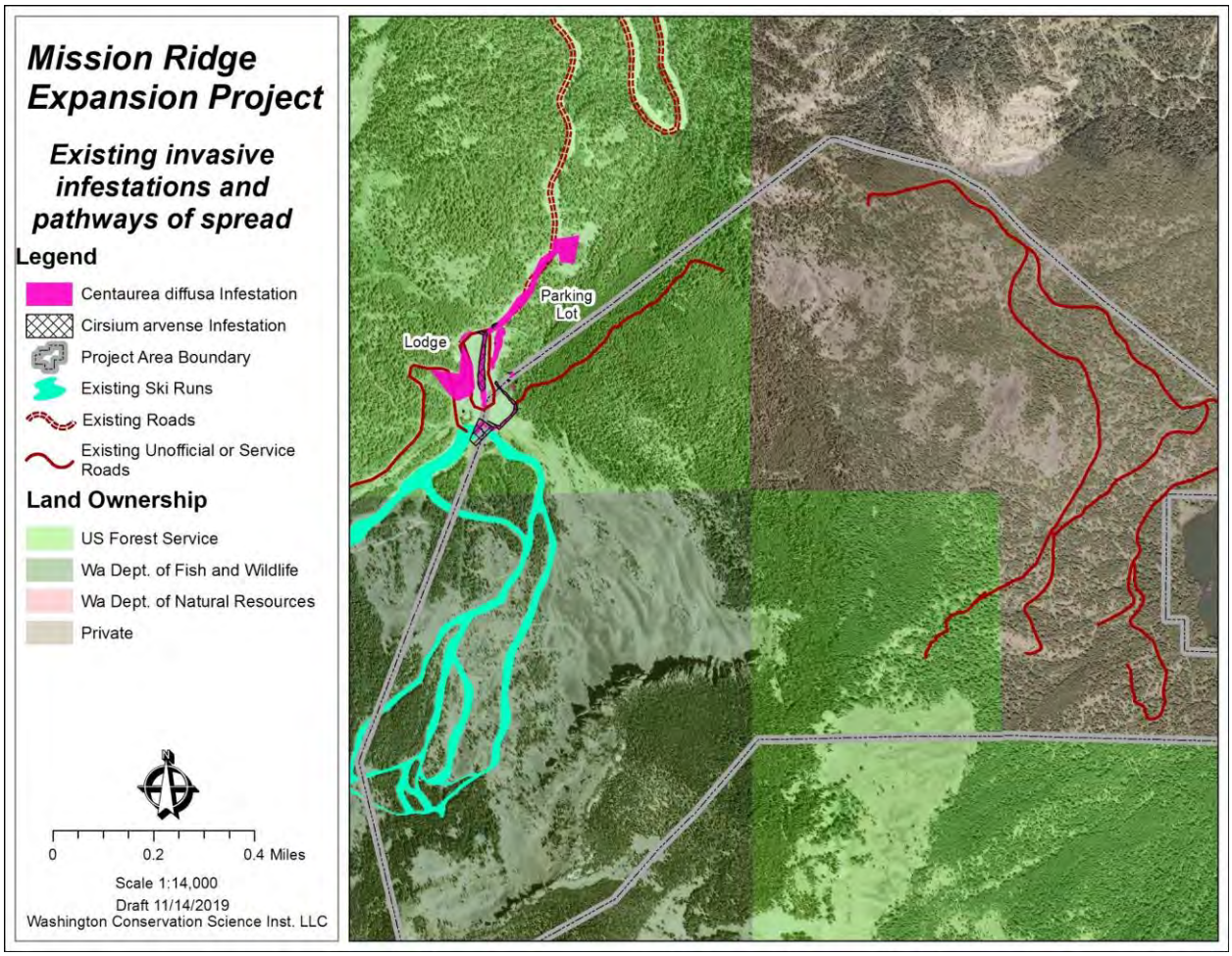


Figure 3-10. Existing infestations of invasive species and their pathways of spread in and adjacent to the Project Area. Infestations were found in and around the existing parking area and along the Mission Ridge Road. Surveys on the Mission Ridge Road and service road did not extend up or down the mountain past the infestations mapped here, nor were all unofficial roads surveyed; infestations may exist on roads beyond the surveyed area. Pathways of spread include an administrative access road originating in the parking lot and unofficial roads in the eastern portion of the Project Area and on the private parcel.

On existing ski runs adjacent to the Project Area, several other non-native species that are not considered invasive were observed, sometimes in abundance. *Bromus inermis* (smooth brome) is abundant on the runs, where it was likely seeded following re-contouring, and is scattered in the existing base area. *Poa pratensis* (Kentucky bluegrass) is present in patches on the ski runs and was likely also seeded. *Taraxacum officinale* (common dandelion) and *Trifolium* sp. were also observed, though not in abundance. Intact forests adjacent to the existing ski runs appear to be largely free of non-native species, despite their proximity to existing infestations.

Away from the base area, most of the National Forest and WDFW lands in the Project Area, and presumably the private parcel as well, contain little habitat that favors invasive species. On the whole, there is very little recent disturbance or active recreation, much of the forest has a closed or nearly closed canopy, and native species are abundant. Two occurrences of non-native *Tragapogon dubius* (yellow salsify) were found on rock outcrops, but these are of little concern because the species is largely considered non-aggressive and does not appear on the Forest Service Region 6 Invasive Plant List. Three plants in total were found and removed.

The only disturbed habitats on the National Forest and WDFW lands in the Project Area are the administrative access road and unofficial roads used by recreationists and surveyors (Figure 3.10). See details in the following section, Resource Indicator: Pathways for Invasive Species Spread. No infestations were observed on these roads, but they were not surveyed exhaustively. Roads on the private parcel were not surveyed.

The existing Mission Ridge Ski Area Vegetation Management Program (Appendix C) guides the treatment and monitoring of invasive species in the existing ski area. This plan provides guidelines for the prevention and management of invasive plants; outlining that mechanical, cultural, and chemical treatments of invasive plants may be used. On National Forest, these treatments must be consistent with the Okanogan-Wenatchee National Forest Invasive Plant Management EIS (2016). An excerpt is shown below, and the full text can be found in Appendix C. While some invasive infestations are present in the existing ski area, it appears that control as guided by this plan is sufficient to have prevented their spread into the adjacent plant communities.

> *"The Invasive Plant Program strategy proposes a multi-phase approach that provides for repeated treatment over time using one or a combination of the methods identified below. The principle objective of the invasive plant prevention and management program is to restore ecological structure and function to native communities.*
>
> *Manual treatment such as hand-pulling and grubbing with hand-tools, and mulching with organic materials as time permits. Other methods available are:*
>
> - *Mechanical treatments such as mowing, weed eating, clipping, steam and propane torches;*
> - *Cultural treatments such as planting and/or seeding of desirable vegetation;*
> - *Use of herbicides."* (Mission Ridge Vegetation Management Program, Appendix C)

Resource Indicator: Pathways for Invasive Species Spread

Currently, there are few human-mediated pathways for moving invasive propagules on the public lands of the Project Area. Aside from the existing ski runs and the gated, administrative access road, there are no designated trails or roads for public use. Summer and winter backcountry recreation is limited because access is difficult (see details in Section 3.25 Recreation; Existing Condition Resource Indicator: Dispersed Recreation on Adjacent Land).

The human-mediated pathways that do exist are unofficial and administrative access roads. There is an unofficial road in the eastern portion of the public lands of the Project Area that connects to a road system on the private parcel, and is lightly used by motorized vehicles and mountain bikes in the summer and by Nordic skiers and snowshoers in the winter (Figure 3-10; see more details in Section 3.25 Recreation; Existing Condition Resource Indicator: Dispersed Recreation on Adjacent Land). There is also a gated, administrative access road originating from the existing parking area that was constructed in the past two years for geotechnical assessment of project construction. The road is used by project surveyors, who occasionally use motorized equipment, and on-foot recreationists such as snowshoers, skiers, and hikers.

On the private parcel (Section 19), there is a roadbed originating from Upper Wheeler Road that travels through the southeast portion of the section to an intersection and hunting camp in the center of the section (Figure 3-10). Though not legal, motorcycles, ATVs, and campers use this road in the summer and fall. The spur roads from this intersection are used lightly by hikers, mountain bikers, and equestrians in the summer and Nordic skiers and snowshoers in the winter.

These few roads in the Project Area serve as potential pathways for the movement of invasive species. Propagules can move more rapidly and further along roads than in the forest, both by natural (e.g., water,

animals) and human-mediated means (e.g., vehicles, bicycles; Gucinski et al. 2001). Infestations can then establish on roadsides or in adjacent patches of favorable habitat. Control of these infestations may be less frequent than in areas of designated motorized use.

In addition to road-related pathways, soil and water movement transport invasive propagules in the Project Area. Around the existing parking area, it is evident that invasive propagules have moved downslope and downstream from areas of excavation. Invasive plants are present on the soil that was moved as well as on the streambanks below. It is possible that some propagules have been transported further downstream to other locations outside the Project Area.

Summary of Existing Condition

Table 3-10 displays a summary of the existing condition of resource indicators of invasive species described in detail above.

Table 3-10. Summary of the existing condition of resource indicators of invasive species.

Resource Indicator	Existing condition
Establishment of infestations	Invasive species are abundant on perimeter of existing parking area and along the Mission Ridge Road but are absent from intact forest and undisturbed talus slopes.
Pathways for invasive species spread	Few pathways for movement into public lands of Project Area currently exist; temporary access road is gated to public motorized access and little backcountry recreation occurs. Some motorized recreation occurs on unofficial roads.

Environmental Consequences

Direct and Indirect Effects

Alternative 1 (No Action)

With no ski area expansion, there would be little change from the existing condition. Invasive species infestations around the parking area would persist, but it is unlikely they would spread into the adjacent intact forest or talus slopes, because they do not appear to have done so in the past. Mission Ridge would continue to control invasive species according to its Vegetation Management Plan (Appendix C). Slightly increased non-motorized use of the temporary access road might serve as a minor pathway for invasives. It is unlikely other pathways would appear.

Alternative 2 (Proposed Action)

Resource Indicator: Establishment of Infestations

The Proposed Action would likely increase the number of invasive plant infestations in the Project Area. Road construction, alpine and Nordic ski run re-contouring, chairlift construction, and installation of underground water piping and electrical conduit would disturb 182 acres of forest (66 acres on National Forest, 6 acres on WDFW, and 109 acres on private), displacing native plants and creating habitat for disturbance-adapted invasive species. Re-seeding re-contoured ski runs with non-native species, a common practice and used previously in the existing Mission Ridge ski area, leads to significantly higher non-native plant cover (Van Ommeren 2001, Burt and Rice 2009). However, design features of this project would require that the seeding on National Forest be locally-sourced, genetically-appropriate native species (see Appendix B, Botany, Design Features 18-31). Presumably, re-vegetated areas would then be dominated by native species, though research is lacking on outcomes from other projects.

Seeding on the private parcel would likely also use native species. Additional design measures, such as reinstating topsoil and cleaning equipment, would also aid in reducing new infestations in disturbed areas.

Some alpine ski runs would not require contouring. Clearing tall vegetation and woody debris in these ski runs would likely have a negligible effect on invasive infestations, as supported by a study that found that cleared ski runs have very low abundances and cover of non-native species, similar to un-impacted forest (Burt and Rice 2009). Cleared runs would cover 22.2 acres in total (15.5 National Forest, 0.75 WDFW, and 6.0 private).

Thinning trees and clearing woody debris in gladed areas between ski runs would increase light availability and germination space for all plants. In addition to native species, it is possible that some non-native species would also benefit. Glading would occur on approximately 18 acres of forest (13 acres on the National Forest, 1 acre on WDFW lands, and 4 acres on private).

Control of invasive plants would be managed by Mission Ridge and would help reduce new infestations. Increased invasive control efforts by Mission Ridge would be required. The new Special Use Permit would require on-going monitoring and treatment of invasive plants on National Forest, and design features of this project would require expanding the current Mission Ridge Vegetation Management Program (Appendix C) to cover all new facilities and ground disturbance, including those on National Forest and WDFW lands. Permitting through Chelan County would likely require similar invasive plant management on the private land. Areas of particular attention would include roadsides, chairlift terminals, trailheads and trails, and ski runs that have been re-contoured. Management by Mission Ridge has thus far kept invasive infestations relatively contained, so their continued monitoring and treatment would likely limit the number of new infestations to an acceptable level.

Resource Indicator: Pathways for Invasive Species Spread

There would be a considerable increase in the quantity and frequency of use of invasive pathways with the expansion of the ski area. First, roads would provide new, year-round access to all parts of the Project Area. On the National Forest, the new access road (from the existing parking lot to the Expansion Area) would become a Maintenance Level-5 road with year-round use, and a new, permanent administrative service road with light, year-round use would access the top of Chairs 6 and 7 and Pulse Gondola 8. These roads would continue into the private parcel, where an additional network of roads for residential and commercial access would also be constructed. The closed road in the private parcel that is currently used by off-road vehicles in the summer and fall to access a hunting camp would become a designated maintained trail, with motorized access not permitted on the National Forest but permitted on the private parcel in snow-free periods.

As described above, roads have been shown to enhance the movement and establishment of invasive species, particularly those with light-weight or attachable seeds (Parendes and Jones 2000, Gucinski et al. 2001). Thus, it is likely that use of the new roads would spread invasive species from the parking area or elsewhere into portions of the Project Area currently free from infestations.

In addition to roads, new trails would provide access to little-used areas of the Project Area. There would be 1.1 miles (1.8 kilometers) of designated trails on the National Forest and 5.4 miles (8.7 kilometers) on private land. These trails would likely have heavy year-round use and would increase use in nearby backcountry areas. While winter recreation would likely have little effect on invasive pathways, summer recreation in the form of motorized recreation (on private land only), horseback riding, mountain biking, and hiking has been shown to transport propagules and introduce invasive species along trails (Moerkerk 2006, Pickering and Hill 2007, Pickering et al. 2010). However, the spread of these invasive species beyond the trail corridor in at least one experiment was minimal (Campbell and Gibson 2001). Nevertheless, increased recreation on new trails throughout the Project Area would present many new pathways for the spread of invasive species into areas of the forest previously absent of invasive species.

Invasive species spread and establishment via use of these new pathways would be minimized by consistent monitoring and control by Mission Ridge, as per the expanded Mission Ridge Vegetation Management Program, and with educational signage at the new trailhead.

Summary of Direct and Indirect Effects

Table 3-11 displays a summary of the direct and indirect effects of Alternative 2 to resource indicators of invasive species described in detail above.

Table 3-11. Summary of the direct and indirect effects of Alternative 2 on resource indicators of invasive species.

Resource Indicator	Effects of Alternative 2
Establishment of infestations	Ground disturbance proposed on 182 acres of forest (66 acres on National Forest); invasive establishment would become more likely in these areas. Only native plant material would be used for re-vegetation on the National Forest, and Mission Ridge managers would anticipate the need for increased weed control and monitoring.
Pathways for invasive species spread	Substantially increased summer use of roads, Nordic trails, and alpine ski runs would create new vectors from parking area or elsewhere to all portions of Project Area. Mission Ridge managers would monitor trails, roads, and disturbed areas to detect and treat invasive plant infestations.

Cumulative effects

Cumulative effects on invasive plant species include consideration of current conditions and foreseeable activities in the Stemilt and Squilchuck watersheds for the next twenty years. Activities most relevant to invasive species include: noxious weed treatments, commercial timber harvest, increased recreation on nearby lands, trail construction, establishment of the Travel Management Plan for motorized recreation, and the continued operation of the existing ski area.

Noxious weed treatments and the establishment of the Travel Management Plan would benefit invasive species resources. Treatments, whether on National Forest under the forest-wide EIS or on other ownerships, would help by controlling established infestations. The Travel Management Plan would restrict motorized recreation to designated routes that can be maintained, so that invasive species are not unduly spread.

The other activities – timber harvest, recreation, trail construction, and ski area operation – would likely increase invasive plant infestations. Timber harvest and trail construction would disturb soil, creating habitats favorable to invasives. Increased recreation on nearby public lands as well as at the operating ski area will intensify pathways for invasive plant spread.

In combination with these foreseeable activities, Alternative 2 would add further to the establishment and spread of invasive plant species in the watersheds. Monitoring and control by Mission Ridge would limit these effects.

Expansion of the Mission Ridge Ski Area would increase both the establishment of invasive plant infestations and the vectors for movement and distribution of invasive propagules, but design features, such as the expansion of the Mission Ridge Vegetation Management Plan and the use of native seed mixes, would keep levels of invasion acceptable.

Forest Plan Consistency

Regulatory framework for invasive plants in the Project Area includes policy from the 1990 Forest Plan, the 2005 amendment Pacific Northwest Invasive Plant Program Record of Decision, and the 2016 Okanogan-Wenatchee National Forest Invasive Plant Management Final Environmental Impact Statement (2016), The 1990 Forest Plan, as amended in 2005, directs the Forest Service to "minimize the creation of conditions that favor invasive plant introduction, establishment and spread" by adhering to prevention objectives and standards. Objectives include reducing soil disturbance, retaining native vegetation, incorporating invasive plant prevention as "an important consideration in all recreational land use and access decisions," and manage previously "unmanaged recreation" such as off-road vehicles and dispersed recreation. Prevention standards include: addressing invasive plant introduction, establishment, and spread in all plans, cleaning heavy equipment, using weed-free straw and mulch, and favoring native plant materials for revegetation. The Project Area also operates under the Okanogan-Wenatchee National Forest Invasive Plant Management Final EIS (2016), which permits invasive plant control, including the use of herbicides.

This project complies with the policy described above. This EA includes analysis of invasive plant introduction, establishment, and spread, which allows for consideration of the resource in decision-making. The prevention objectives and standards have been incorporated into design features within Invasive Species (Appendix B). These design features would minimize soil disturbance and the introduction of invasive plants from heavy equipment or mulch, and require the use of native species for re-vegetation.

3.25 Recreation

This section summarizes the existing condition and the direct, indirect and cumulative effects of the Mission Ridge Expansion Project on recreational infrastructure and opportunities.

Methods

The Assessment Area includes the Project Area and adjacent lands in the Upper Stemilt drainage and the Lake Clara/Beehive area where recreation use patterns extend beyond the Project Area.

Existing ski area chairlifts, rope tows, ski runs, buildings, and other facilities were surveyed, and existing maps consulted. Expansion proposals including: the access road, chairlift locations, ski runs and village facilities were mapped and locations visited in the field.

All known travel routes (system and unauthorized roads and trails) within and immediately adjacent to the Project Area were surveyed. Road closure devices were noted. Existing dispersed recreation use patterns were noted. Effects were analyzed over the short-term (during project implementation) and long-term (>5 years post-project).

Selection of Resource Indicators

The indicators and measures below address the purpose and need and key issues raised during project scoping. Table 3-12 lists the resource indicators used to assess recreation, the reason for selection, and the measurements used for assessment. The reason for selection may include purpose and need statements of this project (see Chapter 1) and/or regulatory documents. Chosen measurements are relevant and feasible assessments of the indicator.

Table 3-12. Resource indicators used to assess the impacts of the Mission Ridge Expansion Project on recreation.

Resource Indicator	Reason for selection	Measurement
Alpine Ski Terrain	Purpose #3, Need #1, 4, 1990 Forest Plan IV-159 Indicates how ski terrain would be expanded.	- # Ski Runs - Acres of Ski Runs - Ski Runs by Difficulty Level (%) - Acres of skiable terrain - Acres of beginner terrain -Acres of learning terrain - Acres of gladed terrain - Ski run total linear distance (feet) - Ski run total vertical feet - Acres of Snow- making - Acres of Night Lighting - # Terrain Parks
Lift and Ski Area Capacity	Purpose #3, Need #1, 1990 Forest Plan IV-159 Indicates how ski-lift facilities would be expanded.	- # Chairlifts -Length of chairlifts -Vertical rise of chairlifts -Chairlift Capacity -Comfortable Carrying Capacity
Skier Services Facilities	Need #1, 4, 1990 Forest Plan IV-159. Indicates how skier service facilities would be expanded.	- # Day Lodges - # Restaurants - # Overnight accommodations - Square Feet Skier Services Buildings
Access/Parking	Purpose #2, Need # 2, 5,	- Miles new access road length

	Issue #5 Indicates how access would be provided to the Expansion Area and how additional parking would meet increased demand.	- Day Use Parking lot vehicle capacity - Off-site parking capacity - Total on & off-site parking
Recreation Options Within the Developed Resort	Purpose #3, Need #1, 1990 Forest Plan IV-159 Indicates how other recreational options would be provided.	- Miles/km of Nordic Trails - # Snow-play Areas
Dispersed and Developed Recreation on Adjacent Lands	Issues # 1, 2, 7, 9, 13 Addresses public issue of how ski area expansion would affect recreation on adjacent lands.	- Qualitative description of recreational use on adjacent lands

Existing Condition

The Project Area and adjacent lands provide a variety of year-round recreational opportunities on lands managed by the U.S. Forest Service (Sections 24, 26, and NW ¼ 30), the Washington Department of Fish and Wildlife (Section 25), the Washington State Department of Natural Resources (Section 36) and the private land in Sections 19 and 30. A ridge at 6,800' dominates the terrain from Mission Peak in the northwest, running southeast to Wenatchee Mountain. Average snowpack is heaviest at the higher elevations (60-80 inches) and decreases at lower, more easterly locations (45-60 inches at Midway and the Base Area). Aside from the existing ski runs and administrative access road, there are no designated trails or roads in the Project Area. There are some old roadbeds on the private land, which have very light, mostly non-motorized use.

The Mission Ridge Ski Area operating season is generally mid-November through mid-April. The ski area operates seven days per week from Christmas week through February ,five days per week (Thursday through Monday) in early March, and three days per week (Friday through Sunday) during early and late seasons. There is no specific season of use established in the Special Use Permit; rather the operating season is reviewed annually and authorized in the annual operating plan. Lifts run from 9:00 AM to 4:00 PM on operating days.

Resource Indicator: Alpine Ski Terrain

Ski terrain variety includes the developed trail system, which varies by ability level and the wide variety of alternate ski terrain between the trails as described below. The availability of these varied types of terrain has become one of the more important factors of a resort's ability to retain guests for longer durations and repeat visits (Diamond Peak, 2015).

The existing Mission Ridge Special Use Permit Area covers 2,080 acres of terrain, which is largely skiable and provides a 2,250-foot vertical drop from the summit elevation of 6,820 feet to the base area elevation of 4,570 feet. There are 33 designated ski runs covering 204 acres (Figure 1-2, Appendix A). Seven percent (7%) of these runs are rated "easiest", 80% are rated "difficult", and 13% are rated "most difficult". There are many skiable acres between the designated runs including: Bomber Cliffs, Bomber Chutes, Central Park, Castle Peak and Outback. The terrain varies from narrow trails within thick forests, to wide cruiser runs, to open snowfields, and tight chutes. There are two lift-serviced backcountry areas that can be accessed with a ten to twenty minute hike from the top of Chair 2. The Windy Ridge area provides

access to open, steep terrain above Chairs 3 and 4 and the Mission Peak area provides unique terrain, chutes and spires to the north of the summit.

There are three terrain parks, which provide freestyle features for snowboarders and skiers. The 100 Laps Terrain Park is at the top of Chair 1 and is serviced by its own rope tow. Lil' Bombers Park is located on the Mimi run providing low level freestyle features. A Family Fun Park is located on the Katsuk trail and features transitions and bowls for all skier/rider levels.

The beginning skier and instructional terrain is currently limited and problematic. The beginner instructional area served by the rope tow is very small and gets crowded during group lessons. Rope tows are also difficult for beginner skiers to use. The Mimi run is the main beginner run, once skiers are comfortable on their skis. However, there is one steep pitch that is difficult for beginning skiers to negotiate. Beginning skiers must also share the Mimi run with all other skiers, because it is the only route to ski from the upper mountain to the Base Area. Therefore, advanced skiers that move at higher speeds are mixed in with beginners that are skiing more slowly. Only 7% of the ski runs at Mission Ridge are rated as beginner.

Lights for night skiing are located on Chair 4 on the Sitkum, Elip, Wounded Knee, and lower Chak-Chak runs, Chair 1 on the Mimi run, and on the Pika Peak and 100 Laps rope tows for a total of 39 acres. Night skiing operates from December 26 through the End of February on Thursday, Friday and Saturday nights from 4:00 to 9:00 PM.

The snowmaking system covers 39 acres of trails as follows:

- Mimi and Sunspot/Tumwater trails under Chairs 1 & 2 provide summit to base area coverage.
- Lower Toketie under Chair 3
- Sitkum and Lower Chak-Chak runs under Chair 4
- 100 Laps Terrain Park and the beginner instructional area

The system consists of an 18 million gallon reservoir on the upper mountain (off the Boundary Road) fed by water pumped up from Squilchuck Creek at the base area. Gravity feed from the reservoir supplies 80 hydrants. The snowmaking season is November 1 through April 30; however, most snowmaking operations occur earlier (November to December) in the season.

Competitive ski races are held during the use season on the Skookum and Tumwater runs. Skookum is closed to the public during these events.

The Ski Area is used off-hours during the use season by skiers, snow boarders and snowshoers. These recreationists hike or ski uphill under their own power and then descend most often within the Ski Area. There is an "Uphill Policy" which allows this activity with conditions, providing for safety considering avalanche mitigations and maintenance operations that occur on the mountain 24 hours a day. Designated routes for uphill travel are far right on Service Road/Mimi/Bomber/Boundary Road and far left on Outback/Chak-Chak.

Resource Indicator: Lift and Ski Area Capacity

There are three fixed grip double chairlifts and one high-speed detachable quad chairlift providing uphill capacity for the mountain (Table 3-13). Each chairlift includes a base and top terminal building. There is also one rope tow, which serves the beginner instructional area, and one rope tow serving the 100 Laps Terrain Park (Table 3-14). Total chairlift capacity is 4,774 skiers/riders per hour and Comfortable Carrying Capacity for the entire Area is 2,784 skiers/riders at one time.

On days when the number of visitors approach the Comfortable Carrying Capacity of 2,784 (approximately 10 days/season on weekend and holiday periods), the day lodges are very crowded and lines for food service are long. The parking lot also fills to capacity. However, the experience on the

mountain remains good, because there is ample terrain for skiers to spread out. Lift lines generally do not exceed 5-15 minutes and the skiing/riding experience does not feel crowded, except on the mainline runs (Tumwater/Bomber Bowl/Kiwa).

Over its 50 years of operation, user visits at Mission Ridge have doubled and continued growth is expected. Skier visits to Mission Ridge have averaged 100,565/year over the last ten years. In the last three years, the trend has been up 13.2% with an average of 112,335 user visits per year. The 2018-2019 season set a new record of 120,812 user visits. This coincides with a similar 20% increase in snow sports visits in the Pacific Northwest since the mid-1990s (US Ski Area Association, 2019).

Table 3-13. Existing Chairlifts

Chairlift #/Type	Length (feet)	Vertical Drop (feet)	Lift Capacity (Skiers/hour)	Comfortable Carrying Capacity (Skiers at one time)
Chair 1 – Fixed Grip Double	3,480	543	1,200	593
Chair 2 - Detachable Quad	6,225	1,650	1,664	1,263
Chair 3 – Fixed Grip Double	3,726	1,128	970	410
Chair 4 – Fixed Grip Double	4,208	1,173	940	518
Total	17,639	4,494	4,774	2,784

Table 3-14. Existing Surface Rope Tows

Rope Tow	Length (feet)	Vertical Drop (feet)	Tow Capacity (Skiers/hour)
Beginner	243	30	870
100-Laps	490	102	980
Total	733	132	1850

Resource Indicator: Skier Services Facilities

Base Area skier services buildings include: the Hampton Day Lodge, Ski School, Ticket Building, and the Skier Services Building, (Table 3-15, Figure 3-11). The Hampton Day Lodge includes: a cafeteria/restaurant/bar, ski rental and repair shop, retail shop, rest rooms, locker room, administrative offices and a large deck overlooking the base area. All ski lessons are registered and meet at the Ski School, which is adjacent to the beginner slope. The Skier Services Building houses the ski patrol, lift engineering staff, employee lockers, first aid room, rest rooms, and childcare. A maintenance building supports slope grooming snow-cats and snowmobiles, and there is a sewage treatment plant, pump house and an administrative trailer.

On mountain structures include: the Midway Lodge, Burchett Patrol Summit Ski Patrol building and a ski demo shop (Table 3-15, Figure 3-11). The Midway Lodge is located at the base of Chair 2 and includes a cafeteria, rest rooms and a small deck. Food and beverage service, the sales and rental shop, restrooms, first aid, lifts and tows, and other public spaces are all accessible to persons with disabilities that meet essential eligibility criteria.

Table 3-15. Existing Skier Services Buildings

Building	Size (Square/feet)	Seating (Inside/Outside/Total)
Hampton Day Lodge	12,900	300/120/420
Ski School	1,400	NA
Skier Services Building	5,000	NA
Ticket Building	172	NA
Midway Day Lodge	2,400	130/75/205
Midway Ski Demo Hut	140	NA
Burchett Patrol Summit Building	720	NA
Total Skier Services Buildings	22, 732	NA

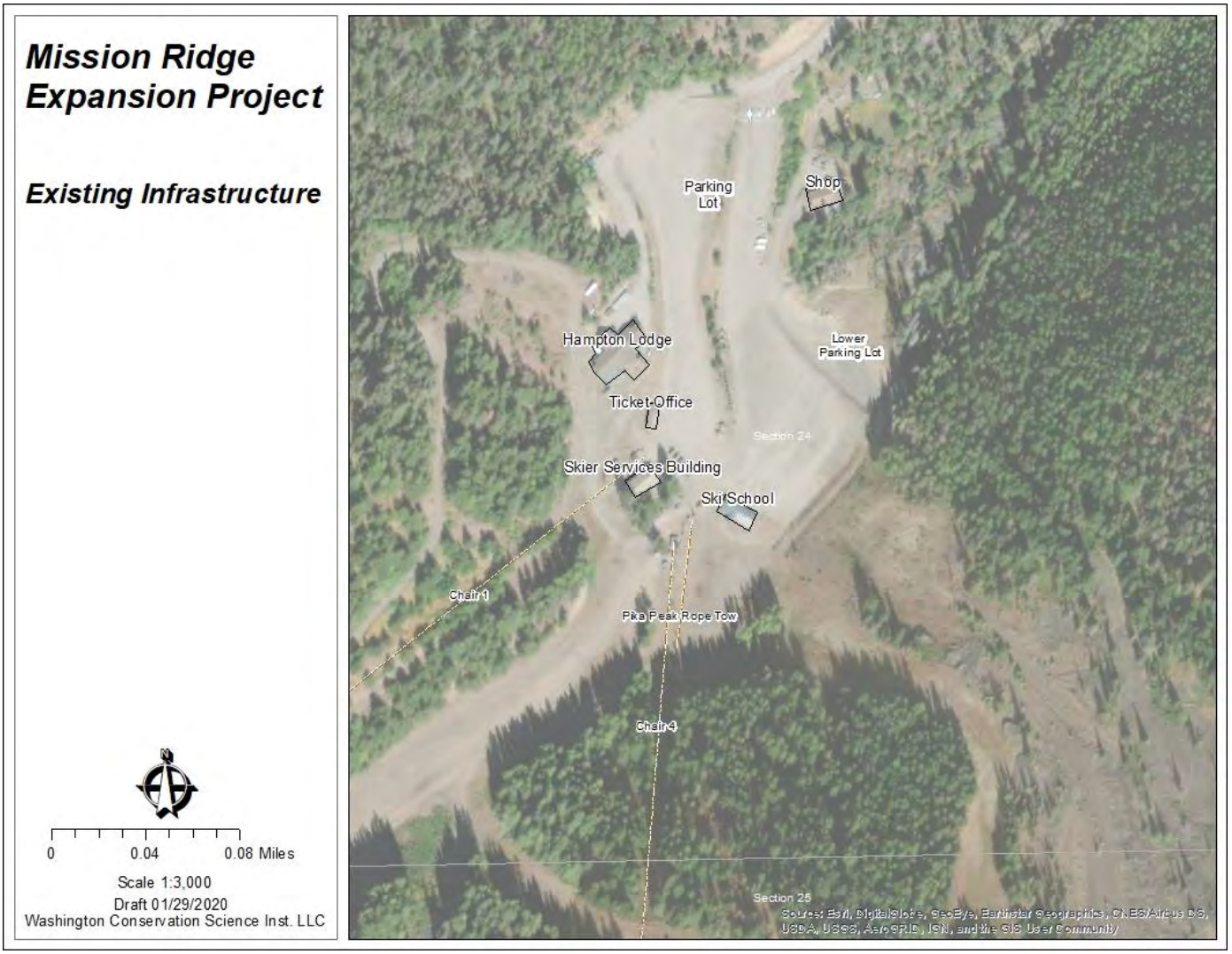


Figure 3-11. Existing skier services buildings in Mission Ridge Ski Area.

Resource Indicator: Access/Parking

Access to Mission Ridge is provided on the Mission Ridge Road (Chelan County Road 711), a two lane paved road 4.0 miles from Squilchuck State Park. There is a service road that provides administrative access from the base area to the summit in the off-season. This road is one lane, native surfaced, and is 5.9 miles long. The road is not open to the public for motorized use.

There are three parking lots for public use with a capacity of 900 vehicles. On weekend and peak days, the parking lots fill early in the day and overflow is accommodated at pullouts along the County road, at the Boy Scout Camp, and at Squilchuck State Park. A shuttle van transports guests from these satellite locations to the Base Area. There are 15 parking spots in the parking lot for Recreational Vehicles available by reservation. RV's must be self-contained because no utilities are provided. Link Transit (a public bus service in Chelan/Douglas County) provides seven round trips per day to Mission Ridge from Wenatchee. This bus service runs on weekends and holidays and is free to the public. There are two accessible parking spaces at Hampton Lodge and two spaces at the ticket booth.

Resource Indicator: Recreational Options within the Developed Resort

In the off-season (generally mid- April to October 31), there are no permitted activities on the mountain under the Mission Ridge Special Use Permit. The Hampton Lodge in the Base Area is available for rental for private parties. The Ski Area is open to public non-motorized access during the off-season, and is used mostly by hikers or mountain bikers utilizing the Service Road or designated runs. The parking lots are mostly closed, except for trailhead parking near the Clara Lake Trailhead. There are mountain bike events permitted to third parties that use the Base Area parking lots to gather and ride to National Forest trails outside the Permit Area. There is no designated Nordic ski area with groomed runs and no designated snow play area. There are no overnight accommodations at the Ski Area. Food and beverage service, first aid, childcare, lifts and tows, ski slopes, ski instruction and other programs and activities are all accessible to persons with disabilities that meet essential eligibility criteria.

Resource Indicator: Dispersed and Developed Recreation on Adjacent Lands

There are several areas adjacent to the ski area boundaries that are used for dispersed recreation (Figure 3-12). The Pipeline Trail and Clara Lake are popular Nordic ski/snowshoe destinations. These users park in the Base Area parking lot and either travel up the Clara Lake trail or use the Service Road (during off-hours) to access the Pipeline Trail #1200. Snowmobilers utilize public lands adjacent to the Ski Area boundary in the Clara Lake area near Bomber Cliffs and on Naneum Ridge near the Microwave Tower. These vehicles can sometimes be heard from the ski area, but are restricted from entering. During warm weather months, hikers and mountain bikers use the Pipeline/Clara Lake areas by parking in the Base Area parking lot and then travelling on the Clara Lake trail or the Service Road to the Pipeline trail. Mountain bikers could also access the Devils Gulch trail system or the Beehive area from the Pipeline Trail. Dispersed camping occurs on flat areas and pullouts along the Beehive Road #9712, mainly in the spring and fall.

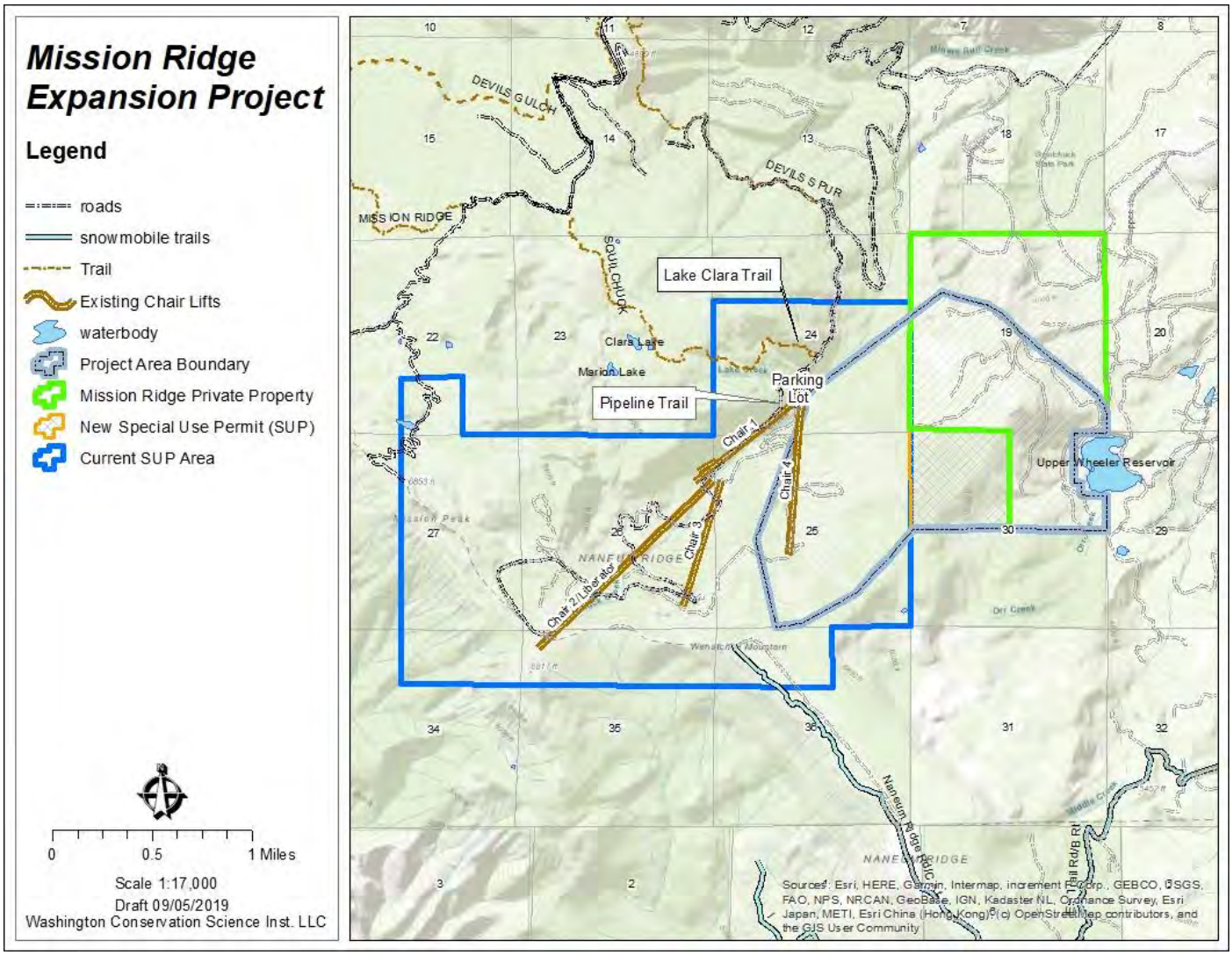


Figure 3-12. Existing recreation routes in the vicinity of Mission Ridge Ski Area.

The portion of the Project Area located in the Upper Stemilt Basin area (T21N R20E Sections 19 and 30) can be accessed cross-country from Mission Ridge Ski Area, on old roadbeds from Squilchuck State Park, and from the Upper Wheeler Road. Advanced Nordic skiers and snowshoers use this area during winter months. This use is very light because it is difficult to access and advanced skills and avalanche awareness are necessary. Most of these users park in the Mission Ridge Base Area parking lot and climb 600 vertical feet southeast to the Stemilt Basin through the Outback area. This is a cross-country route with no set trail. There is also light use of this area in the summer months. Generally, motorcyclists or ATVs access Section 19 on existing roads from lands administered by Chelan County and the Washington Department of Fish and Wildlife in Section 20 and 29 (Figure 3-12). Some of these roads are closed to motorized vehicles, but illegal motorized use occurs. Motorcyclists or ATVs also travel up the existing roadbed in the southeast quarter of Section 19 to the road intersection in the middle of Section 19. There is little use on the old road spurs from this point. Recreationists also access Section 19 from the Upper Wheeler Reservoir using the same road in the southeast quarter of Section 19. Though there is no direct road connection from the reservoir, hikers and a small amount of off-road vehicle traffic travel the short distance cross-country to make this connection. This use is not legal because motorized public access is restricted on all the roads around the reservoir. Upper Wheeler Reservoir is used for irrigation

storage and is owned and operated by the Wenatchee Heights Reclamation District. The public uses the Upper Wheeler Reservoir most heavily during the spring fly-fishing season. There are impressive views of the Columbia Valley, the Stemilt Basin, Upper Wheeler Reservoir, and the Upper Squilchuck drainage from the old roadbeds in Sections 19 and 30. Hikers, mountain bikers and equestrians also access the roads in Sections 19 and 30 from Squilchuck State Park on a connecting trail and old roadbed.

The rest of the Upper Stemilt Basin is a popular snowmobiling area with a groomed trail system and Sno-Parks, accessed from the Stemilt Loop Road (Appendix G – Map of groomed snowmobile system). This area also receives heavy vehicle use during the warm weather months, again accessed from the Stemilt Loop Road. Fishing on the various reservoirs, camping, hunting, wildlife viewing, hiking, and equestrian use are the main recreational activities. Camping occurs on dispersed campsites, many near water bodies that are open to the public. A Green Dot Road System on the Washington State Lands indicates roads open to vehicles; however, there is much illegal vehicle travel on non-Green Dot roads. It is possible to access the Stemilt Basin via non-motorized travel on road systems or cross-country from Squilchuck State Park, but routes are not established or signed (Chelan County, 2019). Very few non-motorized trails exist in the Stemilt Basin.

Environmental Consequences

Direct and Indirect Effects

Alternative 1 (No Action)

Since the No Action Alternative represents a continuation of the existing recreational activities in the Project Area, the existing condition discussion above describes the conditions that would occur under this alternative.

Resource Indicator: Alpine Ski Terrain

The existing skiable terrain, designated ski runs, and terrain parks within the Permit Area (2,080 acres) would continue to be maintained and used. There are about 200 acres of glade skiing; most of this naturally occurring, where trees have grown widely spaced. The percentage of runs by difficulty level would be 7% Beginner, 80% Intermediate and 13% Advanced (Figure 3-13). Since only 7% of designated runs are rated as beginner, this terrain is below the skier/rider market of 15%, not providing enough opportunities for the beginning skier/rider. The placement of the beginner terrain is problematic, because Mimi, the main beginner run, also serves as the route for all skiers to get from the upper mountain to the Base Area. Faster, experienced skiers must use the same ski run as slower, beginner skiers. Mimi also has one steep pitch that is difficult for beginning skiers to negotiate. The beginner teaching terrain is limited to one acre and is served by a rope tow, which does not meet guest expectations for ease of use. 80% of designated runs are rated intermediate, which is above the skier/rider market of 70%. Currently 13% of designated runs are rated Advanced, which is below the skier/rider market of 15%.

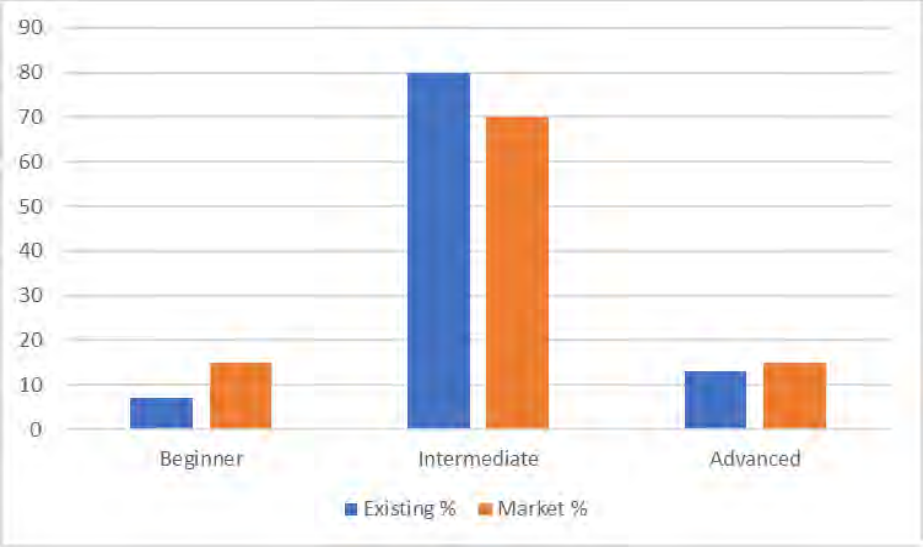


Figure 3-13. Existing Terrain Distribution by Ability Level

The skiing experience on the mountain is good, because there is ample terrain for skiers to spread out, except on the mainline runs: Tumwater, Bomber Bowl and Kiwa. At the Comfortable Carrying Capacity (CCC) of 2,784, there would be an average of 14 skiers per acre on the 204 acres of designated runs. However, actual density is lower because many skiers ski off designated runs. For comparison, preferred skier densities are generally 30 beginner skiers per acre, 20 Intermediate skiers per acre, and 10 Advanced skiers per acre.

Night skiing would continue to be provided on some trails under Chair 4 and Pika Peak Rope Tow (26 acres), and in the 2019-2020 season along the Mimi Trail (12 acres) and the 1,000 Laps Terrain Park (1 acre). Snowmaking would continue providing one route from the top of the mountain to the Base Area, and some coverage on trails served by Chairlifts 3 and 4 (Total 39 acres). However, most designated runs under Chairs 3 and 4 would continue without snowmaking coverage.

Competitive ski races would continue on the Skookum and Tumwater Runs. During non-operating hours, skiers, snowboarders and snowshoers would continue to travel uphill, under the direction of the “Uphill Policy” on the Service Road, Mimi, Bomber, and Boundary runs under Chairs 1 and 2 and under Chair 4 on the Outback and Chak-Chak runs. Alpine ski terrain is all in one watershed; though the three different upper mountain chairlifts provide varied terrain. Out of area visitors mostly ski for two to three days on the existing terrain. There would be no on-mountain overnight accommodations, village, or services. Skiers would have to drive to Wenatchee or surrounding communities for services once the ski area closes for the day.

Climate change, leading to warmer, shorter winter periods, could shorten the operating season for both the alpine and Nordic terrain, likely reducing the annual visits. This could be mitigated in part by increased use of the snowmaking system; to produce the snowpack when it is cold enough to make snow.

This alternative would have a long term, negligible impact, because there would be no change that would move towards or away from the desired condition of providing additional high quality alpine ski terrain.

Resource Indicator: Lift and Ski Area Capacity

The four existing chairlifts and two rope tows would continue to be maintained and used (Tables 3-13 and 3-14). The ski area CCC of 2,784 skiers is approached around ten days per year and is exceeded 2-3

days annually (Peak days). On days when the Comfortable Carrying Capacity is reached, or when some lifts are not operating due to weather or mechanical issues, 5-15 minute lift lines form for the four chairlifts; however, the skiing/riding experience does not feel crowded, except on the mainline trails (Tumwater, Bomber Bowl, and Kiwa).

If skier visits increase, following regional population trends, lift capacity would stay the same. Skier preferences for faster, higher capacity lifts (USFS, 1998) would not be satisfied. This alternative would have a long term, negligible impact, because there would be no change that would move towards or away from the desired condition of providing additional chairlift capacity.

Resource Indicator: Skier Services Facilities

The two existing day lodges and associated visitor services buildings would continue to be maintained and used (Table 3-15). The ski rental/repair and retail shops are small and are crowded during peak times of the day. The existing Hampton Base Area Lodge and Midway Lodge can seat 392 people indoor and 120 outdoors for a total of 512 at one time (Table 3-16). When skier visits are above 2,000 per day (which occurs 10-18 days per year) these lodges exceed comfortable service levels. Lines form for food service and there is not enough seating available. Food service on the mountain is limited to the Midway Lodge, which fills to capacity, requiring many skiers to ski down to the Base Area Hampton Lodge for food or to take a warming break. Food and beverage service, the sales and rental shop, restrooms, first aid, lifts and tows, and ski slopes would all be accessible to persons with disabilities that meet essential eligibility criteria. This alternative would have a long term, negligible impact, because there would be no change that would move towards or away from the desired condition of providing additional ski services, facilities, and accommodations in close proximity to local communities.

Table 3-16. Existing Day Lodge Seating

	Hampton Base Area Day Lodge	**Midway Lodge**	**Total Ski Area**
Lodge Square Feet	6,450	2,400	8,850
Existing Indoor/ Outdoor/Total Seats	315/57/372	77/63/140	392/120/512

Resource Indicator: Access/Parking

Access to the ski area would continue to be provided on the Mission Ridge Road (Chelan County Road 711), 4.0 miles from Squilchuck State Park. This road is maintained by the County and provides safe access in all but the most severe weather and road conditions. The three existing parking lots would be maintained and utilized. On some weekends and holiday periods when the Comfortable Carrying Capacity of 2,784 skiers is met, these parking lots would fill to capacity with 900 vehicles early in the day. Table 3-17 displays the results of the existing skier parking capacity analysis. Preliminary data from Mission Ridge indicates a 2.25 person average occupancy per vehicle, a ratio that is lower than the national average of 2.3 to 2.8 people per vehicle. When using this 2.25 average, and when off-site parking of 250 spots is included, there is a shortage of available parking. However, this shortage (actually realized 2-3 days per year) is remedied by early arriving skiers leaving mid-day, opening up those parking spots to accommodate skiers arriving later in the day. However, if a 2.5 person average occupancy per vehicle is used, then there would be a surplus of 22 spaces.

The off-site parking would be accommodated at pullouts along the Mission Ridge Road, the Scout-a-Vista Boy Scout Camp, and at Squilchuck State Park. A shuttle van then transports guests from these satellite lots to the Base Area. This is a major inconvenience because guests spend time waiting for the shuttle, have to carry all their ski gear on the shuttle, and then store personal items at the Day Lodge. The Link

Transit bus service would continue to provide public transportation to the ski area from Wenatchee on weekends and holidays. Self-contained recreational vehicles would continue to be able to camp overnight in the parking lot by reservation. There would continue to be two accessible parking stalls at Hampton Lodge and two accessible stalls at the Ticket Booth. Accommodations would be made if additional ADA spaces were needed. This alternative would have a long term, negligible impact because there would be no change that would move towards or away from the desired condition of providing road access to new facilities on private land, including additional parking.

Table 3-17. Existing Comfortable Carrying Capacity (CCC) and Parking Capacity

CCC & other Guests	2,784 guests
% Arriving by Shuttle/Bus	4
% Parking private vehicles	96
# Guests arriving by car	2,672
Required Car Parking spaces*	1,188
Required employee car parking spaces	60
Total required spaces	1,248
Existing on-site parking spaces	900
Existing off-site parking spaces	250
Total Parking Spots (On and off-site)	1,150
Surplus/Deficit Parking spots	-98

* Multiplier (2.25 persons per vehicle)

Resource Indicator: Recreational Options Within the Developed Resort

Alpine skiing would be the only developed recreation offered at the ski area. There would be no groomed Nordic skiing or designated snow-play area. Members of a family or party that do not alpine ski would need to travel to other areas to enjoy other developed winter recreational activities. Likewise, there would be no overnight accommodations at the ski area. Guests would have to travel to Wenatchee or other nearby communities to find overnight lodging. Food and beverage service, the sales and rental shop, restrooms, first aid, childcare, lifts and tows, ski slopes, ski instruction and other programs and activities would all be accessible to persons with disabilities that meet essential eligibility criteria.

Off-season, the Hampton Day Lodge in the Base Area would be available for rental for private parties. The ski area would be open to public non-motorized access, most often hikers or mountain bikers utilizing the Service Road or designated runs. The parking lots would be largely closed except trailhead parking would be provided near the Clara Lake Trailhead.

This alternative would have a long term, negligible impact, because there would be no change that would move towards or away from the desired condition of providing access to new facilities on private land, including Nordic ski trails and snow play areas.

Resource Indicator: Developed and Dispersed Recreation on Adjacent Lands

There are several areas adjacent to the ski area boundaries that would be used for dispersed recreation (Figure 3-12).

Beehive/Lake Clara Area: The Pipeline Trail and Clara Lake are popular Nordic ski/snowshoe destinations. These users would park in the Base Area parking lot and either travel up the Clara Lake trail

or use the Service Road (during off-hours) to access the Pipeline Trail #1200. Snowmobilers would use public lands adjacent to the Ski Area boundary in the Clara Lake area near Bomber Cliffs. These vehicles can sometimes be heard from the ski area but are restricted from entering. There is very light snowmobile use on the Liberty-Beehive Road #9712 which is gated to vehicles during the winter months. During warm weather months, hikers and mountain bikers would use the Pipeline/Clara Lake areas by parking in the Base Area parking lot and then travelling on the Clara Lake trail or the Service Road to the Pipeline trail. Mountain bikers could also access the Devils Gulch trail system or the Beehive area from the Pipeline Trail. Recreational use of these trails is light to moderate in both winter and summer seasons. The quality of the experience is excellent because the recreation use spreads out over this very large trail system. Dispersed camping occurs on flat areas and pullouts along the Beehive Road #9712, mostly in the spring and fall.

Naneum Ridge: Snowmobilers use public lands adjacent to the Ski Area boundary on Naneum Ridge near the Microwave Tower (Figure 3-12). These vehicles can sometimes be heard from the ski area but are restricted from entering.

Upper Stemilt Basin: The Upper Stemilt Basin would be used largely by snowmobilers in the winter on a groomed trail system that is accessed from the Stemilt Loop Road (Appendix G). Access to the Upper Stemilt Basin for Nordic skiers and snowshoers is also provided via the Chak-Chak run and Outback area during non-operating hours. However, this use is also very light, because the access is difficult, and winter backcountry skills are needed. In the summer season a small number of motorcyclists and ATVs would illegally access Section 19 on existing roads (not open to motorized vehicles) from Section 20. They would travel up the existing roadbed in the southeast quarter of Section 19 to the road intersection in the middle of Section 19. There would be little use on the old roadbeds from this point. A smaller number of hikers and mountain bikers would also use the Upper Stemilt Basin from trailheads in Squilchuck State Park or off the Stemilt Loop Road. There would be very little summer hiker use from the Base Area to access the Upper Stemilt Basin because access is difficult and there are no designated routes. The Upper Wheeler Reservoir would be used by people fishing and other recreationists who access the reservoir from the Orr Creek Road or the Upper Wheeler Road. These roads are gated before the reservoir because public motorized access is restricted at the reservoir. This Upper Stemilt area receives motorized vehicle use on the extensive road system during the warm weather months, accessed from the Stemilt Loop Road. On WDFW lands, all motorized vehicles are restricted to those roads signed with a green dot. Fishing on the various reservoirs, camping, hunting, wildlife viewing, hiking, and equestrian use are the main recreational activities. Camping occurs on dispersed campsites, many near water bodies that are open to the public. This alternative would have a long term, negligible impact, because there would be no change that would affect how recreationists use adjacent public lands for dispersed recreation.

Summary of Effects

Alternative 1 (No Action)

Effects of Alternative 1 are summarized in Table 3-18.

Table 3-18: Effects of Alternative 1 on the Recreation Resource Indicators

Resource Indicator	Measure	Environmental Effects
Alpine Ski Terrain	# Ski Runs	33
Alpine Ski Terrain	Acres of Ski Runs	204
Alpine Ski Terrain	Ski Runs by Difficulty Level	7/80/13

	(%)	
Alpine Ski Terrain	Acres of Skiable Terrain	2,080
Alpine Ski Terrain	Acres of Beginner Terrain	13
Alpine Ski Terrain	Acres of Instructional Terrain	1.0
Alpine Ski Terrain	Acres of Gladed Terrain	18
Alpine Ski Terrain	Ski Run Total Lineal Distance (miles)	14.7
Alpine Ski Terrain	Ski Run Total Vertical (feet)	19,575
Alpine Ski Terrain	Acres of Snowmaking	39
Alpine Ski Terrain	Acres of Night Lighting	39
Alpine Ski Terrain	# Terrain Parks	3
Lift and Area Capacity	# Aerial lifts	4
Lift and Area Capacity	Length of Aerial lifts and Surface lifts (feet)	18,372
Lift and Area Capacity	Vertical rise of Aerial lifts (feet)	4,494
Lift and Area Capacity	Vertical Rise of Aerial lifts and Surface lifts (feet)	4,626
Lift and Area Capacity	Aerial lift Capacity (skiers/hour)	4,774
Lift and Area Capacity	Aerial and Surface lift capacity (skiers/hour)	6,624
Lift and Area Capacity	Comfortable Carrying Capacity	2,784
Skier Services Facilities	# Day Lodges	2
Skier Services Facilities	# Restaurants	1
Skier Services Facilities	# Overnight Accommodations	0
Skier Services Facilities	Square Feet Skier Services Buildings	22,732
Access/Parking	Miles New Access Road length	0.0
Access/Parking	Day Use Parking Lot Vehicle Capacity	900
Access/Parking	Off-site Parking Capacity	250
Access/Parking	Total On & Off-site parking	1,150
Recreation Options in the Developed Resort	Miles/km of groomed Nordic Trail	0

Recreation Options in the Developed Resort	# of Snow-tubing Areas	0
Dispersed Recreation on Adjacent Lands	Non-motorized Rec Use	Light use In Upper Stemilt Moderate use in Clara Lake area

Alternative 2 (Proposed Action)

Resource Indicator: Alpine Ski Terrain

The skiable terrain, designated ski runs, and terrain parks within the existing Permit Area would continue to be maintained and used. The permit area for the ski area would be enlarged by 160 acres on the National Forest to a total 2,240 acres, which for this analysis is assumed to be skiable. An additional 70 acres of private land, outside the Nordic trail system and areas to be developed, would be skiable by alpine skiers for a total skiable 2,310 acres. In addition, 18 new ski runs and two ski ways totaling 62 acres would be added in the expansion area (Figure 2-1, 2-3, Appendix A). The percentage of runs by difficulty level (Beginner/Intermediate/Advanced) would be 65/30/0 in the Expansion Area and 20/70/10 for the entire ski area, compared to the industry standard 15/75/15 (Figure 3-14). There would also be about 18 acres of gladed terrain interspersed between the designated runs. The Outback area is an open bowl with scattered trees, which is currently accessed from Chair 4 with a long traverse. Chair 6 would serve this area directly, making skier access easier. Chairs 6 and 7 would also provide access to seven intermediate runs. On the private land in Section 19, a magic carpet would access a beginner instruction slope (one acre) and a platter pull would serve another slope that could be used for beginner instruction (one acre) creating two areas that would be used for instruction. This would create a good learning environment and beginning ski experience. Pulsed Gondola 8 would serve nine acres of exclusively beginner terrain. This terrain could be successfully skied by first time skiers on the first day. Most of this beginning ski terrain would not be routinely used by more advanced skiers. Chairlifts 6 and 7 would also access four new beginner runs, which, in addition to the Pulsed Gondola 8 terrain and ski ways from the Chak-Chak trail connecting to the Expansion trail system and a ski way connecting the Village to the Day Use parking area, would total 40 acres of new beginner terrain. One of these beginner trails winds through residential areas of the resort creating a unique ski experience.

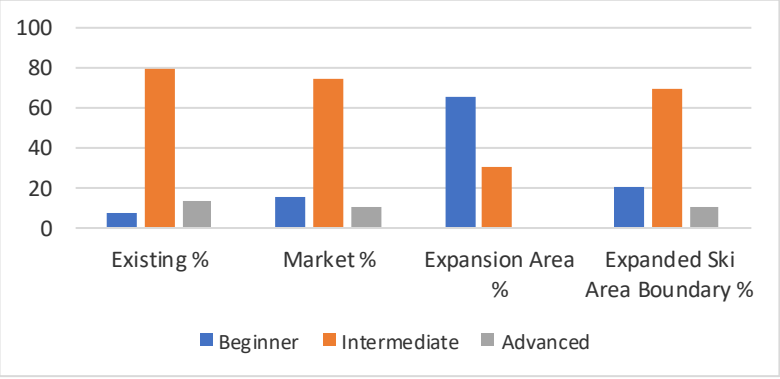


Figure 3-14. Terrain Distribution by Ability Level for the Entire Ski Area (Existing and Expansion Trails) as compared to existing.

At the Comfortable Carrying Capacity of 1,880 in the Expansion Area, there would be an average of 32 skiers per acre on the 62 acres of designated runs. Optimum density would be 28 skiers per acre. Over the entire ski area, at a CCC of 4,664 and 266 acres of designated runs, there would be an average of 17

skiers per acre. For comparison, preferred skier densities are generally 30 beginner skiers per acre, 20 Intermediate skiers per acre, and 10 Advanced skiers per acre. However, since many advanced skiers ski off designated runs, these numbers would actually be lower.

Night skiing would continue to be provided on terrain under Chair 4, Pika Peak (Beginner) rope tow and 100 Laps rope tow (39 acres) and all new ski runs in the Expansion area would also be lighted (62 acres) for a total 101 acres. Snowmaking would continue providing one route from the top of the mountain to the Base Area, and some coverage on trails served by Chairlifts 3 and 4 (39 acres). Snowmaking coverage would be added to all new ski runs in the Expansion Area (62 acres) for a total of 101 acres, ensuring skiing throughout the operating season. There would be a low level of snow avalanche concerns on the new alpine ski terrain due to the largely forested cover and low slope angle.

Competitive ski races would continue on the Skookum and Tumwater Runs. During non-operating hours, skiers, snowboarders and snowshoers would continue to travel uphill, under the direction of the "Uphill Policy", on the Service Road, Mimi, Bomber and Boundary runs under Chairs 1 and 2, under Chair 4 on the Outback and Chak-Chak runs, and in the Expansion Area. The Expansion Area on the "other side" of the mountain from the existing ski area in Stemilt Basin would create an alpine ski atmosphere of variety and discovery, as there would be new terrain and views in a totally different watershed. Ski-in/ski-out experiences would be provided from 90% of the residential units, creating an atmosphere where skiers could park their car and not need it until they left the resort. A platter relay lift would facilitate a number of residences that would be able to ski-in/ski-out. Pulsed Gondola 8 would serve a mountaintop restaurant, providing a unique alpine atmosphere.

Climate change, leading to warmer, shorter winter periods, could shorten the operating season for both the alpine and Nordic terrain, likely reducing the annual visits. This could be mitigated in part by increased utilization of the snowmaking system, to produce the snowpack when it is cold enough to make snow.

This alternative would have a major beneficial, long-term impact, as it would move towards the desired condition of providing additional high quality alpine ski terrain, with improved beginner slopes and instructional areas with additional night lighting and snowmaking coverage. These impacts would provide improved skier experiences well into the future.

Resource Indicator: Lift and Ski Area Capacity

The four existing chairlifts and two rope tows would continue to be maintained and used. In addition, two additional quad chairlifts, a pulsed gondola, a platter pull and a magic carpet would serve new alpine terrain and beginner instructional slopes (Tables 3-19 and 3-20). A pulsed gondola from the Day Use Parking lot to the Village Base Area is strictly a transport lift and does not add to the CCC and is not included in analysis of on-mountain capacity.

The total vertical rise of all the aerial lifts in the ski area (Chairlifts 1, 2, 3, 4, 6, 7 and Pulsed Gondola 8) would increase from the existing 4,494 feet plus 1,785 feet in the Expansion Area to 6,279 feet, an increase of 40%. The total vertical rise of all aerial and surface lifts would increase from the existing 4,626 feet to 6,491 feet, also a 40% increase. The aerial lift capacity (skiers per hour) would increase from the existing 4,774 (plus 4,700 in the Expansion Area) to 9,474, an increase of 98%. The total of all aerial and surface lifts capacity would increase from the existing 6,624 skiers/hour to 13,124 skiers/hour, also an increase of 98%. Skier visits were 114,000 in the 2016-17 ski year. In the 2019-20 ski season, with a move to a seven-day week schedule, skier visits are projected to be 127,000, an 11% increase (RRC Associates, 2018). Ten years after on-mountain improvements are made, projected skier visits would be 168,000, a 32% increase over the 2019-20 season and a 47% increase over the 2016-17 season. The Comfortable Carrying Capacity would increase from the existing 2,784 plus 1,880 in the Expansion Area to 4,664, a 68% increase. Therefore, CCC would increase by 68%; with expected skier visits expected to increase by only 32% over the 2019-2020 season.

Aerial lift (Chairlifts 1, 2, 3, 4, 6, 7, and Pulsed Gondola 8) capacity would increase by 98% compared to the projected increase of 32% skier visits above the 2019-20 seven day a week season. On days when the CCC is reached, no lift lines would be expected to form as skiers spread out over the existing and new terrain. Ski run acreage would increase by 11% compared to the projected increase of 32% skier visits above the 2019-20 seven day a week schedule. The increased acres of designated ski runs would provide a similar skier density on runs as currently exists (17 skiers/acre versus 14 skiers/acres existing). Skier preferences for faster, higher capacity lifts (USFS, 1998) would be satisfied.

Table 3-19. Expansion Aerial Lifts

Chairlift #/Type	Length (feet)	Vertical Drop (feet)	Lift Capacity (Skiers/hour)	Comfortable Carrying Capacity (Skiers at one time)
Chair 6 – Fixed Grip Quad	3,220	755	2,000	880
Chair 7 - Detachable Quad	2,262	620	2,000	640
8 -Pulsed Gondola	1,788	410	700	260
Total	7,270	1,785	4,700	1,780
Transport Pulse Gondola*	981	145	940	NA

* Transport Pulse Gondola not included in Capacity analysis because it is strictly a transport lift.

Table 3-20. Expansion Surface Tows

Tow	Length (feet)	Vertical Drop (feet)	Tow Capacity (Skiers/hour)	Comfortable Carrying Capacity (skiers at one time)
Magic Carpets	206	20	1,200	50
Platter Pull	504	60	600	50
Total	710	80	1,800	100

This alternative would have a major beneficial, long-term impact, because it would move towards the desired condition of providing additional lift capacity. These impacts would provide improved skier experiences well into the future as regional population and demand for alpine skiing increases.

Resource Indicator: Skier Service Facilities

The two existing day lodges and associated visitor services buildings would continue to be maintained and utilized. In addition, a new day lodge, mountaintop restaurant, and skier services facilities would be provided in the Expansion Area (Table 3-21). There would be about 90,000 square feet of commercial space available in the ground floors of the nine condominium buildings in the Village that would house skier services, such as, a day lodge, ski school, first aid, ski patrol, rental and sale shop, and ticketing. The day lodge would be located in the building closest to the Chair 6/7 base terminals. In addition, the mountaintop restaurant near the top of Pulsed Gondola 8 would have about 3,000 square feet of space. Food and beverage service, the sales and rental shop, restrooms, first aid, childcare, lifts and tows, ski slopes, and other public spaces would all be accessible to persons with disabilities that meet essential eligibility criteria.

Space use requirements are directly related to the CCC. Based on industry averages for similar ski areas, the total amount of skier services space available for the CCC of 4,664 ranges from 56,000 to 82,000 square feet. With the existing space of 22,000 square feet and an available 90,000 square feet available in the Village Base Area, the total 112,000 square feet is well above this range. Similarly, with the Comfortable Carrying Capacity projected to increase 68% from existing levels at year ten or a 32% increase in skier visits over the 2019-20 seven day a week season, a 295% increase in available skier services space (90,000 square feet) when compared to the existing 22,732 square feet of space, would provide more than adequate space for skier services. On busy weekends and holiday periods, the three day lodges and mountaintop restaurant would be better able to provide food service in an uncrowded comfortable atmosphere than the existing situation. Food service at the mountaintop restaurant at the top of Chairlift 8 would provide a unique alpine atmosphere. Ski rental/repair and retail shops would be provided at the existing Base Area and in the new Village Base Area, which would provide better service in a less crowded atmosphere.

The condominiums and lodge would be located in the Village, enhancing the alpine atmosphere for visitors. 621 condominiums/multi-family townhomes, 275 single-family residences and a 57-room hotel/lodge (pending Chelan County approval) would provide on-mountain overnight accommodations, providing an alpine resort experience. 90% of these residences would have ski-in/ski-out ability to the alpine terrain. This alternative would have a major beneficial, long-term impact, because it would move towards the desired condition of providing additional ski services, facilities, and accommodations in close proximity to local communities. These impacts would provide improved skier experiences well into the future as the Village is built out and matures.

Table 3-21. Skier Services Buildings

Building	Size (Square/feet)
Existing Skier Services Buildings	22,732
Available Building Space for Expansion Skier Services	90,000
Total Available Skier Services Space	112,732

Resource Indicator: Access and Parking

Access to the ski area would continue to be provided on the Mission Ridge Road (Chelan County Road 711) 4.0 miles from Squilchuck State Park. This road is maintained by Chelan County and provides safe access in all but the most severe weather and road conditions. This road would be extended along the east side of the existing parking lot, then 0.7 miles across the National Forest, and 0.2 miles across private land to access the new Day Use Parking Area. The new access road would be similar to the existing County Road; two lanes with shoulders, asphalt surfaced, maintained for year-round access, and would meet County requirements for emergency access. 4.2 miles of additional road would be built in the Expansion Area to access the Village and residences.

The existing day use parking lot would be maintained and utilized. However, this parking lot would lose approximately 100 parking spots (to a total 800 spots) due to the new County access road, which would route through the parking lot to connect to the expansion area. The new Day Use Parking Area would be built and would accommodate 590 vehicles. Two underground parking lots below the Village Plaza would accommodate 120 vehicles. The condominiums and hotel/lodge in the Village Base Area would have underground parking to accommodate those visitor's vehicles. The other residences in the Expansion

Area would have parking associated with each townhome or single-family residence. Accessible parking would be provided as per code.

Preliminary data on vehicle occupancy from Mission Ridge indicates a 2.25 person average occupancy per vehicle, a ratio that is lower than the national averages of 2.3 to 2.8 people per vehicle. With the new Day Use Parking Area (590 parking spots), underground parking below the Village Plaza (120 spots), and parking provided at Village units and residences (932 spots), this would increase parking capacity by 182% (1,642 parking spots plus the existing 800 parking spots for a total 2,442 parking spots) at the resort and provide a surplus of 332 parking spaces on a busy day at Comfortable Carrying Capacity (Table 3-22).

However, some of the dwellings would be full-time residences or not utilized on a particular day. If only the existing, expansion, and Village Plaza underground day use parking lots are considered, there would be a shortage of 600 parking spots on the approximately ten days when the Comfortable Carrying Capacity of 4,664 is reached. If the 250 off-site parking spots were considered, there would be a shortage of 350 parking spots. However, if 61% of the 932 dwelling units are occupied with skiers who would park at the dwelling, on busy days when Comfortable Carrying Capacity is reached, then parking would be adequate without using the 250 off-site parking spaces. If these 250 off-site parking spots were used, then 36% of the dwelling units would need to be occupied with skiers to provide adequate parking.

Projections at year ten (after on-mountain improvements are made) indicate that 44% of visitors would use overnight facilities (RRC Associates, 2018). If 50% of these visitors using overnight facilities stayed on the mountain on CCC days (the other 50% staying off-mountain), then 438 vehicles would be accommodated by parking provided at the on-mountain dwellings. The three day-use parking lots and 162 off-site parking spots would be able to accommodate all day user-parking needs. Therefore, assuming 50% of overnight visitors stay on the mountain, on the ten days per year when CCC is attained, the Day Use parking lots and on-mountain overnight accommodations would accommodate 94% of the parking needs. On days when CCC is not met, the day use parking lots would be able to accommodate most vehicles, with some reliance on off-site parking.

Parking for day use Nordic skiers is not included in this analysis, because it is not known how much demand there would be for this opportunity. Nordic skiers generally only ski one to two hours and would then leave, compared to most alpine skiers who stay for three to seven hours. These vacated Nordic skier parking spots would then be available to other visitors. This analysis also utilized the low end of national average vehicle occupancy, so that if higher vehicle occupancy were used, it would likely accommodate the additional Nordic skier parking demand.

Any parking overflow would be accommodated at pullouts along the County Road, the Boy Scout Camp, and at Squilchuck State Park, which would provide an additional 250 parking spots. A shuttle van would then transport guests from these satellite lots to the Base Area. The Link Transit bus service would provide public transportation to the ski area from Wenatchee on weekends and holidays. Self-contained recreational vehicles would be able to camp overnight in the existing parking lot by reservation. ADA parking would be provided in the existing base area, in the expansion day-use parking lot and in the Village as required under code. A pulsed gondola would transport visitors from the new parking lot to the Village and base terminals of Chairlifts 7 and Pulsed Gondola 8. Visitors would also be able to drive from the Day-use parking lot to the Village and Chairs 7 and Pulsed Gondola 8 base terminals. This alternative would have a major beneficial, long-term impact, because it would move towards the desired condition of providing road access to new facilities on private land, including additional parking. These impacts would provide access and adequate parking well into the future.

Table 3-22. Parking Capacity for the Entire Ski Area (Existing and Expansion)

Comfortable Carrying Capacity	4,664 guests
% Arriving by Shuttle/Bus	4
% Parking private vehicles	96
# Guests arriving by car	4,477
# Required Car Parking spaces*	1,990
# Required employee car parking spaces	120
Total required spaces	2,110
Total on-site parking spaces	2,442 (800 Existing Day Use/590 Expansion Day Use/120 Village Plaza underground/932 Overnight Dwellings)
Surplus/Deficit parking spaces	+332

* Multiplier (2.25 people per vehicle)

Resource Indicator: Recreational Options Within the Developed Resort

Alpine skiing would be provided at the existing ski area and in the new expansion area. 10.5 kilometers (6.5 miles) of groomed Nordic ski trails would be built on private land and the National Forest in Section 30 (Figure 2-4). Many of these trails would be located on old roadbeds (5.8 km) in the area; others would need to be built (4.7 km). These trails would accommodate classic and skate skiers, snowshoers, and snow-bikers (fat tire bikes), be maintained by Mission Ridge or an authorized partner, and have a use-fee. Different user-groups may be scheduled at different times to avoid user conflicts. A tubing/snow-play facility would be located just below the Village. Members of a family or party that do not alpine ski would be able to enjoy these other winter recreational activities at the resort. Likewise, there would be a variety of overnight accommodations at the ski area. Guests would be able to stay at the resort overnight without having to travel to surrounding communities. Food and beverage service, first aid, childcare, lifts and tows, ski slopes, ski instruction and other programs and activities would all be accessible to persons with disabilities that meet essential eligibility criteria.

Off-season, the Hampton Day Lodge in the Base Area and new facilities in the Village would be available for rental for private parties. Food service, meeting rooms, shops, and other visitor support services in the Village would be open off-season depending on demand. There would be designated open spaces and walking trails within the residential areas, many of which would be accessible. In the summer, the Nordic trails on the National Forest would be open to non-motorized recreation and Nordic trails on the private land would be open to non-motorized and motorized (motorcycles/ATV's) vehicles with no fee. The existing and expansion alpine ski area would be open to public non-motorized access, most often hikers or mountain bikers using Service Roads or designated runs. Dispersed camping is not likely to occur within the Project Area because areas away from the resort development are mostly too steep and forested. The existing Base Area parking lot would be largely closed; except trailhead parking would be provided near the Clara Lake Trailhead. However, the day use parking lot at the expansion area would remain open year round.

This alternative would have a major beneficial, long-term impact, because it would move towards the desired condition of providing access to new facilities on private land, including Nordic skiing trails and snow play areas. Off-season it would provide access to multi-use trails for hikers, mountain bikers and equestrians. These impacts would improve recreational options within the developed resort well into the future.

Resource Indicator: Developed and Dispersed Recreation on Adjacent Lands
There are several areas adjacent to the ski area boundaries that would be used for dispersed recreation (Figure 3-1).

Beehive/Clara Lake Area: The Pipeline Trail and Clara Lake are popular Nordic ski/snowshoe destinations. These users would park in the Base Area parking lot and either travel up the Clara Lake trail or use the Service Road (during off-hours) to access the Pipeline Trail #1200. During warm weather months, hikers and mountain bikers would utilize the Pipeline/Clara Lake areas by parking in the Base Area parking lot and then travelling on the Clara Lake trail or the Service Road to the Pipeline trail. Mountain bikers could also access the Devils Gulch trail system or the Beehive area from the Pipeline Trail. Recreational use of these trails would increase because more people are attracted to and would reside in the dwellings at the Expansion Area. However, the excellent quality of the recreational experience would continue because the recreation use would spread out over this very large trail system. Dispersed camping would occur on flat areas or pullouts along the Beehive Road #9712, mostly in the spring and fall. Increased year round use of the Mission Ridge Road would likely slightly increase use of the Liberty-Beehive Road #9712, which is open to vehicles during the summer season. However this road is a Maintenance Level 3 road that has a hardened gravel surface and intervisible turnouts that would be able to safely handle this increased use. Snowmobilers also would use the public lands in the Clara Lake area north of Bomber Cliffs adjacent to the Ski Area boundary. These vehicles can sometimes be heard from the ski area but are restricted from entering. Snowmobile use of the Liberty-Beehive Road #9712 is not expected to increase substantially because most of the additional recreation users at the Expansion Area would focus on the winter recreational opportunities afforded there.

Upper Stemilt Basin: In winter months, the Upper Stemilt Basin would be used largely by snowmobiles on the existing Lily Lake/Stemilt-Colockum groomed snowmobile trail system (Figure 3-1). This system only approaches the existing and expansion ski area on the Naneum Ridge Road near the Microwave Tower. These vehicles can sometimes be heard from the ski area but are restricted from entering. Backcountry skiers and snowshoers could travel on existing road locations from the Expansion Area groomed Nordic trail system down to Squilchuck State Park and Scout-a-Vista Boy Scout Camp. This route, which lies on WDFW or Mission Ridge lands, would not be groomed or necessarily designated. Access to this route would be made easier by development of the Expansion Area. Most users would stay on the Expansion Area groomed trail system, but experienced backcountry skiers and snowshoers would likely use this route. A smaller amount of skiers/snowshoers would use the Expansion Area Nordic trails or ski from the top of Chairlifts 6 & 7 to more easily access backcountry in Sections 30, 31 and 36. Though there are no designated routes in this area, cross-country winter travel traverses high elevation timberlands and open, talus slopes with expansive views. Only the most fit and experienced backcountry skiers would also be able to connect with and use the groomed snowmobile system in the Stemilt, but this very occasional use would not adversely affect the current snowmobile use. Snowmobilers would need to slow down to safely pass the occasional skier or snowshoer. Non-motorized users share snowmobile trails safely on other groomed snowmobile systems nearby, such as Blewett Pass or Lake Wenatchee. Backcountry use as described above would most often occur in the springtime, when the snowpack has stabilized.

In the warm weather months, mostly motorized vehicles would use the Upper Stemilt Basin. Access is from the Stemilt Loop Road. However, motorized access in Section 19 on existing roads from Section 20 would change and non-motorized use would increase. The existing old roadbeds in Private Section 19 would become a part of the Expansion Area's interior roads or a part of the Nordic trail system. In the summer, these Nordic trails on the private land would be a designated trail system for non-motorized and non-vehicular motorized use. These trails would connect to existing roads in WDFW Section 20 (that are designated non-motorized) and on to existing non-motorized trails in Squilchuck State Park. Mountain bikers, hikers or equestrians would be able to travel from the Expansion Area in Section 19 down to

Squilchuck State Park or in the reverse direction (motorized vehicles are restricted on State Park Trails). Motorized and non-motorized recreationists would also be able to connect to and use the extensive road system in the Stemilt Basin and travel down to the Stemilt Loop Road (or reverse direction). Summer non-motorized users of the Nordic trail system could also access the Upper Wheeler Reservoir by travelling a short distance cross-country. However signing along the trail and patrols would discourage this use by motorized and non-motorized users. This non-motorized use would not adversely affect the current mostly motorized use on the existing road systems. Motorized users would need to slow down to safely pass non-motorized users on the road system. A small number of hikers would use the Expansion Area Nordic trails in the summer to more easily access backcountry in Sections 30, 31 and 36. Though there are no designated routes in this area, cross-country travel traverses high elevation timberlands and open, talus slopes. Current levels of recreation, hunting, fishing, and dispersed camping in the Stemilt Basin would not be expected to increase a large amount because there would be no vehicular motorized access from the Expansion Area and it would be a rather long round trip for most non-motorized users. However, ATV's and motorcycles from the Expansion area could rather easily access those lakes and reservoirs in the Upper Stemilt that are open to the public

The Stemilt-Squilchuck Recreation Plan (Chelan County, 2019) recognized the Mission Ridge Expansion Area; "Recreation expansion on private land in Zone 2 leads to higher concentrations of use in those areas and on adjacent public lands". The Plan also recommended a groomed cross-country ski trail in Sections 19 and NE ¼ Section 30.

This alternative would have a moderate beneficial, long-term impact, because it would provide easier access for recreationists to use adjacent public lands for dispersed recreation. These impacts would continue into the foreseeable future as people take advantage of the access that the new road and Village provides.

Summary of Direct and Indirect Effects of Alternative 2

The effects shown in Table 3-23 below describe the Resource Indicator values for Alternative 2 and the total value when combined with the existing ski area. Both of these values include public and private lands.

Table 3-23. Effects of Alternative 2 on the Recreation resource indicators

Resource Indicator	**Measure**	**Environmental Effects:** **Expansion/Total Existing & Expansion**
Alpine Ski Terrain	# Ski Runs	20/53
Alpine Ski Terrain	Acres of Ski Runs	62/266
Alpine Ski Terrain	Ski Runs by Difficulty Level (%)	65/35/0, 20/70/10
Alpine Ski Terrain	Acres of Skiable Terrain	230/2,310
Alpine Ski Terrain	Acres of Beginner Terrain	40/53
Alpine Ski Terrain	Acres of Instruction Terrain	2/3
Alpine Ski Terrain	Acres of Gladed Terrain	18/218
Alpine Ski Terrain	Ski Run Total Lineal Distance (miles)	7.2/21.9

Alpine Ski Terrain	Ski Run Total Vertical (feet)	5,950/25,525
Alpine Ski Terrain	Acres of Snowmaking	62/101
Alpine Ski Terrain	Acres of Night Lighting	62/88
Alpine Ski Terrain	# Terrain Parks	0/3
Lift and Area Capacity	# Aerial Lifts	4/8
Lift and Area Capacity	Total Length of Aerial Lifts and Surface Lifts (feet)*	7,980/26,352
Lift and Area Capacity	Total Vertical Rise of Aerial Lifts (feet)*	1,785/6,279
Lift and Area Capacity	Total Vertical Rise of Aerial Lifts and Surface Lifts (feet)*	1,865/6,491/
Lift and Area Capacity	Aerial Lift Capacity (skiers/hour)*	4,700/9,474
Lift and Area Capacity	Aerial Lift and Surface Lift Capacity (skiers/hour)*	6,500/13,124
Lift and Area Capacity	Comfortable Carrying capacity	1,880/4,664
Skier Services Facilities	# Day Lodges	1/3
Skier Services Facilities	# Mountain Restaurants	1/1
Skier Services Facilities	# Overnight Accommodations	932 Residences 57 Hotel rooms
Skier Services Facilities	Square Feet Skier Services Buildings	90,000/112,732
Access/Parking	Miles New Access Road	0.9/0.9
Access/Parking	Day Use Parking Lot Vehicle Capacity	710/1,510
Access/Parking	Off-site parking	0/250
Access/Parking	Parking at Dwellings	932
Access/Parking	Total On-mountain Parking	1,642/2,692
Recreation Options in Developed Resort	Miles/km of groomed Nordic Trail	10.5/10.5
Recreation Options in Developed Resort	# of Snow-tubing Areas	1/1
Dispersed Recreation on Adjacent Lands	Non-motorized Rec Use	Light use In Upper Stemilt Moderate use in Clara Lake area

* * Transport Pulse Gondola not included in Capacity analysis, as it is strictly a transport lift.

Cumulative Effects

The spatial boundary for analyzing the cumulative effects to Recreation is the Squilchuck watershed (down to Squilchuck State Park) and Stemilt watershed (down to the Stemilt Loop Road) boundaries. The temporal boundary is from the time of implementation of this project to twenty years into the future, the time when build-out of the resort would be complete.

Present and Ongoing Actions

Road System

Maintenance of the Service Road to the top of the present Ski Area continues and includes drainage devices, surface treatments, and danger tree removal. This road is treated to be hydrologically sustainable and is closed by a gate to public motorized travel.

Maintenance of the existing and Expansion Area Service Roads would be able to be accomplished concurrently.

Trail System

Maintenance of the Pipeline/Clara Lake Trail 1200 continues and includes drainage devices, tread repair, log-out, and brushing.

Public use of this trail would increase due to community development in the Expansion Area, but this use would not be expected to increase maintenance needs of this trail.

Ski Area Management

Permittee activities in the summer include: brushing and hazard tree removal along ski runs, maintenance of ski lifts, buildings, and snowmaking reservoir and piping systems, noxious weed treatments, and staffing administrative offices. Permittee winter activities include day-to-day operation of the ski area including: ski lift operation, ski patrol, ski trail grooming, snowmaking, parking lot snow removal and management, management of domestic water and wastewater systems, and visitor services, such as food and beverage service, retail/ski rental shops, day care, ski school, ticket sales, and first aid. Administrative activities by the Forest Service include: ski area Special Use Permit compliance, ski area operations inspections, trailhead maintenance, and law enforcement patrols.

Operation and maintenance of the existing and Expansion ski areas would be able to be accomplished concurrently with an increased workforce of approximately 120 employees in the winter season.

Winter Recreation

Alpine skiers would continue to utilize the facilities and services at the existing ski area including overnight RV camping in the parking lot. Nordic skiers and snowshoers would access backcountry areas (Clara Lake area and the Upper Stemilt Basin) from the ski area parking lot.

Alpine skiers would have increased opportunities in the Expansion area as described in Alternative 2. RV camping by reservation in the Existing Day Use parking lot would continue. Nordic skiers and snowshoers would have additional access to backcountry skiing and additional opportunity on the groomed Nordic trail system in the Expansion Area as described in Alternative 2 effects analysis.

Summer Recreation

Hikers and mountain bikers would use the existing Service Road and the Clara Lake/Pipeline trails. There is no motorized use in the ski area or immediately adjacent public lands. Private events, such as weddings and parties will occur in the Hampton Base Lodge under the terms of the Special Use Permit. Third parties also use the parking lot as a gathering place for mountain bike trail rides.

Hikers and mountain bikers would have increased opportunities utilizing ski runs, trails and roads in the Expansion Area and increased access to dispersed opportunities in the Stemilt Basin as described in Alternative 2 effects analysis.

Reasonably Foreseeable Activities

Road and Trail System Management
Maintenance of the road and trail systems will continue and will include danger tree removal along the Service Road. The Okanogan-Wenatchee National Forest is conducting an Environmental analysis for travel management that will designate motorized routes open to the public.

Ski Area Operating Schedule
Mission Ridge plans to operate seven days a week from mid-December through February for the 2019-2020 season. The rest of the operating season conforms to the present schedule.

Total skier visits would increase in the existing ski area as discussed in Alternative 2 effects analysis.

Recreation
Recreational activities are expected to occur as described in Present Actions.

Chair 3 Snowmaking

An environmental analysis is being conducted separately from this process to expand snowmaking coverage to the existing Nastar, Skookum, and Sitkum ski runs.

This would add 19 acres of snowmaking coverage to the 104 acres under Alternative 2 for a total of 123 acres. This would be an enhancement to the existing ski area and would also compliment the Expansion Area, improving early and late season coverage and providing a fresh snow surface during icy conditions. The existing reservoir has enough capacity to serve the Expansion Area as well as this Chair 3 and 4 terrain.

Mimi Run Lighting

Night lighting is being installed on the Mimi Trail under Chair 1 and in the 100 Laps Terrain Park during summer 2019. Night skiing on the Mimi trail will occur during the 2019-2020 ski season.

This would add 13 acres of night lighting and skiing to the 88 acres under Alternative 2 for a total of 101 acres. This would be an enhancement to the existing ski area and would also compliment the Expansion Area by providing night skiing opportunities on additional beginner terrain.

Chair 2 Replacement

An environmental analysis is being conducted separately from this process to replace Chair 2 with a new detachable quad lift with retractable Plexiglas bubbles that lower down to protect riders from the cold. The lift would be in the same location as the existing chair, but with different tower configurations.

This would be an enhancement to the existing ski area and would also compliment the Expansion Area by providing updated uphill transport facilities. The lift capacity would be similar to the existing Chair 2, not affecting Comfortable Carrying Capacity.

Chair 5

As proposed in the Mission Ridge Ski Area Master Plan Improvements EA (USDA-Forest Service, 2003), a new chairlift would access the top of Bowl Four. The base of this lift would be east of the current Chair 4 top terminal and the top would be located on Microwave Ridge. There would be two designated ski runs totaling eight acres serviced by this lift and would include 20 acres of tree thinning to provide gladed skiing opportunities.

This would be an enhancement to the existing ski area and would also compliment the Expansion Area by providing additional lift-serviced alpine ski terrain. This terrain is currently within the existing Permit Area and is accessed by a 30-45 minute hike and traverse from the top of Chair 2. Because of the difficult access, this terrain is lightly used now. With chairlift access, skiers could choose to ski down to

the top of Chair 4, access advanced off-piste terrain in Chair 4 Bowl, or down intermediate runs in the Stemilt Basin that would lead to the top of Chairs 7 or Pulsed Gondola 8. Because of the variety of runs possible from the top of Chair 5, no one trail would become crowded from the additional skiers from this lift. With the addition of more lift-serviced terrain, skier density would decrease in the rest of the ski area.

Chair 5 would also provide lift access to backcountry skiers to access terrain outside the permit area, on the slopes above Upper Wheeler Reservoir in Section 30. This would be an enhancement to the existing ski area and would also compliment the Expansion Area by providing additional alpine ski terrain. This project would be studied in a separate environmental analysis, which has not been initiated at this time.

Forest Plan Consistency

The Proposed Action is consistent with the Forest Plan Land Management Allocation of RE-1 Developed Recreation that is applicable to existing and potential alpine ski areas. The Proposed Action is consistent with the Forest Plan because it would provide for development of alpine and Nordic ski facilities and opportunities where demand is high and overuse problems are occurring at existing sites. It would plan recreation activities and facilities to provide a diverse range of recreation opportunities, develop partnerships and encourage recreation development through permits, joint ventures and cooperative agreements, and encourage development of recreation opportunities by private providers.

3.26 Soils

Methods

For analysis of the soil resources affected by the Mission Ridge Expansion Project, the entire Project Area was analyzed for direct and indirect effects. Acreages of effects are divided by land ownership, and activities on the private parcel (within Sections 19 and 30) are analyzed as connected actions. Soil types, parent materials, and erosion hazard ratings were obtained from the NRCS Web Soil Survey (USDA-NRCS 2019).

Field surveys were conducted in the early summer of 2019. The soils specialist measured the depth of the organic ("O") soil horizon in anticipated alpine ski runs, where contouring of the slope is planned. These measurements provide a target depth for the O horizon following project completion, when topsoil has been replaced following re-contouring. Measurements were taken by digging with a trowel to the surface mineral horizon (A horizon) and measuring the depth of the O horizon with a handheld ruler. At least 10 measurements were taken in each soil map unit (i.e., soil type) represented in the ski runs. Sampling occurred between May 28 and June 6, 2019.

Additionally, field ecologists noted existing areas of soil disturbance while conducting botanical field surveys in areas with proposed activity in the National Forest and WDFW portions of the Project Area. Soil conditions were not observed on the private parcel or in the existing ski area. Additional soil measurements and geologic research was performed by GN Northern, Inc., to assess feasibility of the access road planned on National Forest land. Methods and results are detailed in their Geologic Hazards Report (Appendix F of the SEPA, GN Northern, Inc. 2017).

Selection of Resource Indicators

Resource Indicators: Soil Erosion Hazards and Soil Productivity

The resource indicators selected were soil erosion hazards and soil productivity. These soil characteristics address the purpose and need of the project and issues raised during project scoping. They are important to forest health and have the potential to be affected by the Proposed Action. For example, surface soil erosion can lead to the loss of organic material and fine-textured soil particles, increase sedimentation in streams, and promote crust formation (Brady and Weil 2010). Soil erosion can also take the form of landslides or slope failure, causing dramatic shifts in sedimentation rates and soil structure. Soil productivity is important to sustain the productivity and diversity of the entire forest biome; in forests of the Project Area, organic matter forming the organic ("O") soil horizon promotes nutrient cycling and invertebrate activity and is a fundamental aspect of soil productivity.

The National Forest portion of the Project Area is allocated as a developed recreation area (RE-1) and is thus exempt from the Standards and Guidelines for soil management on the Okanogan-Wenatchee National Forest. Specifically, the 15-20% threshold for detrimental soil conditions does not apply to the project, therefore was not selected as a Resource Indicator.

Existing Condition

General soil characteristics and geologic history

Soil types in the Project Area are a result of the ancient collapsing and landslides of stacked basalt from the Columbia Basalt Flows. The Basalt Flows deposited between 16.7 and 5.5 million years ago and then were uplifted and tilted. Subsequent mass wasting is suspected to have occurred during the Pleistocene Epoch, 11,700 years to 2.6 million years ago, when glacial flooding undercut supporting material and saturated thin, weak layers of sedimentary material interspersed in the basalt. While many alpine glaciers existed in the Cascades during the Pleistocene Epoch, surface landforms in the Project Area do not appear to have been scoured or shaped by glaciers. In the last 11,700 years, explosive volcanism has added ash to the upper layers of soil.

The outcome of these geologic activities is an array of deep, unconsolidated soils topped by ash and interspersed with other features. These features include small outcrops of exposed bedrock revealing layered basalt, expanses of stone- to boulder-sized talus, and a ridge and nose slope of exposed, ancient sandstone. Additional details on regional geology can be found in Appendix F Geologic Hazards Report (GN Northern, Inc. 2017) of the 2017 SEPA report.

There are eight soil types found in the Project Area (Table 3-24; Figure 3-15). About 30% of the Project Area is rock or talus with no appreciable soil layer. The remaining 70% is covered by soils that are all well-drained with a loamy texture. The upper mineral layers are mixed with volcanic ash and there is typically 0-2 inches of an O horizon. While all soils are loamy, they range from ashy silt loam to stony loam to very gravelly sandy loam. All but the Blewett series (Map Unit Symbol 47) are moderately to very deep soils; Blewett soils are shallow.

Table 3-24. Soil types and characteristics found in the Project Area. Percent data are the proportion of each land ownership occupied by each soil type. These sum to 100% for each landowner. Data were obtained from the NRCS Web Soil Survey (USDA-NRCS 2019).

Map Unit Symbol	Soil type	Parent material	% of National Forest	% of WDFW land	% of private land	Acres in Project Area
LoF	Loneridge very stony loam, 30-60% slopes	Basalt	47%	3%	9%	185.8
211	Naxing very stony loam, 30-60% slopes	Basalt	21%	16%	-	118.8
StE	Stemilt silt loam, 25-45% slopes	Basalt or andesite	17%	<1%	64%	326.4
Ro	Rock (talus slopes)	Basalt	9%	61%	16%	325
47	Blewett and rock complex, 30-60% slopes	Sandstone	4%	<1%	-	14.1
LnD	Loneridge stony loam, 0-25% slopes	Basalt	2%	14%	-	56
StD	Stemilt silt loam, 0-25% slopes	Basalt or andesite	-	<1%	11%	47.5
263	Saydab extremely stony loam, 3-30% slopes	Basalt	-	5%	-	19.2

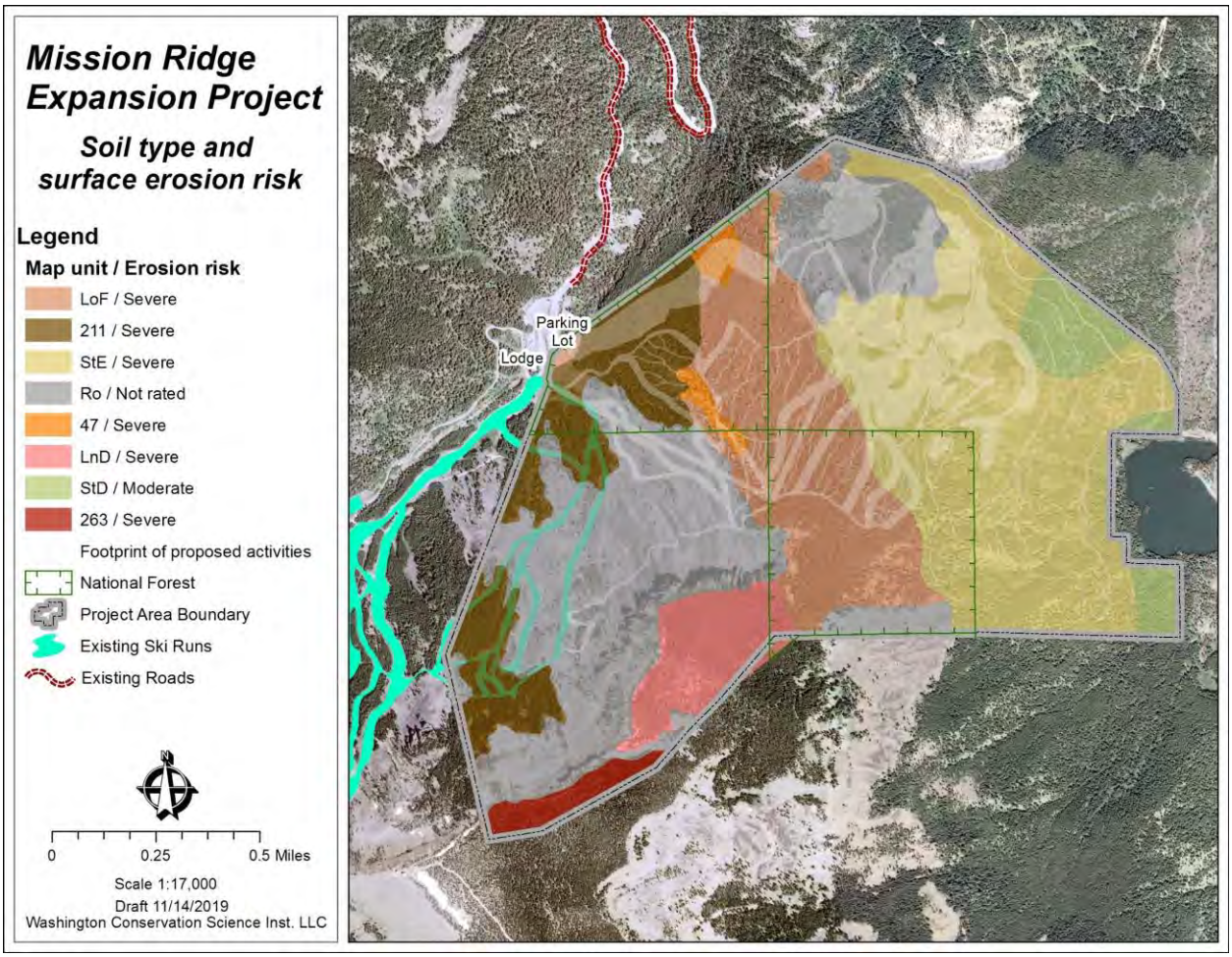


Figure 3-15. Map Unit Symbol and on-road surface erosion risk of soil types in the Project Area. Associated soil types and characteristics are listed in Table 3-22. Erosion risk is that of on-road rather than off-road because ski runs are more similar to roads than to soil exposed by activities such as logging or mining.

Resource Indicator: Soil Erosion Hazards

Few areas of soil disturbance were observed during field surveys. The few existing erosion hazards are due to unauthorized and temporary roads in the Project Area (Figure 3-17). There is an unauthorized road in the eastern portion of the Project Area that has partially diverted a stream. The water observed running over the road likely carries some sediment. There is also a gated, temporary access road originating from the existing parking area, which was constructed in the past two years for geotechnical assessment of project construction. Several instances of soil movement from the uphill road cut were observed, where soil and rock had sloughed from the hillside into or adjacent to the temporary road. These instances suggest the soil on the hillside readily slides when excavated.

Figure 3-16. Photograph of surface rill and sheet erosion on an existing ski run at Mission Ridge.

Aside from these roads, the majority of the Project Area has experienced little recent surface disturbance, so most existing erosion hazards are due to natural conditions. Most slopes are quite steep; ranging from 0° to 61°, with a mean of 19°. The mostly unvegetated, steep talus slopes have active rubble movement, while the dense woody vegetation and organic soil layers limit surface erosion in the forested areas.

Spatial data from NRCS and the Forest Service indicate that most of the Project Area is at a high risk of surface erosion (Figures 3-15). The "severe" erosion-risk rating for 66% of the Project Area (including 91% of the National Forest) indicates that erosion from unsurfaced roads, which are similar to ski runs, is very likely, and erosion-control measures and frequent maintenance are advised. Indeed, surface erosion has occurred on the existing ski runs, where there are exposed rocks and evidence of sheet and rill erosion (Figure 3-16).

Ninety-seven percent of the Project Area consists of landforms with a high risk of both shallow and deep-seated landslides (Figure 3-17). This aligns with the fact that the underlying geology is of ancient landslides and observations of slumping of unconsolidated material along the administrative access road.

Resource Indicator: Soil Productivity

Organic material in the Project Area is of moderate depth and is largely undisturbed. Field measurements in locations planned for contouring (i.e., alpine ski runs) showed an average of 1.3" of O horizon, ranging from 0.4" to 2.3" among soil types (Table 3-25). A thick O horizon exists throughout forests, while soils on the sandstone ridge and nose slope frequently have a shallow O horizon. In some areas with dense forest and steep slopes, many large and small trees have fallen to result in very high amounts of coarse woody debris.

Talus slopes and rock outcrops naturally lack mineral soil and organic material and are low in productivity. Most of these areas have no appreciable soil layers and do not support vegetation. However, some isolated locations have accumulated soil and organic material and do support trees, shrubs, and herbaceous vegetation.

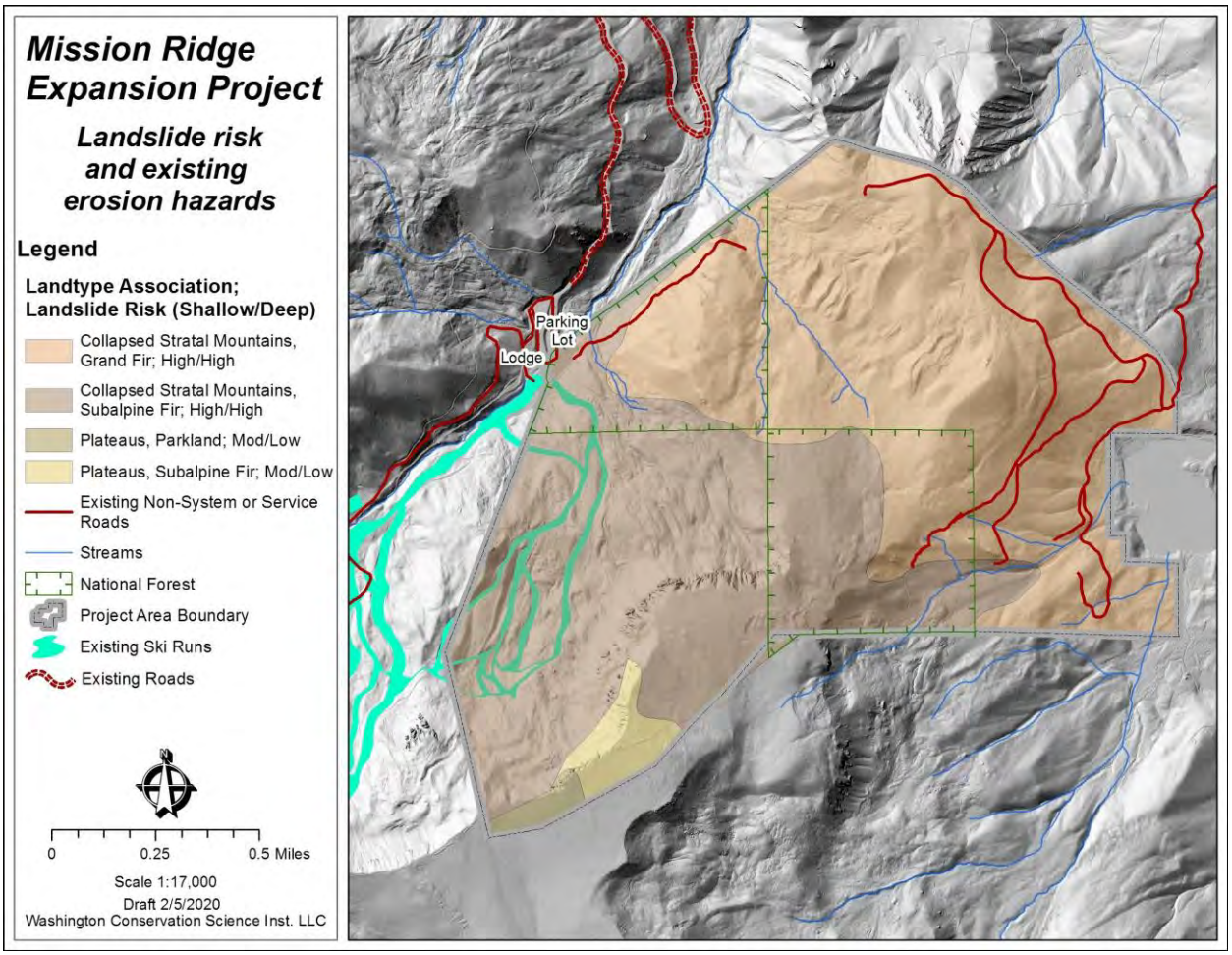


Figure 3-17. Landslide risk, landtype association and erosion hazards in the Project Area. 97% is at high risk of both shallow and deep landslides. Roads and existing ski runs are the only existing erosion hazard in the Project Area.

Summary of Existing Condition

Table 3-26 summarizes the existing condition of soil resource indicators, described in detail above.

Table 3-26. Summary of existing condition of soil resource indicators.

Indicator	Existing condition
Soil erosion hazards	Sloughing on the existing administrative access road, sedimentation on non-system roads, and rill and sheet erosion on ski runs. Elsewhere, forest vegetation limits erosion on steep slopes, while talus areas have active rubble movement. Most of the Project Area is at high risk of surface erosion and landslides.
Soil productivity	Undisturbed, thick organic material in forests; shallow organic layer on sandstone ridge and nose slope. Mean depth of the O horizon ranges from 0.4 to 2.3” among soil types. Some areas with very high levels of coarse woody debris. Little productivity on talus slopes.

Environmental Consequences

Direct and Indirect Effects

Alternative 1 (No Action)

Resource Indicator: Soil Erosion Hazards

With no action, erosion rates would continue at their existing levels. Roads and ski runs would continue to experience sloughing, sedimentation, and rill and sheet erosion, while undisturbed soil in forests would remain in place.

Resource Indicator: Soil Productivity

With no action, soil productivity would remain as it currently exists. In the forests, thick layers of organic soil and large amounts of coarse woody debris would continue to decompose and contribute to nutrient cycling. The sandstone ridge and nose slope would continue to support plant and microbial life adapted to shallow soils; and on talus slopes, isolated locations of soil accumulation and vegetative productivity would remain undisturbed.

Alternative 2 (Proposed Action)

Under Alternative 2, proposed activities would affect the soil resource by disturbing soil, removing vegetation and compacting snow. The relevant activities are summarized as follows:

Intense soil and vegetation disturbance, such as contouring or digging:

- road construction (main access road, mountain access/service roads)
- beginner and intermediate alpine ski runs
- new Nordic ski trails (those not on existing roadbeds)
- construction of bottom and top chairlift terminals
- installation of chairlift towers along lift line corridor
- temporary pioneer roads for installation of chairlift towers
- underground installation of electrical conduit along lift lines
- underground installation of water piping and electrical conduit alongside ski runs

Slight soil disturbance accompanying complete removal of tall vegetation and all large coarse woody debris:

- in 80-ft lift line corridor
- Nordic ski trails on existing roadbeds

Slight soil disturbance accompanying the partial removal of woody vegetation and all large coarse woody debris:

- gladed lines

Snow grooming, making, and compaction:

- beginner and intermediate alpine ski runs
- Nordic ski trails

Resource Indicator: Soil Erosion Hazards

Ski runs, lift lines, underground piping

One of the biggest considerations for soils under Alternative 2 would be surface erosion on ski runs. Historically, substantial erosion has occurred with ski run construction and maintenance. However, the implementation of BMPs to conserve surface soils and prevent sedimentation into streams would greatly improve these historical outcomes.

The construction of alpine and Nordic ski runs requires clearing vegetation and, sometimes, contouring soil (Table 3-27). Removing vegetation exposes bare soil and weakens root systems, increasing the likelihood that soil particles detach and are transported by water or wind. Contouring alters soil structure and compacts soils, reducing infiltration and water-holding capacity and increasing overland flow and erosion (Burt and Rice 2009). Indeed, in their study of Tahoe-area ski runs, Burt and Rice (2009) observed substantially more visible erosion (sheets and rills) on contoured runs, and slightly more erosion on cleared runs, than in reference forest. There was also much more bare ground, less litter, and shallower soil depths on the contoured runs. These findings align with observations of existing ski runs at Mission Ridge, where shallow soil depths and rill and sheet erosion are evident (see Figure 3-16 in Existing Condition).

Table 3-27. Estimates of acres that would be cleared or contoured as a result of ski run and chairlift construction in the Project Area, separated by landowner.

	Gladed	Cleared Ski runs	Lift lines	Contoured Ski runs
National Forest	13	15	4	18
WDFW	1	1	3	20
Private	4	6	9	23
Total	18	22	16	61

These findings reflect historical construction of ski runs that did not implement modern mitigation measures. This project would require the use of BMPs that should largely mitigate the adverse effects described above. The BMPs include salvaging and reinstating topsoil on contoured runs, and installing erosion control and sediment catchment features (full list in Appendix B). While research evaluating the effectiveness of these measures on soil erosion in ski runs is sparse, studies show that reinstating topsoil aids in the establishment of native plant cover (Ruth-Balaganaskaya and Myllynen-Malinen 2000, Barni et al. 2007), as does seeding (Bayfield 1996). Successful re-vegetation in turn aids in re-establishing soil porosity and water infiltration (Delgado et al. 2007). However, reinstated topsoil generally does not fully recover the natural binding of soil microbes (Delgado et al. 2007), resulting in increased risk of soil particle detachment. Furthermore, erosion mitigation is dependent on the success and timeliness of re-vegetation efforts (Delgado et al. 2007). So, while research and common sense point to BMPs greatly improving erosion outcomes, some surface erosion, particularly during construction and before vegetation is re-established, would still be expected. Note, however, that the input of this sediment into streams would be largely mitigated by BMPs, as sediment catchment systems are highly effective (see details in Section 3.21 Aquatics).

Outcomes on areas that are only cleared of vegetation, such as some ski runs, lift lines, and gladed skiing lines, would be less adverse than those on contoured runs. Burt and Rice (2009) observed that while cleared runs had more bare ground and signs of erosion than reference forests, they were similar in soil depth, depth to compaction, and water-holding capacity (unlike contoured runs, which differed dramatically from reference forests). Wipf et al. (2005) also found that long-term vegetation and erosion outcomes are improved on cleared versus contoured runs.

In addition to removing vegetation, some ski runs, lift tower areas, and gladed lines would need to be cleared of coarse woody debris (Figure 3-18). On steep slopes, woody debris disrupts water flow and protects tree seedlings, functions that reduce surface runoff and erosion (Brown et al. 2003). Where coarse woody debris is removed, these functions would be lost and surface erosion would increase slightly.

Figure 3-18. High levels of coarse woody debris in the forested areas of the Project Area disrupt water flow and protect tree seedlings.

Snow grooming on all alpine and Nordic ski runs would slightly intensify erosion. Grooming compacts snow, reducing its water-holding capacity and causing deeper and more intense soil freezing (Fahey and Wardle 1998). Snowmelt then occurs more rapidly and the soil tends to thaw at the surface first, resulting in more surface erosion than under un-compacted snow (Fahey and Wardle 1998).

Areas disturbed for the installation of lift towers and underground piping would likely have similar erosion outcomes as contoured alpine ski runs, since slopes are comparable and similar levels of soil disturbance would occur.

Roads and trails

New roads in the Project Area would impact both surface erosion and the potential for mass wasting. Regarding surface erosion, the permanent, unsurfaced mountain access road to the top of Chairs 6 and 7 would be highly compacted, increasing sediment runoff and altering local hydrology. Minimizing the area of disturbance (by sharing use with a beginner ski run) and promptly constructing erosion-control measures would improve erosion outcomes (Gucinski et al. 2001).

Roads on National Forest are known to accelerate mass erosion processes (Gucinski et al. 2001). They can affect both shallow and deep slumps and slides as well as debris flows. Shallow movement can be caused by the inadequate management of moving water, such as improper construction of stream crossings, inadequate culvert sizes, and diverting water into unstable parts of the landscape. Deep-seated movements are less well-studied, but may be affected when roads destabilize the toe area of or divert water onto a slow-moving, natural earthflow. They also can be triggered by the predictable decay of buried organic material that has been incorporated into road fills or landings.

Mitigating the risk of mass wasting from new roads is critical because of the high risk rating for landslides of virtually the entire Project Area. The access road to the Expansion Area would be constructed on a very steep and unconsolidated slope, presenting the highest risk for accelerating mass erosion. The hillside above and immediately below the road impact area would be of particular concern. The roads accessing the residential areas on the private parcel and the mountain access road would also affect landslide risk, but to a lesser extent because slopes are not as steep.

A preliminary analysis (Mission Ridge 2018) provided construction recommendations and instructions for additional, design-level analyses (GN Northern, Inc. 2017) that would help to mitigate risks associated with the road. Recommendations included assessing the site-specific slope stability, scaling precarious areas, delineating an appropriate setback, and using erosion measures to ensure long-term stability of

the soil surface. These are included in the design features for this project in Appendix B, features 17a-f in Soil Resources. These design features, information from additional, design-level analyses, as well as adherence to other BMPs and construction guidance in Appendix B would reasonably mitigate increased landslide risk.

The recreational use of Nordic trails in snow-free periods would slightly increase erosion on those surfaces. Design features to minimize sediment input to streams would be followed (Appendix B, Aquatics). Non-motorized use on the National Forest would result in very minor effects, while potential motorized use on the private land would have slightly more severe effects. These trails would cover about 14 acres of land, with 2 acres on the National Forest and 12 acres on private.

Resource Indicator: Soil Productivity

In areas with intense soil disturbance (roads, contoured alpine and Nordic ski runs, chairlift towers and terminals, underground electrical conduit and water piping), soil productivity would be adversely impacted. While mitigation measures of reinstating topsoil and successfully seeding with herbaceous vegetation has been shown to significantly improve organic content and porosity of the soil (Delgato et al. 2007), plant productivity on graded ski runs is typically still lower than that off of runs, even with re-seeding and 15 years of recovery (Wipf et al. 2005).

Snow grooming and artificial snow on all alpine ski runs would also reduce soil productivity. Grooming would cause snow compaction on alpine ski runs and Nordic ski trails. Compacted snow is less insulating, which causes the soil beneath to freeze deeper and colder, to thaw more slowly in the spring, and to hold more water in the upper layers (Fahey and Wardle 1998). In turn, soil fauna can be reduced up to 70%, bacterial activity is delayed in the spring, and litter decomposition is slower (Fahey and Wardle 1998). Artificial snow on 62 acres would further delay snowmelt and also add water to the ski run, effectively irrigating the soil and vegetation (Rixen et al. 2003).

Tree thinning on roughly 18 acres for gladed ski lines would have both positive and negative effects on soil productivity. The removal of trees and coarse woody debris – in some areas, very high amounts – could have a long-term, negative effect on soil productivity because input of material is important to the maintenance of soil microorganisms that decompose woody debris into useable nitrogen and other nutrients (Brown et al. 2003). On the other hand, thinning the dense forest would stimulate understory vegetation and tree regeneration, increasing nutrient input over time. By encouraging the retention of overstory canopy and restricting the removal of vegetation and woody debris to narrow, gladed lines, adverse effects would be minimized.

Pile burning of unmerchantable trees and slash from vegetation clearing for ski runs and gladed lines would have very minor effects on soil productivity. Busse et al. (2014) reviews how soil heating from pile burning can cause localized changes in soil properties such as lowering total carbon and nitrogen, reducing root mass and microbial community size, and increasing calcium, magnesium, potassium, pH, and inorganic nitrogen. These changes are dependent on the maximum temperature reached during burning, which in turn depends on the size of the wood burned. However, the authors conclude that burning of piles that are widely spaced and occupy a low percentage of the land surface has little overall effect on soils. For this project, soil productivity would be protected by requiring that piles with large wood not cover more than 30% of a ski run or gladed line (Appendix B, Soils, Design Feature #29).

Summary of Effects

Table 3-28 summarizes the direct and indirect effects of Alternative 2 on soil resource indicators. These effects are described in detail in the preceding sections.

Table 3-28. Summary of direct and indirect effects of Alternative 2 on soil resource indicators.

Indicator	Effects of Alternative 2
Soil erosion hazards	Contoured ski runs, lift tower and underground pipe installation sites, and unsurfaced mountain access roads historically have substantially increased surface erosion, but modern mitigation measures would greatly improve outcomes. Cleared ski runs, gladed lines, and lift corridors would have slightly increased erosion due to removal of vegetation and woody debris as well as snowmelt changes due to snow grooming. Increased landslide risk from the access road to the private parcel would be a concern, so following guidance and BMPs from geotechnical analyses would be essential. Summer use of Nordic trails would slightly increase surface erosion.
Soil productivity	Soil productivity would be reduced on intensely disturbed areas and with snow compaction from grooming; design features would mitigate loss. Tree thinning in gladed ski lines would have both positive and adverse effects. Pile burning would have very minor adverse effects.

Cumulative Effects

Cumulative effects on soil resources include consideration of current conditions and foreseeable activities in the Stemilt and Squilchuck watersheds for twenty years into the future. These activities are listed in the introduction to Chapter 3. Those most relevant to soil resources are road and trail maintenance, trail construction, the establishment of a Travel Management Plan for motorized recreation, commercial timber harvest on adjacent land, and the continued operation of the existing ski area.

These foreseeable activities will benefit soil erosion hazards in some places and adversely affect them in others. Surface erosion and the risk of landslides would be reduced with the maintenance of existing erosion control measures on roads and trails and by the establishment of a Travel Management Plan that restricts motorized recreation to maintained roads and trails. On the other hand, erosion would be increased where new trails are constructed and where timber harvest occurs, though design features can mitigate the increase on the National Forest. Erosion would continue in the existing ski area, where it currently occurs on ski runs and service roads and around the parking lot. In combination with Alternative 2, erosion levels in the watershed would increase a moderate amount.

Soil productivity would primarily be affected by timber harvest activities. The removal of vegetation and disturbance of organic soil layers can result in long-term reductions in inputs to nutrient cycling, but BMPs for leave trees and the retention of coarse woody debris would likely maintain soil productivity. In combination with Alternative 2, soil productivity in the watershed would be slightly reduced.

Forest Plan Consistency

The Proposed Action complies with National Forest regulations. Forest Plan Standards and Guidelines, including limitations on detrimental soil disturbance, do not apply to the Developed Recreation (RE-1) Land Management Allocation in which the Project Area lies(FSM 2520, R-6 Supplement No. 2500.98-1 and FSM 2550).

Mitigations, such as re-vegetating disturbed areas, reinstating topsoil, performing tree removal over frozen soils, and minimizing contouring, would ensure that soil erosion and displacement do not exceed reasonable levels and that sufficient organic material remains for soil productivity. Riparian Reserves would help protect streams from sedimentation. The geotechnical assessment regarding construction of the main access road across a steep slope found that construction was feasible and could be accomplished without undue risk of slope failure.

3.27 Transportation

This section summarizes the existing condition and the direct, indirect and cumulative effects of the Mission Ridge Expansion Project on the Forest Service Road system.

Methods

Impacts to transportation were assessed using the Traffic Report (Gibson Traffic Consultants, 2019) that is incorporated by reference. Existing National Forest System Roads that are tributary to the Mission Ridge Road were also assessed.

Resource Indicators

The resource indicators included length of new roads, maintenance responsibility and traffic levels along Mission Ridge and Squilchuck Roads.

Existing Condition

The Mission Ridge Expansion Project Area is accessed from Wenatchee via County Road 711, locally known as the Squilchuck Road to Squilchuck State Park, and as the Mission Ridge Road from Squilchuck State Park to the Mission Ridge Base Area. Mission Ridge Road is a two-lane asphalt road that was recently improved in 2007. November 2017 data identified peak-hour volumes of 107 northbound vehicles and 174 southbound vehicles. A temporary road was constructed from the existing parking lot in the base area along the proposed road corridor to the Expansion Area. This road was constructed to allow for geotechnical assessments (see Soils Section). In the private sections 19 and 30 there are old roadbeds from historic timber harvest that are no longer used.

Environmental Consequences

Direct and Indirect Effects

Alternative 1 (No Action)

Under Alternative 1, there would be no changes to the Chelan County or National Forest road system. Mission Ridge would not be able to access their property in Section 19 via a new access road across the National Forest in Section 24.

Alternative 2 (Proposed Action)

Under the Proposed Action, 0.7 miles of road would be built across National Forest land. Maintenance obligations for the Forest Service would not increase because the road would be maintained by Chelan County. There would be an increase in vehicular traffic along Squilchuck/Mission Ridge Road due to increased use of the expanded ski area facilities and occupancy of the residential community in Section 19. The results of the Traffic Impact Analysis (Gibson Traffic Consultants, 2019) suggested traffic volume would increase but the Squilchuck and Mission Ridge Roads are expected to have adequate capacity as a two lane road for the full build out of the resort in the year 2039. Please see the Traffic Impact Analysis (Gibson Traffic Consultants, 2019) for further detail (incorporated by reference).

The new access road to the Expansion Area, which would be managed by Chelan County, would not impact the National Forest road system. Increased vehicular traffic could indirectly increase recreational use along connecting FS roads and trails (skiing, horse-back riding, mountain biking, hiking, trail running, hunting, driving for pleasure). The Liberty-Beehive Road #9712 is the only National Forest System road open to motorized vehicles that is tributary to the Mission Ridge Road. It accesses the Beehive Reservoir, which attracts mostly people fishing in the spring, and the Devils Gulch trail system during the warm weather season. However, the Liberty-Beehive Road is a Maintenance Level 3 road that has a hardened gravel surface and inter-visible turnouts that would be able to safely handle this increased use. It is gated during the winter to restrict vehicles and is mostly used by snowmobiles. This use is not expected to

increase because most of the additional road users would focus on the recreational opportunities that the ski area offers. The Lake Clara and Devils Spur Trails may see increased use. However, these trails are currently lightly used and limited by available parking at the trailheads so increased use would likely be low.

Cumulative Effects

The area considered for cumulative effects analysis includes Forest Service Road (FSR) 9712 (Liberty-Beehive Road) and any National Forest System road or trail that connects to Mission Ridge Road. The following activities could add to the amount of Forest Service system roads and/or change the level of maintenance required on certain roads. There are no known foreseeable actions that would likely decrease the amount of Forest Service system roads.

The Okanogan-Wenatchee National Forest is preparing a Travel Management Plan, which would designate specific roads and trails where motorized use is permitted on the National Forest. Although Travel Management could result in a change in maintenance level or the closure of some roads, it is not anticipated that it would close roads or change the maintenance level for any roads in the Project Area. It will, therefore, not change maintenance costs or the number of Forest Service roads.

Road construction on the National Forest and adjacent lands could occur as a result of forest management and/or private land development. New National Forest road construction for timber harvest would be temporary roads that would be decommissioned after use, while private road construction is more likely to be permanent in nature. Therefore these actions could add temporarily to Forest Service maintenance responsibilities and costs. Timber harvest of private lands could have a similar effect and add maintenance costs and responsibilities if cost-share roads are used with adjacent landowners.

Forest Plan Consistency

There are no known conflicts between the alternatives discussed in this document and the Forest Plan. Alternative 2 is consistent with Standards and Guidelines for RE-1 to “Provide and manage roads that are compatible with the development level.” Travel Analysis of the National Forest Road system is not needed because the only road proposal on the National Forest is construction of the new access road, which will become a Chelan County Road. No changes are being proposed to National Forest roads that would impact travel management decisions previously made.

3.28 Vegetation and Fire Risk

This section summarizes the existing condition and the direct, indirect and cumulative effects of the Mission Ridge Expansion Project on vegetation resources and fire risk.

Methods

Two spatial scales were used to assess the potential effects of the Mission Ridge Expansion Project on vegetation structure and composition. At the broadest scale, vegetation information was summarized for the Assessment Area that included the Squilchuck and Stemilt subwatersheds. Vegetation was also assessed within the Project Area.

Two spatial scales were used to assess the potential impacts of the Mission Ridge Expansion Project on fire and fire risk. At the Assessment Area scale (39,000 acres), fire and fuel conditions were evaluated based on information generated from Gaines et al. (2019) and the Quantitative Risk Analysis process described in Scott et al. (2013). This analysis includes: 1) the current condition of fire regimes relevant to their natural conditions using historical and future reference conditions, and 2) how fire is likely to move across the landscape. The second spatial scale is the Project Area. The assessment at this scale is based on the Proposed Actions on state and federal lands and how they influence fire risk. On private lands, the assessment is based on information from the Squilchuck Valley Area Community Wildfire Protection Plan (Squilchuck Valley CWPP 2015) and the Mission Ridge Wildfire protection plan.

Selection of Resource Indicators

Resource Indicator: Vegetation Structure and Composition

Key indicators included the current and proposed changes to the vegetation structure, composition, and spatial arrangement compared to historical and future reference conditions. Assessing the landscape relevant to the future reference conditions provides for a means of addressing a warmer and drier climate scenario (Gartner et al. 2008, Hessburg et al. 2013). Reference conditions were derived from landscape evaluations (Gaines et al. 2019, Hessburg et al. 2013).

Resource Indicator: Fire and Fire Risk

Key indicators used to assess fire and fire risk included the current condition of fire regimes and fire movement at the landscape scale establish context that can influence the risk of fire impacting homes and other infrastructures, and assesses how Proposed Actions may influence risk levels. In addition, on private lands, consistency with existing wildfire protection plans was assessed.

Existing Condition

Forests across western North America are experiencing an increasing amount and severity of wildfires (Westerling et al. 2006, Westerling 2016). For example, in Washington State, the amount of area burned by wildfires each year has increased dramatically since 2005 (Figure 3-19). Past management practices, including timber harvest and fire suppression, have resulted in increased risks of uncharacteristically severe wildfire, escalating fire suppression costs, and risks to communities (Hessburg et al. 2000, Lehmkuhl et al. 2013, Hessburg et al. 2015). The resulting changes in tree species composition (often the most fire resilient species were harvested) and increases in forest density (as a result of fire suppression) have resulted in decreased resilience of forests to drought and fire for many of the regions forests. This occurs at a time when climate change is projected to increase drought stress and wildfire risks (Hessburg et al. 2000, Littell et al. 2010, Haugo et al. 2014, Spies et al. 2018, Hessburg et al. 2019).

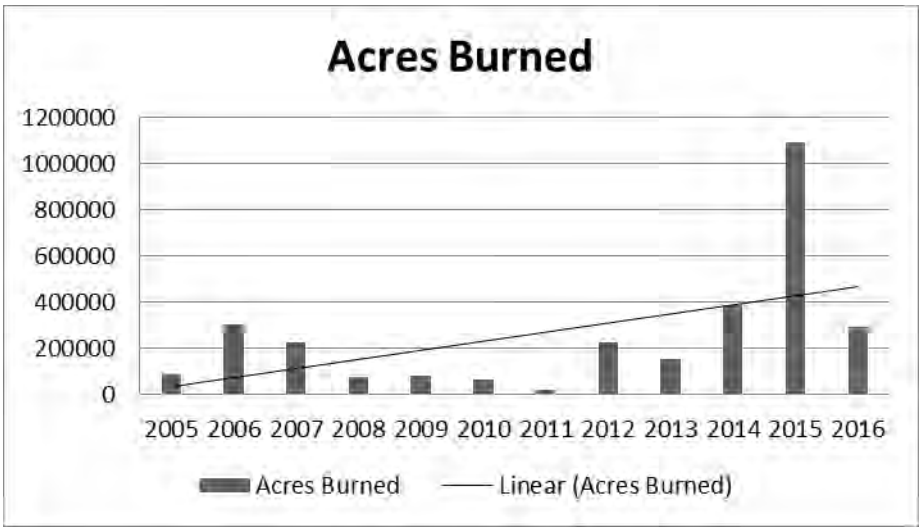


Figure 3-19. Area burned within Washington State from 2005-2016.

Resource Indicator: Vegetation Structure and Composition

Stemilt Subwatershed

The Stemilt subwatershed is 21,222 acres in size. The dominant forest cover types in the Stemilt subwatershed area are ponderosa pine (25%), Douglas-fir (14%), subalpine fir (12%), and larch (11%). The primary structure types include young-forest-multistory (30%), stem-exclusion-open-canopy (20%), and understory-reinitiation (15%). The non-forest types include shrubs over 12% of the subwatershed and a combination of agriculture/rock/water that occurs on 17% of the subwatershed.

The amount of mid-successional (YFMS) structure classes are currently above reference conditions within the Dry Forest (Table 3-29). In the Mesic Forest, amount of mid-successional (YFMS) structure classes is overabundant and the amount and patch sizes of understory re-initiation (UR), old forest structures (OFMS, OFSS), and complex-early successional patches (SI) are under-represented. In the Cold Forest, the amount of mid-successional (YFMS, UR) and open canopy (SEOC) forest structure is high relative to reference conditions.

Squilchuck Subwatershed

The Squilchuck subwatershed is 17,763 acres in size. The primary cover types in the Squilchuck subwatershed include Douglas-fir (22%) and ponderosa pine (21%). Young-forest-multistory (28.5%) is the primary structure type. The non-forest vegetation is primarily composed of shrub (28%) and a combination of agriculture/rock/water (17%).

In the Dry Forest, current conditions show that the amount of early-successional (SI) and old forest (OFMS, OFSS) vegetation types are currently low in abundance compared to reference conditions (Table 3-29). Structure Classes in the Mesic Forest show an abundance of mid-successional classes (YFMS) relative to reference conditions (Table 3-29). In the Cold Forest, the abundance of mid-successional forest (YFMS) is high relative to reference conditions (Table 3-29).

Table 3-29. The existing condition of forest structure and composition compared to reference conditions (HRV-Historic Range of Variability, FRV-Future Range of Variability) for the Squilchuck and Stemilt subwatersheds.

Vegetation Structure and Composition	Current	HRV	FRV
Squilchuck Subwatershed			
Dry Forest - Acres			
Stand Initiation	0	0-1,494	0-1,281
Understory Reinitiation	0	0-2,398	0-2,003
Stem Exclusion Closed Canopy	0	0-142	0-124
Young Forest Multistory	5,062	0-2,056	0-1,897
Old Forest Multistory	0	0-559	0-451
Old Forest Single Story	0	0-362	0-300
Mesic Forest - Acres			
Stand Initiation	282	0-1,312	0-1,112
Understory Reinitiation	245	37-4,232	0-3,266
Stem Exclusion Open Canopy	330	0-6,685	0-3,954
Stem Exclusion Closed Canopy	49	0-1,261	0-1,456
Old Forest Multistory	0	0-4,021	0-3,108
Old Forest Single Story	0	0-522	0-419
Cold Forest - Acres			
Stand Initiation	0	0-730	0-179
Understory Reinitiation	955	0-1,008	0-684
Stem Exclusion Open Canopy	369	0-384	0-362
Stem Exclusion Closed Canopy	0	0-329	0-297
Young Forest Multistory	1,488	0-426	0-282
Old Forest Multistory	0	0-162	0-34
Stemilt Subwatershed			
Dry Forest - Acres			
Young Forest Multistory	2,905	0-2,056	0-1,897
Stem Exclusion Closed Canopy	0	0-170	0-148
Old Forest Single Story	0	0-433	0-270
Mesic Forest - Acres			
Stand Initiation	0	0-1,566	0-1,328
Understory Reinitiation	11	44-5,057	0-3,903
Old Forest Multistory	0	0-4,804	0-3,709
Old Forest Single Story	0	0-624	0-501
Cold Forest - Acres			
Stand Initiation	81	0-872	0-214
Understory Reinitiation	2,808	0-1,204	0-817
Stem Exclusion Open Canopy	1,038	0-458	0-433
Stem Exclusion Closed Canopy	0	0-393	0-354
Young Forest Multistory	2,313	0-509	0-335

Environmental Consequences

Resource Indicator: Vegetation Structure and Composition

Alternative 1: No Action

Direct and Indirect Effects

There would be no direct or indirect effects in the Project Area on state or federal lands to vegetation as a result of this alternative. There would be no change to forest structure classes.

Cumulative Effects

There would be no cumulative effects in the Project Area on private lands from this alternative. There are ongoing projects, not associated with the Mission Ridge Expansion Project, on county land and WDNR lands within the Assessment Area for forest thinning and fuel reduction treatments that could alter forest structure and composition. These treatments would occur in dry forest and create more stem exclusion-open canopy forests.

Alternative 2 (Proposed Action)

Direct and Indirect Effects

The activities associated with the Mission Ridge Expansion Project would alter the structure of some vegetation types. The amount of cold forest in a mid-successional condition would be reduced by about 65 acres and the amount of non-forest openings would be increased by about 65 acres as a result of vegetation removal for ski runs and roads on federal lands. On state lands, the amount of cold forest in a mid-successional forest condition would be reduced by about 6 acres and the amount of non-forest increased by 6 acres as a result of vegetation removal for ski runs and lift lines. These activities would result in moving minor amounts of vegetation conditions closer to historical and future reference conditions by reducing the amount of mid-successional forest.

Connected Actions

The proposed Mission Ridge Expansion Project activities on private lands would occur within 124 acres of cold forest-mid successional vegetation type. Many of these activities (e.g., paved roads, houses, ski lodges, etc.) would result in the permanent removal of vegetation. Some areas of forest cover would remain in the village area for aesthetics.

Cumulative Effects

The removal of vegetation across all land ownerships would occur in 195 acres of cold-mid successional forest type resulting in a reduction of <1% in these types across the Assessment Area. There are ongoing projects, not associated with the Mission Ridge Expansion Project, on 486 acres of county land and WDNR lands within in the Assessment Area, for forest thinning and fuel reduction treatments that could alter forest structure and composition. These treatments would occur in dry forest and create more of the stem exclusion-open canopy forests.

Forest Plan Consistency

Implementation of Alternative 2 would be consistent with Forest Plan direction (Standards and Guidelines) for the management of vegetation in developed recreation areas (RE-1).

Resource Indicator: Fire and Fire risk

Over half of the Assessment Area is composed of private land resulting in a considerable amount of urban interface where current fuels conditions create considerable risks to existing homes and other infrastructure (Table 3-30). In the Stemilt subwatershed, 41% of the area is rated as high to very high risk; in the Squilchuck subwatershed 43% is rated as high to very high risk; and 41% of the entire Assessment Area is rated as high to very high risk (Table 3-30). There is a need for both stand and landscape-scale

restoration treatments in strategic locations to reduce the risk of fires to existing homes and other infrastructure (Squilchuck Valley CWPP 2015, Gaines et al. 2019).

Table 3-30. Fire risk categories based on the Quantitative Risk Assessment showing the acres by risk category and land ownership in the Mission Ridge Expansion Project Assessment Area.

Risk Category	Land Ownership (Acres)				
	Private	County	State	Federal	Total (%)[1]
Squilchuck Subwatershed					
Very High	2,614	325	325	516	3,780 (21%)
High	2,770	150	408	517	3,845 (22%)
Moderate	1,341	147	427	606	2,521 (14%)
Low	2,511	278	464	591	3,844 (22%)
Stemilt Subwatershed					
Very High	729	488	2,729	280	4,226 (20%)
High	2,000	388	2,102	59	4,549 (21%)
Moderate	2,770	405	1,508	5	4,688 (22%)
Low	2,213	812	1,839	76	4,940 (23%)
Assessment Area					
Very High	3,343	813	3,054	796	8,006 (20%)
High	4,770	538	2,510	576	8,394 (21%)
Moderate	4,111	552	1,935	611	7,209 (18%)
Low	4,724	1,090	2,303	667	8,784 (22%)

1/Does not add up to 100% due to additional acres that are rock/water.

In the Project Area, 66% of the area is in the high to very high risk categories, and these areas primarily occur on private and state lands (Table 3-31). This assessment shows that the risk of fire to homes and other infrastructure is a key issue to address in the design and development of this project.

Table 3-31. Fire risk categories based on the Quantitative Risk Assessment showing the acres by risk category and land ownership in the Mission Ridge Ski Expansion Project Area.

Risk Category	Land Ownership (Acres)			
	Private	State	Federal	Total (%)[1]
Very High	348	14	238	600 (56%)
High	44	51	14	109 (10%)
Moderate	0	133	6	139 (13%)
Low	45	160	19	224 (21%)

Alternative 1 (No Action)

Direct and Indirect Effects

This alternative would not result in activities on state and federal lands that could reduce fire risks. These include the clearing of vegetation for ski runs, ski lifts, roads, and Nordic ski trails. Alternative 1 would not result in the development of the Expansion Area that would bring additional residential areas, increasing structures in the urban interface, and increasing the potential for human caused ignitions.

Cumulative Effects

This alternative would not result in the development of the ski village that would bring additional residential areas, increasing structures in the urban interface, and increasing the potential for human caused ignitions.

Alternative 2 (Proposed Action)

Direct and Indirect Effects

The implementation of this alternative would reduce the amount of area in high to very high fire risk categories by 6 acres on state lands and by 65 acres of federal lands. This would reduce the number of acres of high to very high fire risk categories by 11% in the Project Area. This alternative has a minor effect on fire risk for the entire Assessment Area.

The logging activities and run clearing would result in increased surface fuels in some locations. Concentrations of branches and small trees may accumulate along logging skid corridors. These fuels could lead to increased wildfire risk in subsequent years as these fuels cure but before they decompose. The increased fuel loading and wildfire risk can be reduced by piling and burning concentrations of logging and clearing slash. This would be especially important near the proposed development in the upper portion of the ski area.

Connected Actions

The activities associated with the Mission Ridge Expansion Project on private lands would treat vegetation on 124 acres that is in the high to very high-risk categories. This, in combination with activities on state and federal lands, would reduce the amount of area in high to very high-risk categories by 28% in the Project Area.

The expansion project may lead to higher use during winter months but have no effect on human caused wildfire. There could be higher summer use as a result of the project (particularly in the proposed development area) and therefore, there is the potential for increased human ignited wildfire. The removal of overstory and logging slash would promote the growth of forbs and grasses within some of the proposed ski runs. In other areas, proposed ski runs are in rocky terrain that will not burn. At this elevation, this understory vegetation will likely remain green for most of the summer months mitigating most accidental ignitions. In some years, this vegetation may never cure and carry fire. In the driest years, forbs and grasses would cure and carry fire in late August and September. The potential for human caused ignitions during this time is possible, but the probability is low, because most recreational use would occur on existing road and trail prisms.

Mitigations and design criteria to address fire risks within the private land portion of the ski area expansion are described in the Mission Ridge Wildfire Protection Plan (Mission Ridge, 2018). Chelan County would review fire plans and mitigations to assure they comply with planning codes. The designs and mitigations address issues such as water supply, fire response, building materials and design, access for fire-fighting, and evacuation plans. Final design and mitigations are subject to approval by Chelan County.

Cumulative Effects

There are ongoing projects, not associated with the Mission Ridge Expansion Project, on 489 acres of county and WDNR lands in the Assessment Area for forest thinning and fuel reduction treatments that would be designed to reduce fire risk.

Forest Plan Consistency

Implementation of Alternative 2 would be consistent with Forest Plan direction (Standards and Guidelines) for the management of fuels in developed recreation areas (RE-1): 1) Treatment of both activity generated and natural fuels is appropriate when coordinated with the recreation management objectives of the area, and 2) The protection of recreation values will be emphasized.

3.29 Visual Resources

This section summarizes the existing condition and the direct, indirect and cumulative effects of the Mission Ridge Expansion Project on visual resources.

A key element and one of the most important aspects of the Scenery Management System (SMS) process is sense of place and Special Places. Sense of place, for most people, refers to the rich and varied meanings of places and emphasizes people's tendency to form strong emotional bonds with places. The importance of this concept is that it places humans in the landscape and is a tool to help managers understand the importance of places to people when doing planning or management activities. Scenery contributes to a sense of place, a mutually shared image. The majority of the recreation-oriented people who visit the National Forests have an image of what they expect to see. Such an image or mental picture is generated by available information concerning a particular area and the person's experience with that or similar areas (USDA, SMS, pg. 30). Consequently, Mission Ridge Ski Area has features and attractions that have special value. The focus for this scenic analysis is the recreation-oriented user.

Managing visual resources involves the process of analyzing effects, implementing scenic character goals and applying scenic conservation design features or mitigation measures to achieve the Forest Plan desired conditions and direction for scenery resources.

Methods

Several field trips were made to identify key viewpoints of the proposed activities and assess the existing visual condition of the landscape. The scenic quality was analyzed using the Scenery Management System (SMS) to determine the Scenic Integrity Level (high, moderate, or low) and Visual Quality Objective (retention, partial retention, or modification), as allocated from the Forest Plan, and was based on the length of viewing time, and human caused deviations in the landscape character elements of form, line, color, texture, and pattern. Scenic integrity serves as a frame of reference based on the valued attributes of the existing landscape character being viewed.

The Mission Ridge Expansion proposal includes construction of an access road, modifications to the existing base area parking lot, and construction of new chair lifts and ski runs, which have the potential to affect the scenic resources of the area. Impacts to visual resources were assessed using two methods.

1) A visual simulation was produced to examine the effect of new road construction from the Mission Ridge Hampton Lodge and Mission Ridge County Road Viewshed, as well as development of new runs and lifts above the road and in the Expansion Area.
2) The Seen Area Model Analysis examined how the proposed road, lifts and runs would affect the scenic resource (scenic integrity and landscape character) as viewed from several key viewpoints. Three Key Observation Points (KOPs) were selected to represent views of the most visually intrusive elements of the proposed improvements (access road, chairlifts, and ski runs), from locations commonly traveled through or occupied by casual observers. The KOPs were: KOP1 - backdrop viewpoint from Wenatchee Valley, KOP2 - view from Mission Ridge Hampton Lodge, and KOP3 - from Mission Ridge County Road Viewshed entering the ski area.

The scenic quality of the area was analyzed in the context of the management direction, goals, and objectives of the Forest Plan, as amended at the following scales. Foreground is based on landscape visibility and is defined as views up to ½ mile distance zone, middleground is ½ mile to 4 miles distance zone and background is 4 miles to the horizon from the travel way and use areas. The immediate foreground distance zone is 300 feet.

Additional information and descriptions regarding Visual Quality Objectives may be found in the Forest Service Scenery Management System (USFS 1995), and the Visual Management System (USFS 1974) National Forest Landscape Management Handbooks.

Important Interactions

There are four activities proposed that would directly affect the visual landscape character: 1) construction of new facilities or modification of existing facilities, 2) vegetation modification, 3) landform modification, and 4) soils manipulation. The key viewpoints are from the Mission Ridge Hampton Lodge, the viewshed from Mission Ridge County Road and a backdrop setting viewed from the Wenatchee Valley. The viewing duration, location and angle of viewing are crucial elements in managing to blend the new ski facilities into the landscape. The viewing duration is primarily from people travelling to Mission Ridge Ski Area and from recreationists using the landscape areas for a variety of year round activities. The location and angle of viewing are seen as foreground and middle ground. By managing the new ski expansion facilities to meet Retention VQO from the foreground and middle ground views, Retention VQO will be met in the built environment from the key viewpoints.

Selection of Resource Indicators

Table 3-32 lists the Resource Indicators used to assess visual resources and the measurements used for assessment. The reason for selection may include purpose and need statements of this project (see Chapter 1) and/or regulatory documents. Chosen measurements are relevant and feasible assessments of the indicator.

Table 3-32. Resource Indicator used to assess the impacts of the Mission Ridge Expansion Project on visual resources.

Resource Indicator	Measurement
Visual Landscape Character	• Construction of new or modification of existing facilities • Vegetation modification • Landform modification • Soils manipulation • How the Proposed Action of modifying the existing parking lot, new access road, construction of chairs 6 and 7, and new ski runs would affect the scenic resource (scenic integrity and landscape character) as viewed from the key viewpoints from Hampton Lodge, Mission Ridge County road viewshed and backdrop setting from the Wenatchee Valley
Visual quality objective (VQO) of Retention	• Consistency with Forest Plan standards and guidelines; the resulting scenic integrity level in the short term and long term (Retention VQO).

<u>Resource Indicator: Visual Landscape Character</u>

Four metrics provide a measurement of changes to visual landscape character: Construction or modification of existing facilities, vegetation modification, landform modification and soils manipulation. Construction of a new access road, and Chair 6, which would originate from the existing base area, Chair 7, which would originate from private property with the terminus ending on National Forest Lands at the upper elevations in the eastern area of the proposed SUP boundary, as well as associated ski runs in Sections 24 and 25, have the potential to affect visual quality and existing landscape character as viewed from the key viewpoints of the Hampton Lodge, Mission Ridge Road and the Wenatchee Valley backdrop setting.

Resource Indicator: Visual Quality Objective

The Forest Plan has designated the Mission Ridge Ski Area to the Developed Recreation land allocation (RE-1) with a visual quality objective (VQO) of Retention. As defined in the Wenatchee Forest Plan, the Goal and Description of RE-1 is to provide developed recreation in an Urban to Semi-Primitive Recreation Opportunity Spectrum (ROS) setting. This prescription is applicable to existing and potential developed recreation sites within the full spectrum of ROS settings. The areas allocated to this use include only the specific site on which development takes place. This prescription is applicable to existing and potential alpine and Nordic ski areas including runs, tows or lift facilities, shelters, lodges, services and parking lots.

The Retention VQO implies that all foreground landscapes shall have the visitor perception of natural appearing and will have High scenic integrity. High scenic integrity refers to landscapes where the valued landscape character appears intact. Deviations may be present, and expected in a developed recreation site, but must repeat the form, line, color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident (Landscape Aesthetics Handbook 701, p 2-4, USFS 1995). Implicit in the RE-1 Developed Recreation allocation is the essential role of constructed facilities and the resulting environmental modification. Structures and other modifications must meet identified design, placement and appearance standards; however, by definition, their presence does not necessarily reduce the visual quality level to the degree they would in other land allocations or settings. A greater tolerance for environmental modifications and their effects on visual quality standards is incorporated into the RE-1 Developed Recreation allocation. Ultimately, the desired character of a ski area should be a blending of the constructed alterations into the natural, established landscape in a way that achieves harmony during all seasons of the year (USFS 1984).

Existing Condition

Developed winter recreation dominates the existing visual landscape character at the terminus of the Mission Ridge Road where it meets the Mission Ridge Ski Area. In the Mission Ridge Ski Area, the landscape has been defined by recreation since the ski area opened over 50 years ago and people expect to see developments associated with the ski area, such as the Mission Ridge Road, parking lot, lodge and other ski area buildings, ski runs and chairlifts, amidst the outstanding scenic quality of the landscape character and setting (Figure 3-20 thru Figure 3-27). It is important that the expansion plans reflect a high concern for maintaining the high scenic quality. The goal of landscape management on all National Forest System Lands is to manage for the highest possible visual quality, commensurate with other appropriate public uses, costs, and benefits.

Viewshed Information

The natural landscape consists of forested areas interspersed with talus slope openings on broken topography of cliffs, steep bowls and flatter areas. Mission Ridge Ski Area consists of areas of clearing, grading and development interspersed with forested areas and talus slopes. The Hampton Day Lodge, buildings for ski school, skier services, ticket sales, maintenance and parking lots are located in the base area. Very little of the ski area is visible from the Base Area. Portions of Chairs 1, 2, and 4 are visible as are some lower runs (Chak-Chak, Mimi), but the majority of the runs are not seen from the Mission Ridge Road or Base Area. The ski area is accessed via Mission Ridge Road (Chelan County Road # C-711). The road is classified as a USFS Maintenance Level 5 road (USFS 2005b) and a rural road, based on Chelan County Standard Plan PW-7 for a Rural Collector (Chelan County Code Chapter 15.30 - DEVELOPMENT STANDARDS). Ski runs, chair lifts and administrative use roads can be seen as openings scattered across the basin above the base area.

Figure 3-20. Mission Ridge Ski Area, as seen looking south, from the north edge of the parking lot.

Figure 3-21. View of Mission Ridge Ski Area from Wenatchee Valley (Eastmont pullout viewpoint). This is Key Observation Point 1.

Figure 3-22. Existing Mission Ridge Road and associated cut bank.

Figure 3-23. Alternate view of Mission Ridge Road. Here the viewer is looking west across Squilchuck Creek from the private parcel.

Figure 3-24. View of proposed Expansion Area from existing parking lot near Hampton Lodge. The landform slopes steeply down valley and is highly textured. This is Key Observation Point 2.

Figure 3-25. View from existing parking lot looking back at Mission Ridge Road.

Figure 3-26. View of the part of the expansion area where the access road would cross, as seen looking across Squilchuck Creek from Mission Ridge Road. This is Key Observation Point 3.

Figure 3-27. Mission Ridge Ski Area trail map.

Sense of Place

The sense of place is particularly strong at Mission Ridge. Mission Ridge is an important asset to residents of the Wenatchee Valley and the people who visit Mission Ridge have a specific image of what they expect to see. During cold weather seasons, people relate to a winter environment of snow and winter sports both at the Ski Area and adjacent areas. In the warm seasons, the ski area and environs provide roads and trails and expansive views with a wild feeling, close to town and often much cooler than the Wenatchee Valley, just 20 minutes away. Consequently, Mission Ridge Ski Area has features and attractions that have special value. The focus for this analysis is the recreation-oriented user.

Environmental Consequences

Direct and Indirect Effects

Alternative 1 (No Action)

The No Action Alternative would not change the existing landscape character or sense of place. The proposed access road, chair lift and associated infrastructure (towers, terminal buildings, etc.) and associated ski runs would not be constructed. Mission Ridge Ski Area would remain as existing and would not fulfill user expectations in the future by providing additional recreational opportunities, particularly during high use periods.

Resource Indicator : Visual Landscape Character

- Construction of new facilities or modification of existing facilities: None
- Vegetation modification: None
- Landform modification: None
- Soils manipulation: None

Resource Indicator: Visual Quality Objective (VQO) of Retention

The VQO within the Project Area would be classified as High. Alternative 1 would have a neutral impact, as there would be no change to the Visual Resources of Mission Ridge Ski Area.

Alternative 2 (Proposed Action)

Alternative 2 would change the existing landscape visual character (as viewed from the key viewpoints of the Hampton Lodge and Mission Ridge Road) by constructing a new access road, and Chair 6, which would originate from the existing base area, Chair 7, which would originate from private property with the terminus ending on National Forest Lands at the upper elevations in the eastern area of the proposed SUP boundary, as well as associated ski runs in Sections 24 and 25. Connected actions on WDFW land and private land would also change the existing landscape character to different degrees.

Access Road

The access road would cross the steep (18-70% slope), north facing hillside between the existing parking lot and Section 19 (Figure 2-1 and Figure 2-2). The plan for the road would include 1:1 cut slopes that have been designed to the extent possible to provide for safety while minimizing soil and vegetation disturbance. To minimize disturbance and construction costs, the fill slopes would predominantly consist of retaining walls that would range in height from about 8 to 20 feet. When possible, retaining walls would be designed to plant trees in the terraces which would help screen the road and cut bank. Other options to save large trees critical for screening the cut slopes would be to install tree wells. Preliminary design indicates the cut slope would be at a 1:1 ratio, and may reach heights of up to 180 to 200 feet. In comparison, the existing Mission Ridge Road has cut slopes up to about 100 feet. As demonstrated in the visual simulation (Figure 3-28, 3-29), the cut slope would be noticeable in places. The fill slopes would primarily be retaining walls to also minimize soil and vegetation disturbance and keep fill slopes and sediment away from Squilchuck Creek. The access road would create a linear feature across the hillside

with large clearings seen upslope of the road. The steep landform and evenly textured coniferous forest vegetation contribute to a low visual absorption capacity for the landscape to accept changes that blend well, especially openings and cut slopes. Additionally, the design would include seeding and planting native grasses, shrubs and trees on the cut slope and along the sides of the road to further screen and blend the construction into the existing landscape.

Rehabilitation of disturbed slopes would occur immediately following construction to limit the amount of time the viewshed is impacted by short-term construction activities.

Figure 3-28 provides a visual simulation of the Proposed Actions from the existing Mission Ridge Ski Area parking lot (Key Observation Point 2). In Figure 3-28 the new road is colored tan, while the runs are blue and chairlifts are red. Changes to scenery would be more noticeable here because users are immersed in the landscape as a destination and would not be moving very fast (walking across parking lot, driving slowly through parking lot). However, because it is an existing ski area and designated for Developed Recreation, guests expect development commensurate with a ski area.

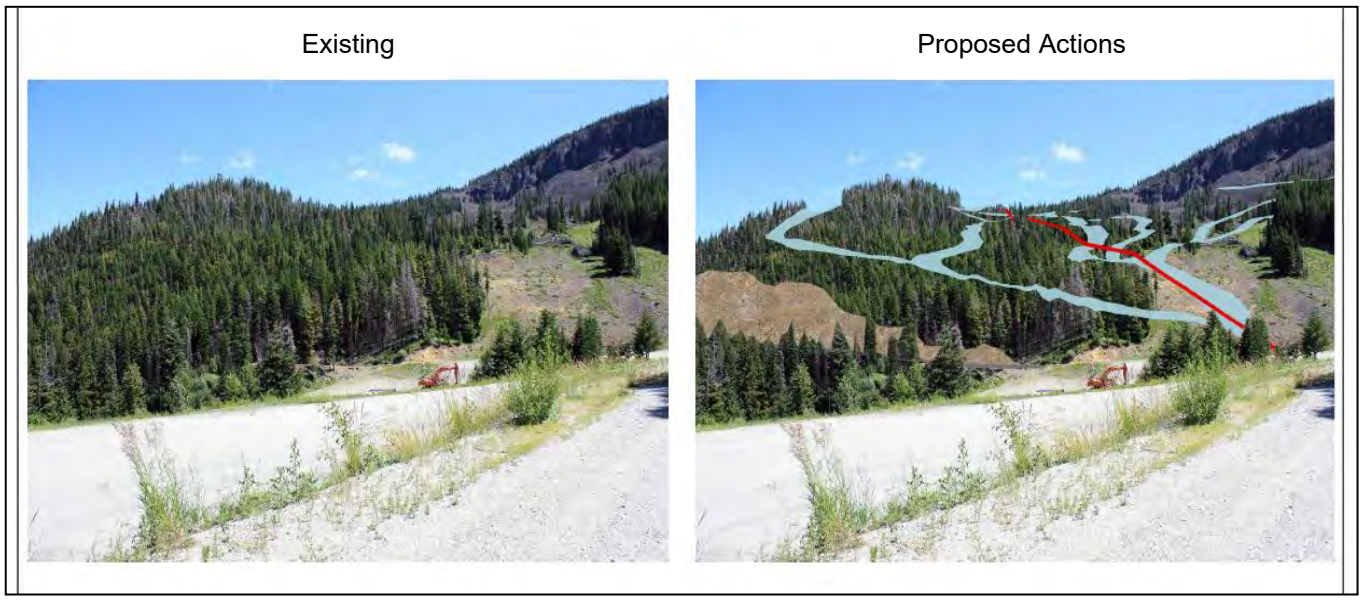


Figure 3-28. Visual simulation of Proposed Action from the Mission Ridge Ski Area parking lot. The picture on the left shows the existing condition. The picture on the right simulates changes to the scenic integrity resulting from construction of the access road (tan), ski runs (blue) and Chair 6 (red). Provided by Ecosign.

Figure 3-29 provides a visual simulation of the Proposed Actions as seen from the existing Mission Ridge road (KOP3). In Figure 3-29 the new road is colored tan, while the runs are blue and chairlifts are red. The new road cut slope would be very visible, but changes to the landscape would be less noticeable as guests would be moving at a more rapid pace as they climb or descend Mission Ridge Road in a vehicle. In addition, reseeding and planting of grasses, shrubs and trees would help to blend the cut slope and runs into the hillside. This section of road would benefit by planting larger sized evergreen trees and shrubs on the south side of the Mission Ridge County Road in strategic places to provide further screening of the proposed cut slopes.

Figure 3-29. Visual simulation of the Proposed Action from the Mission Ridge road (KOP3). The picture on the top shows the existing condition. The picture on the bottom provides an idea of how the scenic integrity would change with the access road and ski runs (blue). Chair 6 and Chair 7 would not be visible. Provided by Ecosign.

Resource Indicator: Visual Landscape Character

Construction of New or Modification of Existing Facilities: The vegetation, landform and soils modification/manipulation necessary to construct the access road would require substantial cut slopes, retaining walls and grading. The access road, as well as construction of new chairlifts and ski runs, would modify the natural appearing landscape character, requiring thoughtful design and mitigation.

Vegetation modification: Vegetation removal would be in scale to the surrounding landscape and would be very noticeable but not dominant. Alternative 2 removes or disturbs existing vegetation on about 80 acres (on USFS and WDFW lands) between the clearing of trees on ski runs, lift corridors and the access road cut/fill slopes. Most of the ski runs and lift corridors would not be visible from the Mission Ridge parking lot or Mission Ridge Road (Figs 3.30-3.32). Trees and other vegetation close to the disturbed areas would be preserved where possible to provide screening and to maintain a natural setting. Where feasible, ski run and chairlift corridor edges would be “feathered” or scalloped to reduce any linear appearance and discourage hard edges, giving them the appearance of a more natural opening that

would blend into the surrounding landscape. Although it is unlikely that the casual observer would be able to identify the upper terminal of the new chairlifts, the color of the terminal buildings and chairlifts would be chosen to blend with the adjacent vegetation. The developed facilities would incorporate the Cascadian Architectural Style, blending materials and colors and minimizing the disturbance footprint to maintain sense of place and high quality of scenic experience. Where possible, downshade lighting would be used to control light and glare impacts from the site. Additional mitigation measures and design features are provided in Appendix B.

Landform modification: The proposed access road would be constructed along the northern edge of the existing parking lot and then across the forested hillside to Section 19. Due to the existing steep slope, landform modifications would be seen as grading, cut and fill (retaining walls). It would be visible from the Key Viewpoints 2 and 3. It would appear as an extension of the existing ski area parking lot and Mission Ridge Road. Some grading would also be necessary to create beginner ski runs. Where soil grading or cuts and fills are needed, visual impacts would be reduced by blending with existing topography and smoothing edges. It would not be noticeable from KOP 1 (Wenatchee) because it would be at a distance where it would blend with the existing pattern of forest and openings.

Soils manipulation: The proposed soils manipulation would incorporate an erosion control plan with revegetation done immediately with a low growing grass seed mix and/or a variety of ground cover and shrubs that would provide vegetative structure and fall color.

Resource Indicator: Visual Quality Objective (VQO) of Retention

Viewshed Analysis

Key observation points (KOP) were selected to represent views of the most visually intrusive elements of the proposed project (access road, chairlifts and ski runs) from locations commonly traveled through or occupied by casual observers (Figure 3-30).

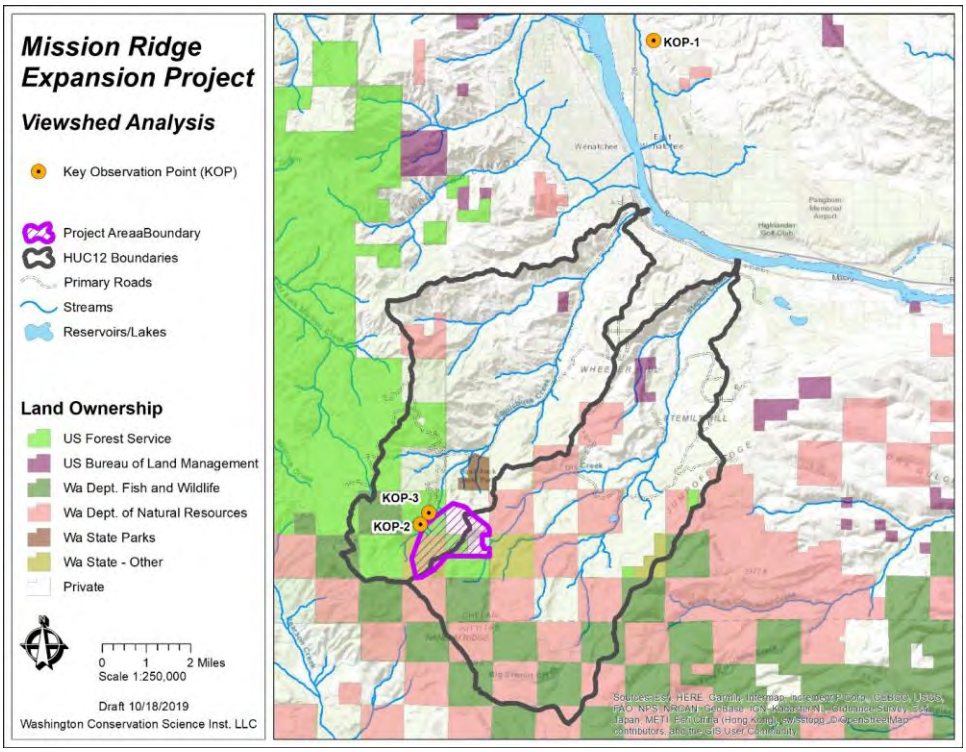


Figure 3-30. Overview of the location of key observation points used in Mission Ridge Expansion viewshed analysis.

KOP 1 – Key Observation Point 1 was located along Grant Road in East Wenatchee, WA, approximately 15 miles north of the Project Area. This location was selected for its representation of the background view of the proposed expansion (Figure 3-21) from the Wenatchee Valley. The proposed development on the private and National Forest land would be slightly visible from this distance; however, the features would be difficult to distinguish from the rest of the landscape (Figure 3-31). Mission Ridge night lighting is currently visible from the Wenatchee Valley. Some additional lights may be visible in the evenings from the southern portion of the residential development site in Section 19 and from a portion of the ski runs and lifts in Sections 24 and 30.

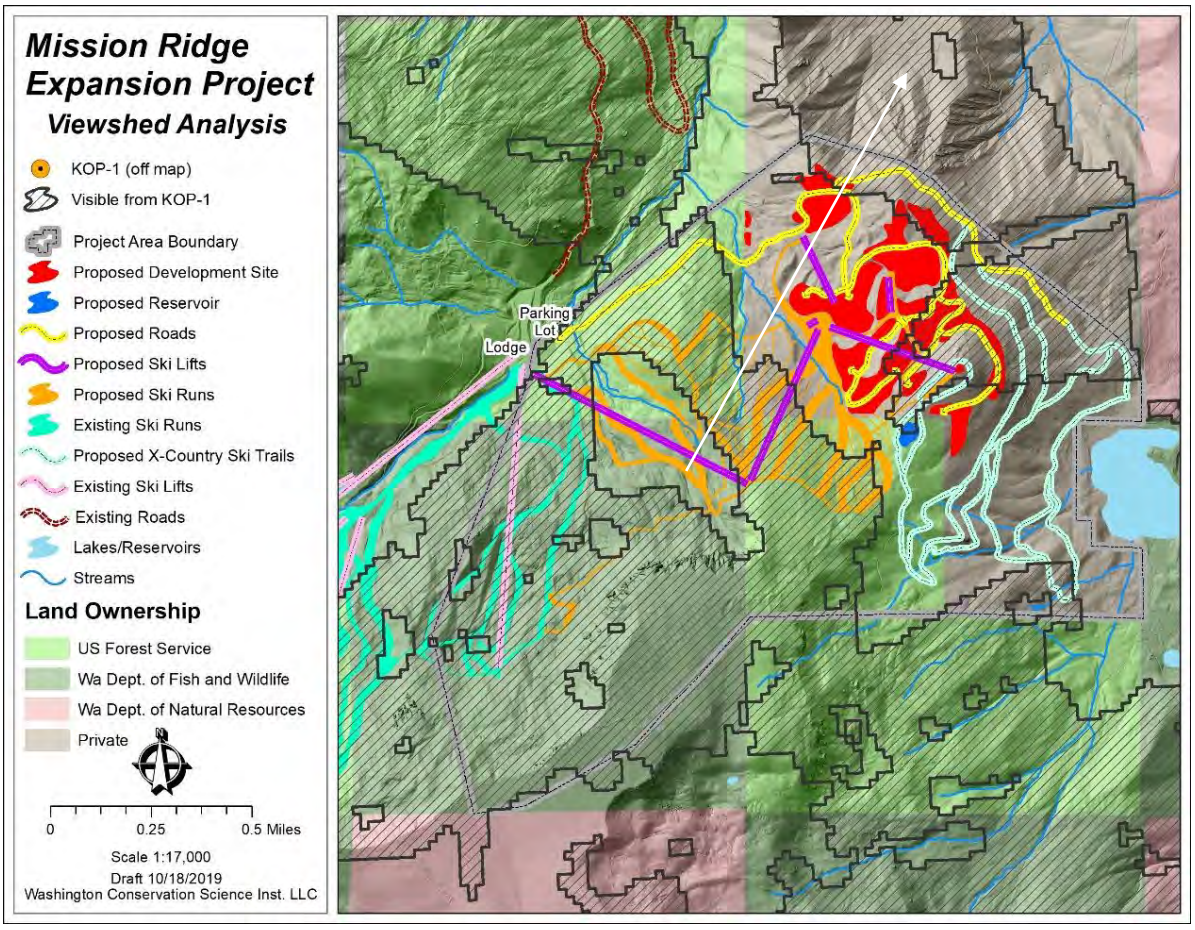


Figure 3-31. Viewshed analysis results from Key Observation Point 1. White arrow indicates direction of KOP.

KOP 2 –Key Observer Point 2 was located within the Mission Ridge Ski Area, near the existing Hampton Lodge. Some of the existing ski area and proposed activities would be visible from this Key Observation Point 2 (Figure 3-32) in the foreground and middleground. The expansion effectively begins adjacent to the northeast side of the ski area so new ski runs in the Outback and tributary to the existing Base Area, Chairlift 6, and the access road would be visible. However, most of the Proposed Actions on National Forest and WDFW lands would not be visible. The majority of the development on the private land in Section 19 would not be visible from this KOP.

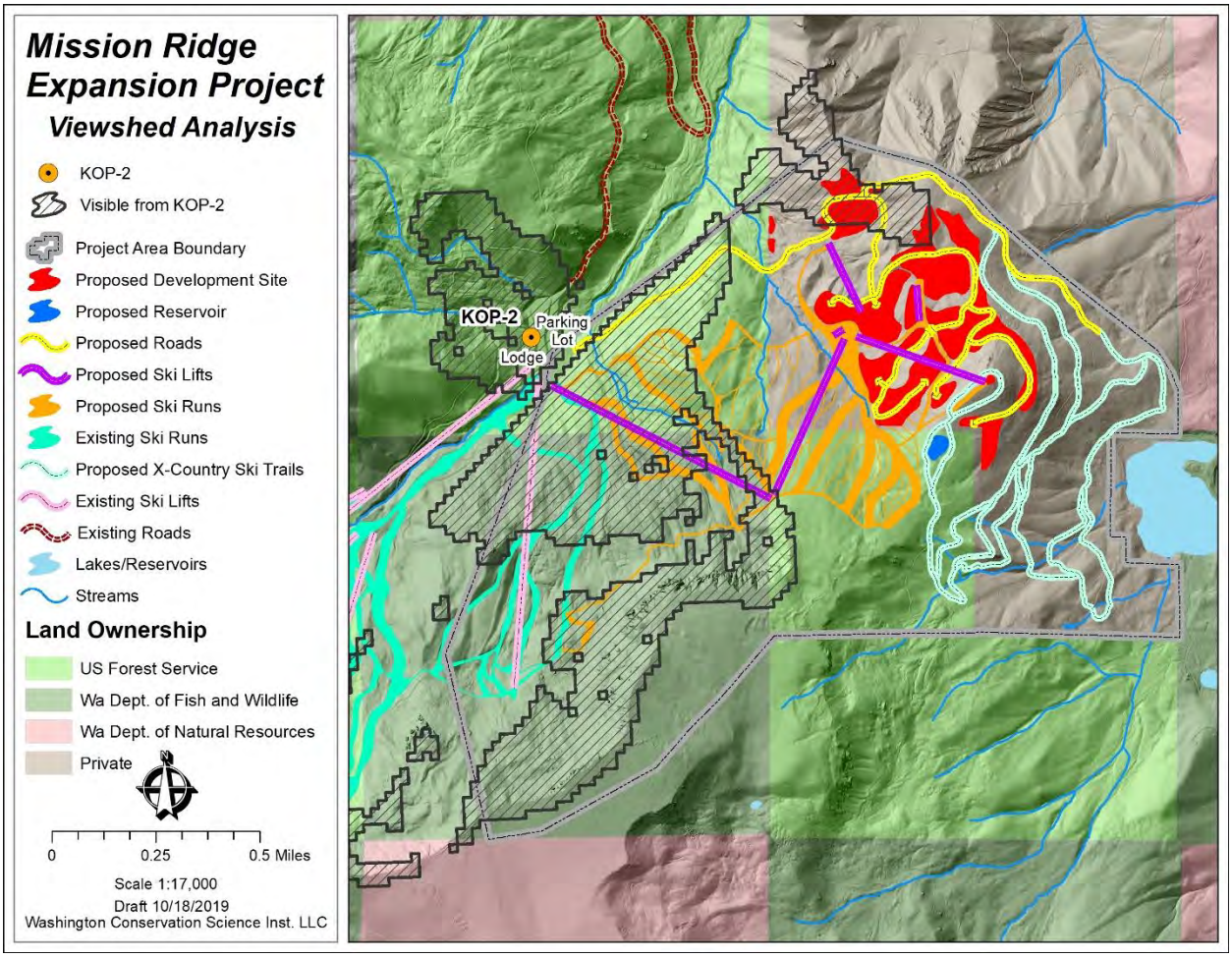


Figure 3-32. Viewshed analysis from Key Observation Point (KOP) 2.

KOP 3 –Key Observation Point 3 was located along the upper portion of Mission Ridge Road, looking across Squilchuck Creek. This view would be visible for short periods (5-10 seconds) for drivers heading to the ski area on the Mission Ridge Road. Even less of the existing ski area and proposed activities would be visible from this KOP. A portion of Chairlift 4 and the Sitkum, Elip and Chak-Chak runs would be visible from this point (Figure 3-33). As with KOP 2, the expansion effectively begins adjacent to this side of the ski area so we would expect the new runs tributary to the Base Area, chair lift 6, and the access road to be visible.

Most of the development on the private land in Section 19 would not be visible, particularly because people would be moving at a rapid pace along Mission Ridge Road.

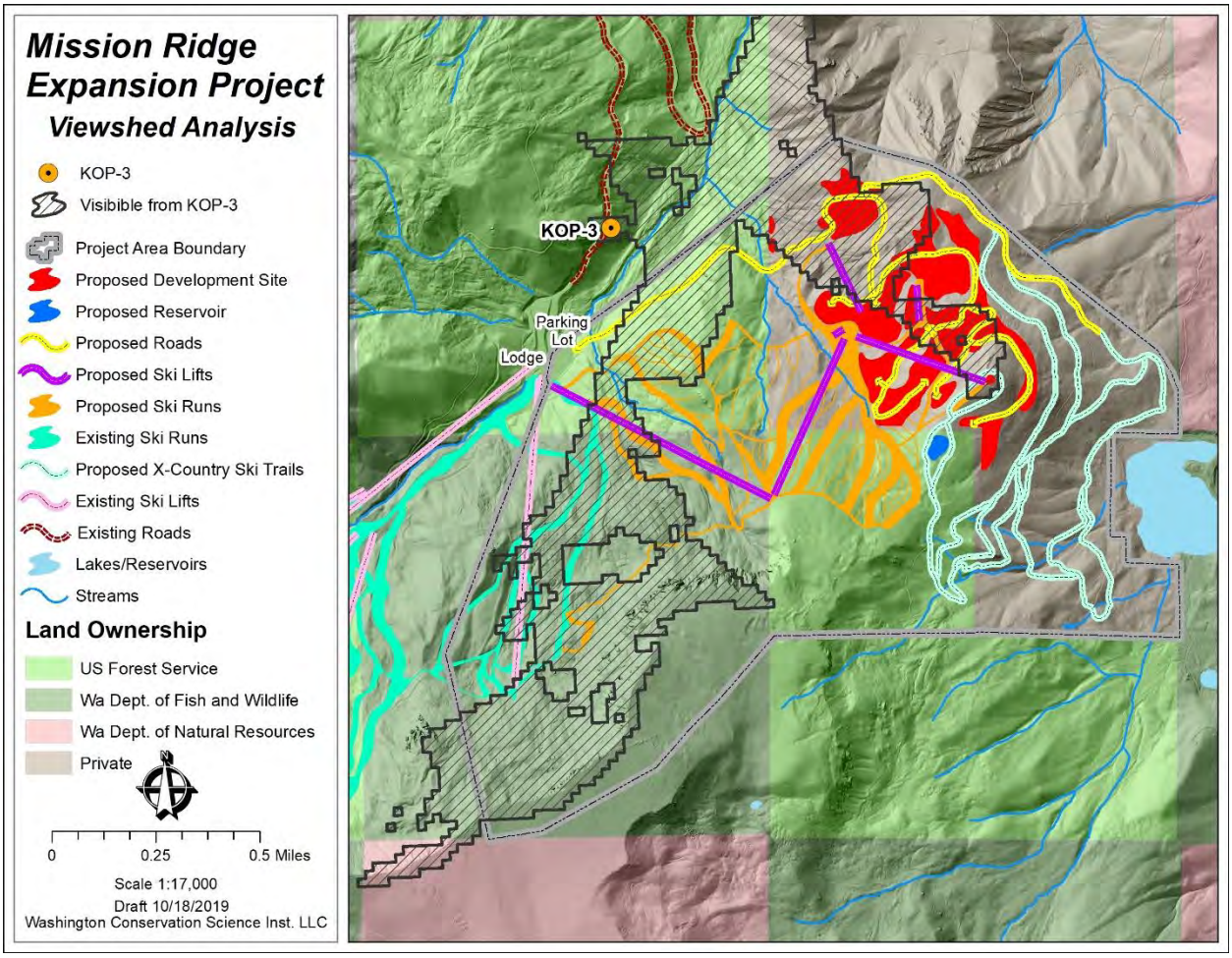


Figure 3-33. Viewshed analysis from Key Observation Point (KOP) 3.

Summary

The landscape character changes viewed from the Hampton Lodge (KOP 2) and Mission Ridge Road (KOP 3) would predominately be seen as a more open environment resulting from removal of trees that provide form, color and texture next to the existing ski area. The area within Section 24 is steep and densely forested. The development (access road, ski runs and lifts) would remove a noticeable amount of vegetation. The greatest impact would result from the access road. The access road would cross a slope that is quite steep in places and would require extensive cut. Design standards and mitigation measures would be implemented to decrease the impact to visual resources and address these concerns. These include, but are not limited to:

1) Planting trees and shrubs along roadways using native species compatible with existing trees and vegetation cover
2) Retaining walls would reduce the size of the fill slopes
3) As soon as possible, all cut and fill slopes would be top-soiled, revegetated, and mulched to prevent erosion.
4) Cut slopes required for the access road and ski runs shall be seeded with native seed mixes compatible with existing native species.

5) Final design of the road would incorporate adjustments to ditch width and turn-out locations. Reducing ditch width could substantially decrease the height of the cut to allow screening by existing vegetation (USDA 1985).

Chair lifts and lift line corridors
To meet visual quality objectives and avoid construction of straight line features, chairlift corridors would be blended into the vegetation on the mountainside by implementing the following design features: 1) lift corridors would blend with ski runs where possible, 2) chairs and chairlifts would be similarly colored and blend in with the mountain backdrop setting; and 3) Non-reflective galvanized steel, of a darker color would be used to blend in and avoid producing glaring reflected light.

Glades and ski runs
Straight edges for the gladed lines would be avoided, and the width of the gladed lines varied to provide natural, uneven ski routes. Vegetation along the edges of ski runs would be feathered and or scalloped to avoid severe looking linear features.

Buildings
All newly constructed buildings, such as the lift terminal buildings on National Forest land and the development on the private parcel would take on a Cascadian style that reflects the heritage of the surrounding landscapes, where the colors blend in with the natural surroundings of the forest and native foliage. Residential areas would be interspersed with open natural areas and pedestrian paths. The new Base Area Village with several condominium and skier services buildings, the hotel, and lifts converging, would be a community gathering area with views of the nearby slopes. The Village and residential development areas would appear as a mountain resort community blending in with the natural landscape. Where possible, downshade lighting would be used to control light and glare impacts from the site.

Implementation of the Proposed Actions would certainly affect the appearance of the currently intact forested areas within the Project Area. However, the landscape visual character and scenic integrity would be maintained because the actions, in concert with careful design and mitigation, are consistent with the existing uses in this area. The Proposed Actions would mimic the existing conditions (ie. chairlifts, ski runs, Mission Ridge Road) and be designed to reflect a high concern for maintaining the scenic quality. Expansion of the ski area would meet user expectations and enhance the recreational experience by designing and managing uses on National Forest land. This action would enhance recreation and aesthetic experiences at the site, providing benefits for the community of Wenatchee, as well as visitors, through greater opportunities for future uses. The valued sense of place for the recreational user would be maintained and enhanced.

Cumulative Effects

Effects on visual resources are related to actions that may displace or degrade the visual experience, either in duration or quality. The reasonably foreseeable activities that may occur in this area, including those that are within the Mission Ridge Master Plan, would occur within the scope and scale of the existing ski area activities and be commensurate with the desired condition of maintaining high scenic quality. Actions outside of the Mission Ridge Ski Area would be beyond the scale of visual impacts.

Forest Plan Consistency

The Proposed Actions are consistent with Management Practices for RE-1 (Forest Plan page IV-159) and include (as numbered in Forest Plan):

1- A visual analysis is required to blend activities with the naturally established landscape.
3- Consistent with safety, retain the vegetative character off the area.
5- Sites may be modified to accommodate recreation facilities and uses.
8- Rehab measures are to be applied to landscape where needed to improve the visual setting.

Additionally, standards and guidelines for Facilities (page IV-163) indicate the Forest will "Provide and manage roads that are compatible with the development level" and include the following Management Practices:

> 1- Roads must conform to the terrain whenever possible, with a minimum of cuts and fills
> 2- Design roads to accommodate the number and type of rec vehicles appropriate to the ROS and development level.

Alternative 2 would expand the Mission Ridge Ski Area, where people expect to see developments associated with the ski area in concert with the outstanding scenic quality of the landscape character and setting. Overall, Alternative 2 would meet the Retention Visual Quality Objective as seen from the Hampton Lodge and Mission Ridge Road and Wenatchee Valley. The proposed treatments would be consistent with Forest Plan Standards and Guidelines for Retention Visual Quality by designing safe, appropriate roads and developed ski facilities that blend with the landscape as possible, and modifying the site to accommodate a recreational facility and use. Design measures to mitigate the built environment will be done as much as feasible including planting large trees in strategic places to provide screening. The cut slopes associated with the access road would create a Modified landscape character; however, implicit in the RE-1 Developed Recreation allocation is the essential role of constructed facilities and the resulting environmental modification. Structures and other modifications must meet identified design, placement and appearance standards; however, by definition, their presence does not necessarily reduce the visual quality level to the degree they would in other land allocations or settings. A greater tolerance for environmental modifications and their effects on visual quality standards is incorporated into the RE-1 Developed Recreation allocation.

3.30 Wildlife

This section summarizes the existing condition and the direct, indirect and cumulative effects of the Mission Ridge Expansion Project on wildlife resources.

Methods

Federally Listed and Proposed Wildlife Species

For wildlife species that are federally protected by the Endangered Species Act, recovery plans, critical habitat designations, and status reviews were used to identify factors (indicators) that threaten species recovery. These factors (indicators) were used to assess how the Proposed Action influenced the threats that affect the recovery of the species.

Sensitive Wildlife Species and Management Indicator Species

The Region 6 Sensitive Species list (USFS 2019) was used to identify wildlife species that are documented or may occur in the Assessment Area. The Management Indicator Species (MIS) were identified in the original Wenatchee Land and Resource Management Plan (USFS 1990). The habitat association identified for the Region 6 Sensitive and MIS species was based on extensive literature review (see Gaines et al. 2017) and species facts sheets provided by the Interagency Special Status and Sensitive Species Program. The habitat associations were used to group species based on their habitats and risk factors, similar to the process described in Suring et al. (2011). The habitats and risk factors were used to determine resource indicators that influence species habitats and population viability, and were used to assess the potential effects of alternatives.

Spatial and Temporal Context for Effects Analysis

The spatial context for the analyses of effects of the proposed Mission Ridge Expansion Project varied according to the species or group of species being assessed. For the grizzly bear, the portion of the Project Area that lies within the North Cascades Grizzly Bear Recovery Area was assessed. The Project Area does not occur within a Grizzly Bear Management Unit (GBMU). For the Canada lynx, Lynx Analysis Unit (LAU) was used where it intersected the Project or Assessment Areas. For all other species, the direct and indirect effects were assessed for the Project Area and the cumulative effects were assessed using the Stemilt and Squilchuck subwatersheds, referred to as the Assessment Area (Figure 3-34).

The temporal scale used to assess the effects included: the short-term impacts, which are those likely to occur during the construction phase of the project (generally <10 years), and the long-term impacts, which are those that are likely to persist following completion of the ski area expansion (generally >10 years).

Selection of Resource Indicators

The Resource Indicators used to assess the effects to wildlife are unique to each species or group of species. The Resource Indicators are listed for each species/species group in Table 3-33.

Table 3-33. Region 6 Sensitive Wildlife Species, Management Indicator Species, Survey and Manage Species, and State Listed Wildlife Species that are likely to occur or may occur in the Mission Ridge Expansion Assessment Area. Species are placed into habitat groups based on their habitat associations, and indicators used to assess the effects are shown.

Habitat Group[1]	R6 Sensitive and MIS Wildlife Species	State Wildlife Species[2]	Indicators	Potential Habitat in the Assessment Area
Habitat Generalist Group	Rocky Mountain Elk, Mule Deer, Wolverine, Cascade Red Fox	Cascade Red Fox	Security Habitat	954 acres
Late-Successional Habitat in Mesic/Moist Forest Group	American Marten, Pileated Woodpecker, Little Brown Bat, Northern Goshawk, Rosner's Hairstreak, Magnum Slug, Survey and Manage Species	Northern Goshawk, Pileated Woodpecker, American Marten	Amount of late-successional forest	4,025 acres
Open-Forest Habitat in Dry Forest Group	White-headed Woodpecker, Gray Flycatcher, Eastern Tailed Blue, Meadow Fritillary	Flammulated Owl, White-headed Woodpecker	Key Habitat Features: large trees, open canopy	4,930 acres
Riparian/Wetlands Group	Beaver, Ruffed Grouse, Bald Eagle, Gray Flycatcher. Meadow Fritillary, Peck's Skipper, Tawny-edged Skipper, Damsel Flies	Columbia Spotted Frog, Western Toad, Dusky Grouse, Sooty Grouse,	Amount of Riparian and Wetland Habitats	2,650 acres Wetland, 90 acres Riparian (in Project Area)
Low Elevation Grassland/ Shrubland	*Giant Palouse Earthworm, Grand Coulee Mountainsnail, Chelan Mountainsnail, Shiny Tightcoil*	Golden Eagle	Soil Disturbance	5,782 acres
Talus Habitat Group			Amount of talus habitat	1,540 acres
Snags and Logs Group	Fringed Myotis, Pallid Bat, Townsend's Big-eared Bat, Other Bats, Woodpeckers	Pileated Woodpecker, White-headed Woodpecker, Bats	Availability of Habitat	Likely few large snags due to past management
Native Pollinators	Western Bumblebee, Eastern Tailed Blue, Meadow Fritillary		Impacts of understory plants	extensive
Migratory Birds	A wide-variety of species, including some that are R6 Sensitive		Availability of Habitat	38,985 acres

[1]Habitat Group based on Gaines et al. (2017), Due to limited information it is unknown if the species in italics occur in the Assessment Area. [2]Some State species are addressed individually.

Key Assumptions

The key assumptions used to analyze the effects of the Mission Ridge Expansion Project alternatives on wildlife species include the following:

- The use of habitat groups (as opposed to analyzing each individual species) is a credible and scientifically rigorous method to assess ecosystem conditions that contribute to the viability of wildlife species.
- Available vegetation and habitat data for the assessment and Project Areas provides a reasonable representation of habitats for wildlife species within habitat groups to adequately assess potential impacts to species habitats and populations.
- The selected resource indicators for each habitat group are adequate to predict expected impacts to wildlife habitats and populations.

Existing Condition

Affected Environment

To assess the potential direct, indirect, and cumulative effects of the Mission Ridge Expansion Project, two spatial scales were used. The direct and indirect effects were evaluated at the Project Area scale and the cumulative effects were assessed using a larger area referred to as the Assessment Area (Fig. 3-34). Some species-specific Assessment Areas were used for some of the federally listed species and are described in detail below.

The Assessment Area is 38,985 acres in size and is comprised of a diversity of wildlife habitats from subalpine fir forests in the higher elevations (southern portions of the Assessment Area), to mixed-conifer forests in the mid-elevations, to dry ponderosa pine forests that quickly transition to a variety of non-forested grasslands and shrublands in the lower elevations. The Assessment Area includes habitats for federally listed wildlife species, Region 6 Sensitive Wildlife Species, and species of management interest such as mule deer and Rocky Mountain elk. The Project Area is 1,090 acres in size and is 73% cold-forest, primarily in a mid-successional condition, and 27% talus.

Federally Listed and Proposed Wildlife Species

The Assessment Area provides habitat, or potential habitat, for four federally listed wildlife species: Canada lynx (*Lynx canadensis*), grizzly bear (*Urus arctos*), gray wolf (*Canis lupus*), and northern spotted owl (*Strix occidentalis caurina*). In addition, the wolverine (*Gulo gulo*) has been proposed for listing as a threatened species, and is a federal candidate species. There would be “no effect” to the marbled murrelet (*Brachyramphus marmoratus*) because the Project Area is well outside the range of the species. The Project Area is not within designated critical habitat for the Canada lynx or northern spotted owl.

The spatial context for the analyses of effects of the proposed Mission Ridge Expansion Project varied according to the listed-species being assessed. Canada Lynx: Lynx Analysis Unit (LAU) was used where it intersected the project or Assessment Areas. In addition, cumulative effects were evaluated for the entire Assessment Area, which includes the Stemilt and Squilchuck subwatersheds (Figure 3-34). Grizzly Bear: the portion of the Project Area that lies within the North Cascades Grizzly Bear Recovery Area was assessed. The Project Area does not occur within a Grizzly Bear Management Unit (GBMU). In addition, cumulative effects were evaluated for the Assessment Area, which include the Stemilt and Squilchuck subwatersheds (Figure 3-34). For the Gray Wolf, Northern Spotted Owl, and Wolverine, the direct and indirect effects were evaluated within the Project Area, and the cumulative effects within the Assessment Area, which include the Stemilt and Squilchuck subwatersheds (Figure 3-34).

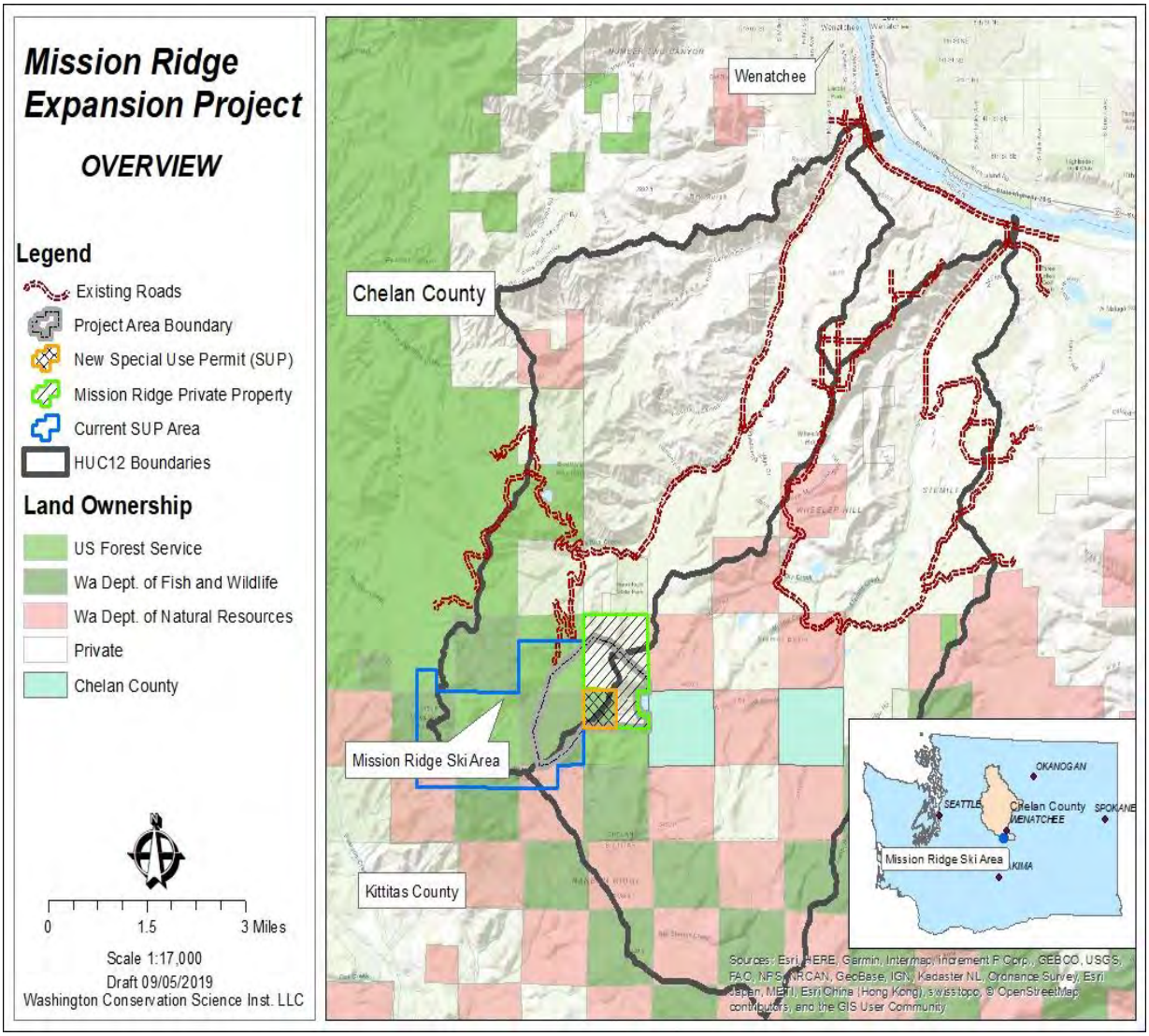


Figure 3-34. General location of the Mission Ridge Expansion Project, showing the Project Area (outlined in gray) and the Assessment Area (outlined in black).

Canada Lynx

The Canada lynx was listed as a federally Threatened species in 2000 (USFWS 2000). The US Fish and Wildlife Service designated revised critical habitat for lynx in 2014 (USFWS 2014a); however, no critical habitat was designated within the Assessment Area. No federal recovery plan has been developed for the Canada lynx.

The conservation and recovery of lynx on federal lands is guided by two primary guiding documents: the Canada Lynx Interagency Agreement, which relies on science presented in the Lynx Conservation Strategy and Assessment (ILBT 2013), and the US Fish and Wildlife Service's Recovery Outline (USFWS 2005). The Recovery Outline stratified lynx habitat into three categories: core, secondary and peripheral. The Assessment and Project Area for the proposed Mission Ridge Expansion Project are within areas designated as peripheral. The Lynx Conservation Strategy and Assessment (ILBT 2013) provide management guidance (conservation measures) for activities proposed within each of the strata identified

in the Recovery Outline. For areas designated as peripheral, the conservation measures pertain to vegetation management (see Box A).

BOX A

Canada Lynx conservation measures for vegetation management in peripheral areas: Provide a mosaic of forest structure that includes dense early-successional coniferous and mixed coniferous-deciduous stands, along with a component of mature multi-story conifer stands. Flexibility in the amounts and arrangement of various successional stages is acceptable, provided that a mosaic can be sustained. Vegetation treatments should be designed with consideration of historical landscape patterns and disturbance processes. Design timber harvest, planting, and thinning to include some representation of young densely-stocked regenerating stands in the mosaic for snowshoe hare production areas.

Canada lynx are closely associated with boreal forests in areas with cold, snowy winters, and adequate prey resources, primarily snowshoe hares (*Lepus americanus*)(ILBT 2013). These forests are generally comprised of Engelmann spruce (*Picea engelmanii*), subalpine fir (*Abies lasiocarpa*), and lodgepole pine (*Pinus contorta*) (Maletzke et al. 2008, Koehler et al. 2008, Vanbianchi et al. 2017). Canada lynx use a variety of forest successional stages to meet their life history needs and thus require a mosaic of forest structures across the landscape to provide prey habitat for snowshoe hares (early-successional forest), habitat to facilitate movement (travel, mid-successional forest) and habitat for denning (and foraging, late-successional forest) in which to raise kittens.

There are about 9,225 acres of potential lynx habitat within the Assessment Area and 1,492 acres is located on federal lands. In the Project Area, there are 806 acres of lynx habitat and 255 acres are on federal lands. Within the portion of the Assessment Area that is included in a Lynx Analysis Unit (LAU), there are 7,463 acres of potential lynx habitat of which 1,350 acres occurs on federal lands. Within the Project Area in the LAU, there are 705 acres of potential lynx habitat with 255 acres on federal lands. Table 3-34 shows the current condition of lynx habitat within the Assessment Area and Project Area.

Table 3-34. The pre and post-construction (of the Proposed Action) condition of lynx habitat (and the primary habitat function) within the Assessment Area and Project Area in the Lynx Analysis Unit.

Lynx Habitat Structure Class	Acres Pre-Construction	Acres Post-Construction
Assessment Area within a Lynx Analysis Unit		
Early Successional - foraging	80	127
Mid-Successional - travel	7,300	7,253
Late Successional - denning	83	83
Project Area within a Lynx Analysis Unit		
Early Successional - foraging	0	47
Mid-Successional - travel	705	658
Late Successional - denning	0	0
Federal lands in the Assessment Area within a Lynx Analysis Unit		

Early Successional - foraging	0	32
Mid-Successional - travel	1,350	1,318
Late Successional - denning	0	0
Federal lands in the Project Area within a Lynx Analysis Unit		
Early Successional - foraging	0	32
Mid-Successional - travel	255	223
Late Successional - denning	0	0

The potential impacts of winter recreation on Canada lynx have received limited research. There are two potential impacts that were identified in the Lynx Conservation Strategy and Assessment (ILBT 2013): 1) the removal of forest cover used by lynx and snowshoe hares, as a result of the construction of ski runs (ILBT 2013); and 2) the potential for changes in the competitive interactions between lynx, coyotes, and bobcats as a result of snow compaction on ski runs, Nordic ski trails, and snowmobile routes (Bider 1962, Ozoga and Harger 1966, Murray and Boutin 1991, Koehler and Aubry 1994, Murray et al. 1995, Buskirk et al. 2000, Kolbe et al. 2007). Unique morphological differences between coyotes, bobcats, and lynx (lynx have large feet) would suggest that lynx are especially adapted to soft, cold, deep winter snows. As such, increases in snow compaction prevent them from accessing areas not available to coyote and bobcats, thus increasing competition for prey species (Buskirk et al. 2000, ILBT 2013).

Surveys for Canada lynx were conducted on the Okanogan-Wenatchee National Forest, including in areas within the vicinity of the Assessment Area, as part of a national lynx survey conducted from 1998 to 2003. Lynx presence was not detected during this survey, nor have lynx been documented to occur in the Assessment Area. Additional surveys were completed on the Forest by Washington State University in 2017, 2018 and 2019. No lynx were detected south of Lake Chelan (about 60 miles north of the Project Area) in this survey. However, due to their wide-ranging nature and that the Assessment Area occurs within an area designated as peripheral habitat; effects of the proposed Mission Ridge Expansion Project on Canada lynx were assessed. The resource indicators used to assess the effects include: 1) changes to lynx habitat components, and 2) changes to areas that would be groomed or designated as snow-play areas (e.g., ski runs, groomed Nordic ski trails, and snowmobile routes).

Grizzly Bear

The grizzly bear is a federally Threatened species (USFWS 1993), and was determined to be warranted for Endangered status in the North Cascades (USFWS 1998). Grizzly bears were once much more widespread within the state of Washington, until the mid-1800s, when they were intensively trapped (Almack et al. 1993, Rine et al. 2018). Trapping, hunting, predator control and habitat loss all contributed to the decline of grizzly bears in Washington and in the North Cascades (Almack et al. 1993, USFWS 1997, 2011; Rine et al. 2018). In 1997, the North Cascades was designated as a recovery area for grizzly bears and a recovery chapter (added to the overall recovery plan) was completed (USFWS 1997). The federal lands within the Project Area are included in the North Cascades Recovery Area; however, the Project Area is not included in a Grizzly Bear Management Unit (GBMU). The Project Area is 1.5 miles east of the Peshastin GBMU and 1.5 miles north of the Swauk BMU.

A considerable body of research has documented the influences that roads, trails, and human access can have on grizzly bear survival and use of habitats (Archibald et al. 1987, Kasworm and Manley 1990, Mace and Waller 1996, 1998; Mace et al. 1996, 1999; Mattson et al. 1987, McLellan and Shackleton 1988, 1989). The effects of roads and human access on grizzly bears include: increased potential for poaching,

collisions with vehicles, food conditioning as a result of bears gaining access to human foods, and displacement of bears from important habitats due to disturbance from vehicle traffic (see Gaines et al. 2003 for a review). As a result of these interactions, the management of human use levels through access management is one of the most powerful tools available to balance the needs of grizzly bears and humans (IGBC 1998). The effects of human access on grizzly bear habitat is assessed using a standardized protocol developed by the Interagency Grizzly Bear Committee (IGBC 1998) and involves the identification of "core areas"; areas that are >500 meters from an open road or motorized trail, provide seasonal food resources for bears, and are within Grizzly Bear Management Units (GBMU). Because the Project Area is not within a GBMU, core was not assessed at that scale. However, because the federal portion of the Project Area is within the North Cascades Recovery Area, core was assessed for the federal lands within the recovery area. Currently, there are 75 acres (10%) of the Project Area that are in a core area, of which 38 acres are on federal lands. Current management direction for the North Cascades, applied only to federal lands within GBMUs, is for "no net loss" of core area (USFS 1997).

Another important aspect of management within the grizzly bear recovery area is sanitation planning. This includes the proper disposal and storage of human food and garbage to make them inaccessible to bears and other wildlife. Bears and other wildlife that are exposed to human foods can become habituated and learn to associate the presence of humans with something to eat. Habituated wildlife can become dangerous and generally have to be destroyed.

The Mission Ridge Expansion Project Assessment Area occurs on the periphery of the North Cascades Grizzly Bear Recovery Area. In the US portion of the North Cascades Grizzly Bear Recovery Area, there have not been enough verified sightings of grizzly bears, in particular females with cubs, in the past 5 years to meet the definition of a "population" (USFWS 2000, Lyons et al. 2018). To date, there have been no verified sightings of grizzly bears in the area, in part a result of the extremely low numbers of grizzly bears that are left in the North Cascades. The most recent evidence of grizzly bears near the Project Area was a confirmed track on Wedge Mountain in 1991, approximately 20 miles to the northwest. However, because federal lands within the Assessment Area occur in the recovery area, the effects to grizzly bears will be assessed. The indicators used to assess potential impacts to grizzly bears include: changes to the availability of core areas within the recovery area (but outside of any GBMU), and the potential for grizzly bears to become habituated to human foods and garbage.

Gray Wolf

The gray wolf is federally listed as an Endangered species in the western two thirds of Washington State (USFWS 2003). Recovery regulations require consideration of potential impacts to known denning habitat or rendezvous sites (USFWS 2003).

Gray wolves historically occurred throughout much of the state of Washington, but were nearly extirpated by the 1940s through aggressive predator control efforts (Laufer and Jenkins 1989, Gaines et al. 2000). In the early 1990s, wolves started to be documented again in the Cascade Mountains (Fritts 1992, Gaines et al. 1995) and have since recolonized the northeastern portion of the state and much of the North Cascades with at least 126 known wolves in 27 known packs and 15 breeding pairs (WDFW et al. 2019). The closest pack to the Assessment Area is the Naneum Pack which had a minimum of two individuals as of December 2018 (WDFW et al. 2019) and has experienced at least one human caused mortality. This pack has not been confirmed as a breeding pair. This pack has been documented to occur in the Assessment Area and likely use the Project Area.

Wolf packs are generally comprised of breeding pairs and older off-spring that help in the feeding and care of current-year pups. Wolf activity during pup rearing is centered on den and rendezvous sites that are used throughout the spring until mid-summer (Mech 1970, USFWS 2003). Gray wolves are

considered to be vulnerable to human disturbance while at den and rendezvous sites (Mech et al. 1991, Frame et al. 2007).

Roads and trails can increase human presence within wolf habitat and increase opportunity for illegal killing of wolves. Areas with low road densities (<1 mile/square mile) are referred to as security habitat and provide wolves with areas relatively free of human disturbance. Currently there are 954 acres of security habitat in the Assessment Area, of which 161 acres occur on federal lands. There are 35 acres of security habitat in the Project Area and 26 acres are on federal lands.

The gray wolf is dependent upon an adequate supply of prey, primarily deer and elk (Messier 1995, Vales and Peek 1995, WDFW 2011). Mule deer and elk are common in the Assessment Area. Elk habitat quality was assessed using the approach described in Gaines et al. (2019 Table 2).

The effects of the Mission Ridge Expansion Project will be assessed on gray wolves and their habitats using the following indicators: potential for disturbance during the pup-rearing period, changes to security habitat, and effects to their primary prey.

Northern Spotted Owl and Critical Habitat

The northern spotted owl is federally listed as a Threatened species (USFWS 1990). A recovery plan was completed in 2011 (USFWS 2011) and revised critical habitat was designated in 2012 (USFWS 2012). In 1994, the Northwest Forest Plan amended the Okanogan-Wenatchee Land and Resource Management Plan. One of the primary components of the Northwest Forest Plan was the designation of a system of reserves to provide for the conservation and recovery of wildlife species, such as the northern spotted owl, that are associated with late-successional forests (USDA and USDI 1994). The Assessment Area for the Mission Ridge Expansion Project does not include any designated critical habitat for the northern spotted owl, nor does it include any of the federal reserves that were designated under the Northwest Forest Plan. Outside of reserves or critical habitat, the management of spotted owls focuses on the protection of suitable habitat around spotted owl activity centers.

Forest conditions that provide for nest/roosting functions for northern spotted owls in the eastern Cascades are generally characterized as having a relatively high degree of structural complexity (see Gaines et al. 2015 for a recent summary). These forest conditions generally include a high canopy closure (e.g., >70%) and multiple canopy layers (e.g., multiple age or size classes of trees). These forests are generally composed of grand fir (*Abies grandis*) and Douglas-fir (*Pseudotsuga menziesii*) forested plant associations in dry and mesic forests, and western hemlock (*Tsuga heterophylla*) in moist forest associations (Buchanan et al. 1995, Herter et al. 2002, Irwin et al. 2000, Loehle et al. 2011). The presence of large snags and coarse downed wood is quite variable in spotted owl nesting habitat, but mistletoe appears to be regularly associated with nesting habitat (Buchanan et al. 1995, Loehle et al. 2011, Marshal et al. 2003). Nesting, Roosting, Foraging (NRF) habitat, also referred to as “suitable” habitat, was mapped using high resolution stereo imagery to establish the initial map. This map was evaluated by field surveys and using LiDAR imagery to develop a final “suitable” spotted owl habitat map used in this assessment.

Forest conditions that provide for spotted owl foraging function is thought to be the most variable of habitats used by territorial spotted owls, and may be most closely tied to forest conditions associated with primary prey species (Irwin et al. 2007, USFWS 2011). The primary prey species for northern spotted owls in the eastern Cascades include northern flying squirrels (*Glaucomys sabrinus*) and bushy-tailed woodrats (*Neotoma cinerea*) (Forsman et al. 2001, 2004; Lehmkuhl et al. 2006a,b). Foraging habitat includes nesting/roosting habitat but also includes forests that are less structurally complex and would not support successful nesting.

Spotted owls begin nesting in early March and extends until juveniles disperse from the nesting area in August and September. Monitoring of spotted owl nests in the eastern Cascades has shown that spotted owl young are generally mobile enough to move away from disturbance by the end of July. Dispersal habitat is used by spotted owls to move between patches of nesting/roosting and foraging habitats. Dispersal habitat is composed of single or multi-layered forests with moderate sized trees, and canopy closure >40%. Limited information is available concerning the habitats used by spotted owls during dispersal. There is no dispersal habitat located within the Project Area and there are 15,430 acres of dispersal habitat within the Assessment Area.

Surveys for northern spotted owls were conducted throughout the Assessment Area from the late 1980s through 2006, and again during 2018. A single spotted owl was located within the Assessment Area in 1996 and a resident single spotted owl within the Assessment Area in 1998. No spotted owl nesting has been documented within the Project Area. There is no spotted owl suitable habitat within the Project Area. There are approximately 1,754 acres of spotted owl suitable habitat within the Assessment Area and 243 acres occurs on federal lands.

The effects of the Mission Ridge Expansion project will be assessed on spotted owls and their habitats using the following indicators: potential for disturbance during nesting and changes to amount of suitable (nesting, roosting, foraging) and dispersal habitat.

Wolverine

The wolverine is considered to be a habitat generalist and is sensitive to the effects of human associated disturbances (Copeland et al. 2007, Krebs et al. 2007). Past trapping and harvest greatly reduced wolverine numbers throughout much of the western U.S. (Aubry et al. 2007). Reports of wolverines in the Cascades have been steadily increasing since the 1960s (Aubry et al. 2007, Edelmann and Copeland 1999, Johnson 1977). Wolverines are year-round residents of the Cascades, and, although they have not been recently confirmed in the Assessment Area, suitable habitats are present. Wolverines are wide-ranging, and their home ranges are often large (80,000 to >300,000 acres)(Krebs et al. 2007).

Montane coniferous forests connected to subalpine cirques provide suitable habitats for winter foraging and summer kit rearing (Copeland 1996, Copeland et al. 2010). The distribution of wolverines is highly influenced by the intensity of human settlement and the persistence of spring snow cover (Aubry et al. 2007, Banci 1994, Carroll et al. 2001, Copeland et al. 2010, Kelsall 1981). Wolverines, in particular females, are sensitive to human disturbance associated with winter recreational activities. For example, female wolverines in British Columbia selected home ranges and denning areas that excluded areas used by humans for backcountry skiing (Krebs et al. 2007).

Key factors to consider when assessing the potential impacts of projects on wolverines include changes to security habitats (Gaines et al. 2003) and potential for disturbance to denning habitat. Currently there are 954 acres of security habitat in the Assessment Area, of which 161 acres occur on federal lands. There is a high level of human influence (<50% of the Assessment Area is security habitat) on security habitat and potential denning habitat in the Assessment Area. There are 35 acres of security habitat in the Project Area and 26 acres are on federal lands. There are approximately 35 acres of potential denning habitat on state lands and none on federal lands in the Project Area.

Region 6 Sensitive Species, Survey and Manage Species, and Management Indicator Wildlife Species

There are eight wildlife species that are identified as Management Indicator Species (MIS) and 13 wildlife species that are on the Region 6 Sensitive Species list that likely occur or may occur in the Assessment Area (Table 3-33). Survey and Manage Species include those that are associated with late-successional and old forest habitats. These species were grouped into habitats and resource indicators were selected

to assess the potential effects of the proposed Mission Ridge Expansion Project on their habitats and populations. The existing condition of each habitat group and resource indicator is presented below.

Habitat Generalist Group

The wildlife species represented in this group use a wide-variety of habitats. Their distribution, habitat use, and populations are generally influenced by the presence of human activities. Therefore, to assess the potential effects of the Mission Ridge Expansion Project on these species, the summer and winter habitat disturbance index (Gaines et al. 2003) was used to identify areas with relatively low levels of human use (security habitat). Currently, there are 954 acres of security habitat in the Assessment Area, of which 161 acres occurs on federal lands. There is a high level of human influence (<50% of the Assessment Area is security habitat) on security habitat in the Assessment Area. There are 35 acres of security habitat in the Project Area and 26 acres are on federal lands.

Late-Successional Habitat in Mesic/Moist Forest Group (including Survey and Manage Species)

There are approximately 4,025 acres of late-successional habitats within the mesic/moist forests in the Assessment Area, of which 429 acres occur on federal lands. There are 162 acres of late-successional habitat in mesic/moist forests in the Project Area and 7 acres are on federal lands. An important component of these habitats that is generally missing or in low abundance is large and old trees (Gaines et al. 2019). These habitats have been considerably fragmented as a result of past management and landownership patterns. The key resource indicators used to assess habitat for this group of wildlife species include changes to the amount and spatial arrangement of late-successional forest in the mesic/moist forest zone.

Open-Forest Habitat in Dry Forest Group

There are approximately 4,925 acres of open-forest habitat within the dry forest zone in the Assessment Area, with <1 acre occurring on federal lands. There are no acres of this habitat in the Project Area. An important component of these habitats that is currently lacking or in low abundance is the large and old tree component. In addition, these habitats have been fragmented as a result of past management and ownership patterns. The resource indicators used to assess the potential effects of the ski area expansion on these wildlife species and their habitats include: changes to the availability of large trees and changes to the canopy closure.

Riparian and Wetland Habitat Group

There are many wildlife species that are associated with riparian and wetland habitats. These habitats have a disproportionately high level of use by many wildlife species, meaning that, even though the amount of habitat in the Assessment Area is limited, the use by wildlife is high. Two indicators are used to assess the potential effects of the project on riparian-associated wildlife species: the amount of habitat and the habitat influence index to assess human disturbance to these habitats (Gaines et al. 2003). Currently, there are 2,650 acres of riparian and wetland habitats in the Assessment Area, of which 76 acres occur on federal lands. There are 90 acres of riparian habitats in the Project Area.

Low Elevation Grassland and Shrubland

There are a number of species associated with low-elevation grassland/shrubland. One of the key indicators for this group includes changes to the soils within these habitats. Currently, there are 5,782 acres of these habitats within the Assessment Area and no acres in the Project Area.

Talus Habitat Group

There are a wide variety of species associated with these unique habitats. Currently, there are 1,540 acres of these habitats in the Assessment Area and 160 acres occur on federal lands. There are 250

acres in the Project Area, with 22 acres on federal lands, 188 acres on state lands, and 40 acres on private lands.

Snags and Logs Habitat Group

Snags are standing dead trees that provide important habitat for numerous cavity nesting birds, such as woodpeckers and nuthatches, and mammals, such as squirrels and bears (Brown, 2002). Logs arise from fallen trees, large branches and snags. Log habitat, also referred to as downed wood or coarse woody debris, often serves a function similar to snags and provides nesting, denning, foraging habitat, hiding cover and shelter from inclement weather for a wide variety of species. Snag habitat is limited on the site, particularly large snags, as a result of past timber harvest.

Species of Management Interest

Rocky Mountain Elk

Elk (*Cervus elaphus*) are a species of management interest and a management indicator species. Elk are an important resource and have substantial influence on ecosystems in the eastern Cascades of Washington. For example, elk can influence plant community composition (Opperman and Merenlender 2000, Riggs et al. 2000, Alldredge et al. 2001, Rooney 2001, Baker et al. 2005, Beschta 2005, Wisdom et al. 2006), nutrient cycling (Frank 1998, Evens and Belnap 1999, Schoenecker et al. 2004), disturbance regimes (Hobbs 1996, Vavra et al. 2004), and songbird community composition (Berger et al. 2001, Fuller 2001, Bailey and Whitham 2003). In addition, elk are an important economic and cultural resource (WDFW 2018).

Elk are often seen in the Assessment and Project Areas. These elk are part of the Colockum Elk Herd and use the Assessment Area as summer range and the Stemilt portion of the Assessment Area as calving habitat. The Project Area is used as summer range and elk likely migrate through the Project Area as they move from summer to winter ranges. Elk calving in Washington is generally from mid-May to mid-July. The Colockum Elk Herd is estimated to be approximately 6,018 individuals, and the herd population objective is 4,050 to 4,950 individuals (WDFW 2014). The limiting factors for this herd include: habitat, hunting, and lethal removals related to agricultural damage (WDFW 2014).

Recent research has highlighted the importance of forage quality and quantity on elk summer range, particularly in the late-summer and early fall, and how nutrition influences elk body condition, productivity, calf growth, and survival (Cook et al. 2004, 2013, 2018). Recently developed methods used to assess elk habitat better account for elk nutrition (Rowland et al. 2018) and better assess how proposed projects may influence elk forage or elk access to high value forage areas, in addition to other factors that influence elk habitat use (i.e. roads) (Rowland et al. 2018, Wisdom et al. 2018). Therefore, to assess elk habitat within the Assessment and Project Areas, key indicators that were used included: elk forage, cover, security habitat, and terrain (Figure 3-35 and Table 3-35) (Appendix E Gaines et al. 2019).

Table 3-35. Existing elk habitat quality index scores for the Mission Ridge Expansion Project Assessment Area and Project Area.

Area	**Habitat Quality Index – Acres (%)**		
	Low	**Moderate**	**High**
Assessment Area	19,365 (50%)	17,030 (44%)	2,575 (6%)
Project Area	507 (46%)	555 (51%)	34 (3%)
Private Lands	284 (26%)	232 (21%)	8 (<1%)
State Lands	184 (17%)	98 (9%)	13 (1%)
Federal Lands	39 (3%)	225 (20%)	13 (1%)

Figure 6. Proximity of Mission Ridge Proposed Expansion Project relative to Rocky Mountain elk and mule deer winter range and cal
as mapped by the Okanogan-Wenatchee National Forest and WDFW Priority Habitat and Species.

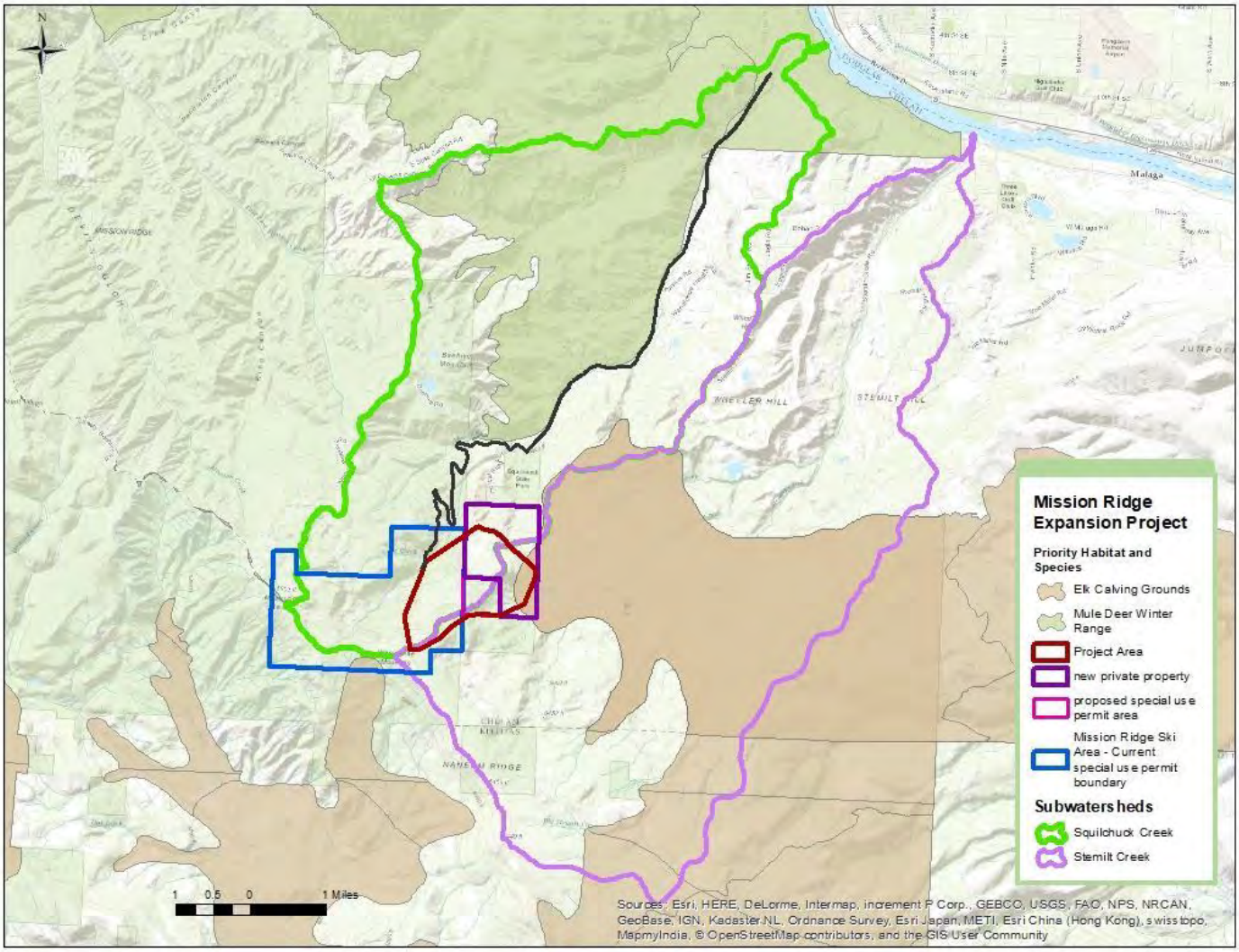


Figure 3-36. Map showing the location of the elk calving areas and mule deer winter range within the proposed Mission Ridge Expansion Assessment Area.

Mule Deer

Mule deer (*Odocoileus hemionus*) are both a species of management interest and a management indicator species. Deer are common within both the Assessment and Project Areas. Mule deer populations in north-central and eastern Washington are stable to increasing (WDFW 2016a). The Assessment Area is used by mule deer for summer range and at the lower elevations as winter range (Fig. 3-35). The Project Area is used by mule deer as summer range but is generally too high in elevation with too much snow cover to provide winter range. Mule deer often use riparian areas with dense vegetative cover for fawning during May through July in eastern Washington (WDFW 2016a). Habitat quality, in particular forage quality and quantity, can influence mule deer habitat use, productivity, and survival (Forrester and Wittmer 2013). The key indicators used to assess habitat quality for mule deer included forage, cover, and habitat security (Table 3-36).

Table 3-36. Mule deer habitat quality index scores for the Mission Ridge Expansion Assessment Area and Project Area.

Area	Habitat Quality Index – Acres (%)		
	Low	Moderate	High
Assessment Area	19,365 (50%)	17,030 (44%)	2,575 (6%)
Project Area	507 (46%)	555 (50%)	34 (3%)
Private Lands	284 (26%)	232 (21%)	8 (<1%)
State Lands	184 (17%)	98 (9%)	13 (1%)
Federal Lands	39 (3%)	225 (20%)	13 (1%)

Native Pollinators

Native bees, such as the western bumblebee, butterflies, moths, bats, and beetles are collectively referred to as native pollinators. The Western bumblebee is a native pollinator that is also listed on the Region 6 Sensitive Species list and has been documented to occur on the Okanogan-Wenatchee National Forest. Native pollinators pollinate more than 80% of wild flowering plants in temperate latitudes, thereby enhancing biodiversity and supporting more resilient ecosystems (USDA 2015). The health of native pollinator populations has been impacted over recent decades by a variety of factors including: the loss of habitat, diminished quantity and quality of food sources, exposure to pesticides, and increased adverse effects of pathogens and parasites (USDA 2015). As a result, on June 20, 2014, President Obama issued a memorandum directing the heads of executive departments of agencies to create a Federal strategy to provide for the health of pollinators. This resulted in a set of Best Management Practices for management on Federal lands (USDA 2015). Some key aspects of the Best Management Practices include: restoration of native plants (food sources for pollinators), and reducing the potential for competition from non-native pollinators through the placement of apiaries.

Migratory Birds

Migratory birds are of great ecological and economic value and contribute considerably to biological diversity. Typically, 30-50% of the native bird community in eastern Washington forests is comprised of neotropical migratory birds (Gaines et al. 2007, 2010), including some species that are identified as Region 6 Sensitive Species, such as the gray flycatcher. Migratory birds occur over a wide-range of habitats in the Assessment Area. The primary habitats that are potentially influenced by the proposed Mission Ridge Expansion project include late-successional forest habitats (4,025 acres in Assessment Area, 162 acres in Project Area), open canopied dry forest habitats (4,925 acres in Assessment Area, 0 acres in Project Area), and riparian and wetland habitats (2,650 acres in Assessment Area, 90 acres in the Project Area). The primary resource indicator used to assess their habitats is changes to habitat availability.

Climate Change and Wildlife

The anticipated climatic changes to eastern Washington environments are likely to result in a variety of effects to wildlife populations and their habitats (Gaines et al. 2012, Lawler et al. 2014). A striking conclusion reached from several climate change studies is the degree of change to wildlife habitats and populations that has already occurred (Lawler and Mathias 2007, Root et al. 2003). There are a variety of responses of wildlife to changing climatic conditions that have occurred or are anticipated to occur including: changes in species distributions, changes in the timing of breeding and other activities,

changes in pathogens and invasive species distributions, changes in survival and extinction risks, and changes in the interactions among species. Agency policy requires that potential impacts of climate change be evaluated for any interactive or inter-related effects with project proposals and that these analyses are presented in environmental assessments. To aid in the assessment of the effects of climate change on wildlife species and their habitats, the Climate Change Sensitivity Database (CCSD 2019) was used to determine the vulnerability of each species and the particular effects that climate change might have given their life history. The vulnerability of wildlife species to climate change was considered in the assessment of the viability of species and their habitats in the Environmental Consequences section.

Wildlife Species Vulnerability

The wildlife species or species groups that were assessed in the CCSD database (not all species have been assessed) showed that 7 (41%) have a high vulnerability rating, 4 (24%) have a medium vulnerability rating, and 6 (35%) have a low vulnerability rating (Table 3-37).

Table 3-37. Climate change vulnerability for wildlife species or species groups assessed in the Mission Ridge Expansion Environmental Assessment.

Wildlife Species	Climate Change Vulnerability Rating	Climate Change Impacts
Canada Lynx	High	Changes in snowpack would change the distribution of key habitats and prey species. Predator/prey dynamics are likely to be influenced.
Grizzly Bear	Low	Changes in snowpack will change hibernation, exposing bears to humans for longer time.
Gray Wolf	Low	Habitat generalist
Northern Spotted Owl	High	Loss of habitat due to altered disturbance regimes.
Pacific Marten	High	Changes to habitat distribution and amount.
Pileated Woodpecker	Medium	Loss of habitat due to altered disturbance regimes.
Wolverine	High	Changes in persistence of spring snow used for denning
Bald Eagle	Low	Changes to fish populations
Peregrine Falcon	Low	Generalist with high mobility
White-headed Woodpecker	Medium	Changes to habitat from altered disturbance regimes
Northern Goshawk	High	Changes to food supply and suitable habitat
Lewis's Woodpecker	Medium	Changes to habitat from altered disturbance regimes
Gray Flycatcher	Medium	Changes to habitat from altered disturbance regimes

Mule Deer	Low	Habitat generalist with high mobility
Rocky Mountain Elk	Low	Habitat generalist with high mobility
Molluscs	High	Sensitive to drying conditions
Native Pollinators	High	Sensitive to changes in forage plants

Environmental Consequences

Federally Listed Wildlife Species

Canada Lynx

Alternative 1 (No Action)

Direct, Indirect and Cumulative Effects

There would be no direct or indirect effects on federal or state lands to Canada lynx habitat as a result of this alternative. There would be no effects on Canada lynx habitat from this alternative. Without the access road from federal lands to private lands, the private land development and associated ski area expansion would not occur and there would be no change to lynx habitat. Conditions as described in Existing Condition would continue. The no action alternative would have “no effect” on Canada lynx and its habitat.

Alternative 2 (Proposed Action)

Direct and Indirect Effects

There are approximately 255 acres of lynx habitat on federal lands in the Project Area in the LAU that is currently in a mid-successional (lynx travel habitat) forest condition. Approximately 32 acres of lynx habitat on federal lands would be converted to an early-successional non-forest condition as a result of new ski run and ski lift construction (glading and Nordic trails would retain lynx habitat forest structure). These areas would not develop into dense early-successional forest (foraging habitat) preferred by snowshoe hares, because they would be maintained in a non-forest condition as ski runs and planted with native grasses. This represents 12% of the lynx habitat on federal lands in the Project Area in the LAU, and 2% of the lynx habitat on federal lands in the Assessment Area in the LAU.

There are approximately 151 acres of lynx habitat on state lands in the Project Area in the LAU. These acres are in a mid-successional (travel habitat) forest condition. Eighteen acres of lynx habitat on state lands would be converted to a non-forest condition as a result of new ski run and ski lift construction (glading and Nordic trails would retain lynx habitat forest structure). These areas would not develop into dense early-successional forest (foraging habitat) preferred by snowshoe hares, because they would be maintained in a non-forest condition as ski runs and planted with native grasses. This would result in the loss of approximately 12% of the lynx habitat on state lands in the Project Area, and <1% of the lynx habitat on state lands in the Assessment Area.

The combined effects of the proposed developments on state and federal lands would result in a reduction in lynx habitat of 50 acres, which is 0.7% of the lynx habitat on state and federal lands in the portion of the Assessment Area in the LAU.

There are approximately 43 acres of proposed ski runs, 29 acres on federal lands and 14 acres on state lands. There are 1.1 miles of Nordic ski trails that would be groomed during the winter on federal lands (none on state lands). These areas would result in an increase in the area of snow compaction that could influence access by competitors (e.g., coyotes and bobcats) of the Canada lynx.

Connected Actions
There are approximately 300 acres of lynx habitat on private lands that occur in the Project Area. About 175 of these acres would be converted to a non-suitable habitat condition by the construction of proposed roads, ski trails, condominiums, houses, and other development associated with the proposed resort.

In total, approximately 225 acres of lynx habitat across all land ownerships would be converted to a non-habitat condition, affecting about 5% of the lynx habitat in the portion of the Assessment Area that is in a LAU.

There are approximately 5.4 miles of Nordic trails that would be groomed during the winter on private lands that would increase the area of snow compaction and could influence access by competitors (e.g., coyote and bobcats) of the Canada lynx.

Cumulative Effects
There are no additional cumulative effects to lynx habitat in the Assessment Area known at this time.

Summary of Effects
The direct, indirect and cumulative effects, and interrelated and interdependent actions associated with the proposed Mission Ridge Expansion Project "may affect, but will not likely adversely affect" the Canada lynx and its habitat. This determination is made based on the following: (1) an insignificant and discountable reduction in lynx habitat on state and federal lands, (2) the location of the project occurs in an area designated as "peripheral" to the recovery of lynx, (3) the location of the project make it unlikely that lynx reside in this area because it is a considerable distance to known occupied lynx (core) areas, and (4) the project is consistent with the conservation measure for Canada lynx in "peripheral" areas.

Grizzly Bear

Alternative 1 (No Action)

Direct, Indirect and Cumulative Effects
There would be no direct or indirect effects on federal or state lands to grizzly bear habitat as a result of this alternative. There would be no effects on grizzly bear habitat from this alternative. Without the access road from federal lands to private lands, the private land development and associated ski area expansion would not occur and there would be no change to grizzly bear habitat. Conditions as described in Existing Condition would continue. The no action alternative would have "no effect" on grizzly bear and its habitat.

Alternative 2 (Proposed Action)

Direct and Indirect Effects
The proposed ski area developments within the Project Area would not occur within the 38 acres of core area located on federal lands that provide a variety of seasonal food resources. There would be no effects to existing core areas within the recovery area. The proposed ski area developments and road access within the Project Area would not reduce the 30 acres of core area on state lands. The core areas on state lands are not located within a GBMU or in the recovery area.

There would be increased human presence during the construction phase of the project on federal and state lands outside of the core areas. The project would increase human use in the general area as the resort development on private lands would bring more people to the area that are likely to participate in both winter and non-winter recreational activities. This is likely to increase human use of the Nordic trail system by ATVs, motorcycles, and non-motorized trail users and on existing roads and trails down to Squilchuck State Park. Because these activities are likely to occur on existing roads and trails, they would not reduce core habitat and they would occur outside the recovery zone.

Connected Actions
The proposed ski area developments and road access within the Project Area would not reduce the 7 acres of core area on private lands. The core areas on private lands are not located within a GBMU or in the recovery area.

The proposed resort development on private lands would include bear resistant structures and facilities to reduce the potential for bears to become habituated to human foods and garbage (Appendix B).

Cumulative Effects
The cumulative effects of human activities in grizzly bear habitat is assessed at the scale of the GBMU by evaluating effects to core areas (IGBC 1998, Gaines et al. 2003). Because the Mission Ridge Expansion Project Area does not occur in a GBMU, there would be no cumulative effects to core areas for grizzly bears in the adjacent Peshastin or Swauk GBMUs.

Summary of Effects
The proposed Mission Ridge Expansion Project development does not occur within a GBMU but a portion of the Project Area that is on federal lands does occur within the North Cascades Grizzly Bear Recovery Area. The proposed development activities would not reduce the amount of core area within the recovery area or on adjacent core areas that occur on private and state lands outside of the recovery area. The proposal would be consistent with the interim “no net loss” of core direction (USFS 1997). The proposed development on private lands includes installation of bear resistant structures and facilities. There would be an increase in human activity in the general area, including on federal and state lands, as a result of the development on private lands, both during the winter and non-winter time periods. Based on the direct, indirect, and cumulative effects, the proposed Mission Ridge Expansion project “may affect, but is not likely to adversely affect” grizzly bears.

Gray Wolf

Alternative 1 (No Action)

Direct, Indirect and Cumulative Effects
There would be no direct or indirect effects on federal or state lands to gray wolf habitat as a result of this alternative. There would be no additional cumulative effects on gray wolf from this alternative. Without the access road from federal lands to private lands, the private land development and associated ski expansion would not occur and there would be no change to gray wolf habitat. Conditions as described in Existing Conditions would continue. The no action alternative would have “no effect” on gray wolf and its habitat.

Alternative 2 (Proposed Action)

Direct and Indirect Effects
At this time, the Naneum wolf pack is not a known breeding pair (WDFW et al. 2019), meaning there are no known den or rendezvous sites associated with this pack. Pack monitoring by the WDFW occurs during the late-winter and if a den or rendezvous sites are discovered, mitigation measures would be applied to protect these sites and reduce human disturbance (Appendix B). The existing level of human activity (ski area) may preclude wolves from denning in the area.

A new road (0.7 miles) would be constructed on federal lands to access the resort development area on private lands. This road would not affect any of the existing 26 acres of security habitat for gray wolves on federal lands within the Project Area. The current level of human activities (e.g., existing ski area access road, existing roads to access ski lifts, and existing roads on adjacent state and private lands) around the new road precludes it meeting security habitat criteria. Construction activities associated with the ski

development (road construction, lift line construction, ski run construction) on federal lands may cause disturbance to gray wolves using the Project Area. This would be most likely to occur in the spring and fall as wolves follow elk migrating between seasonal ranges.

The proposed ski area expansion activities on federal lands within the Project Area would reduce elk habitat quality on approximately 272 acres while construction activities are occurring. The reduction in elk habitat quality is a result of the disturbance (noise, human presence) associated with the construction activities. Once construction activities are completed, habitat quality on 253 acres on federal lands would improve to a moderate level because some maintenance activities (noise, human presence) may disturb elk. However, these activities would be timed to reduce impacts during critical time periods such as elk calving and during spring and fall migration.

The proposed expansion activities would reduce security habitat for gray wolves by 6 acres on state lands in the Project Area. Construction activities associated with the ski development (road construction, lift line construction, ski run construction) on state lands may cause disturbance to gray wolves using the Project Area. This would be most likely to occur in the spring and fall as wolves follow elk migrating between seasonal ranges.

The proposed expansion activities on State lands within the Project Area would reduce elk habitat quality on 295 acres as a result of disturbance (noise, human presence) during the construction phase of the project. Post-construction 110 acres would return to a moderate level of habitat quality because some maintenance activities may occasionally disturb elk (e.g. noise, human presence). However, these activities could be timed to reduce impacts during critical time periods such as elk calving and during spring and fall migration.

Connected Actions
The proposed expansion activities would reduce security habitat for wolves on private lands by 2.5 acres in the Project Area. Existing activities already reduce security habitat on private lands in the Project Area. The proposed expansion activities (road construction, home construction, ski lift, ski runs, etc.) on private lands would likely create a level of human disturbance that would prevent wolves from using the area.

The proposed expansion activities on private lands within the Project Area would permanently reduce (but not preclude) elk habitat quality on 524 acres as a result of activities associated with the human development (houses, condos, road, etc.). While elk may still continue to use these areas, they would be subject to relatively high levels of human disturbance.

Cumulative Effects
Cumulatively, the existing security habitat for wolves would be reduced by less than 1% across all land ownerships. This is largely due to the existing high levels of human activities (e.g., existing high road densities, existing motorized trails, existing ski area activities) that preclude security habitat.

Within the Assessment Area and across all land ownerships, elk habitat quality would change but only to a limited degree. The amount of area rated as low quality elk habitat would increase from 50 to 52% of the Assessment Area, the amount rated as moderate would be reduced from 44 to 42% of the Assessment Area, and the amount of high quality habitat would remain at 6% of the Assessment Area. While disturbance from Mission Ridge Expansion Project may alter elk movement patterns and displace elk within portions of the Project Area, elk are highly mobile and capable of finding alternative routes between summer and winter ranges. The proposed developments would not alter the availability of elk as a food resource for wolves.

Summary of Effects
The direct, indirect, and cumulative effects associated with the proposed Mission Ridge Expansion Project "may affect, but is not likely to adversely affect" gray wolves and their habitat. This determination is made based on the following: 1) no known denning or rendezvous sites and mitigations to protect sites if discovered, 2) limited effects to security habitat on federal lands and within the Assessment Area, and 3) limited effects to prey species on federal lands and within the Assessment Area, and partial mitigation through timing restrictions during critical time periods if needed.

Northern Spotted Owl and Critical Habitat

Alternative 1 (No Action)

Direct, Indirect and Cumulative Effects
There would be no direct or indirect effects on federal or state lands to spotted owl habitat as a result of this alternative. There would be no cumulative effects on spotted owl habitat from this alternative. Without the access road from federal lands to private lands, the private land development and associated ski area expansion would not occur and there would be no change to northern spotted owl habitat. Conditions as described in Existing Condition would continue. The no action alternative would have "no effect" on spotted owl and critical habitat.

Alternative 2 (Proposed Action)

Direct and Indirect Effects
There is no suitable spotted owl habitat within the Project Area. However, there are approximately 6 acres of suitable spotted owl habitat outside the Project Area but within a ¼ mile of construction activities (these include use of the existing road by construction equipment and construction of the main access road) that may produce noise above ambient levels during the nesting period. Past and recent surveys have not resulted in the location of nesting spotted owls. Additionally, the existing Mission Ridge Road bisects the suitable habitat to the northwest of the Project Area. The fragmented nature of the existing habitat within the Assessment Area and the location on the extreme eastern edge of the spotted owl range makes it unlikely that a pair or resident territorial spotted owl may be present. The potential for noise from construction activities to disturb spotted owl nesting is very small; however, if a nest is located during surveys, timing restrictions would be implemented (Appendix B).

Connected Actions
There is no suitable or dispersal habitat on private lands.

Cumulative Effects
There are 1,754 acres of suitable spotted owl habitat within the Assessment Area. Approximately 243 acres of this habitat occurs on federal lands, with the remaining habitat on private land (587 acres), WDFW land (435 acres), WDNR land (263 acres) and Chelan County land (226 acres). None of these lands are in a land allocation that would emphasize spotted owl habitat. There are ongoing projects, not associated with the Mission Ridge Expansion Project, on Chelan County land and WDNR lands for forest thinning and fuel reduction treatments that could reduce spotted owl habitat by 489 acres. This would result in cumulative effects to about 28% of the spotted owl habitat in the Assessment Area, all on the periphery of the range, and outside critical habitat.

Summary of Effects
Based on the direct, indirect, and cumulative effects, the Mission Ridge Expansion Project "may affect, but is not likely to adversely affect" spotted owls and their habitat. The reasons for this determination include: 1)The activities associated with the Mission Ridge Expansion Project do not occur in an area designated to emphasize spotted owl recovery, on either federal or state lands. 2) The project occurs on

the eastern edge of the range of the spotted owl. 3) The project would not degrade or downgrade any suitable spotted owl habitat, dispersal habitat, or potential habitat, either within the Project Area or in the Assessment Area. 4) There is a limited potential for disturbance to occur to nesting habitat; however, this potential is low and, surveys and timing restrictions would be implemented.

There is no designated critical habitat for the northern spotted owl in the Project Area or in the Assessment Area. Therefore, a determination of “no effect” to spotted owl critical habitat has been made.

Wolverine

Alternative 1 (No Action)

Direct, Indirect and Cumulative Effects

There would be no direct or indirect effects on federal or state lands to wolverine habitat as a result of this alternative. There would be no additional cumulative effects on wolverine from this alternative. Without the access road from federal lands to private lands, the private land development and associated ski area expansion would not occur and there would be no change in wolverine habitat. Conditions as described in Existing Condition would continue. The no action alternative would have “no effect” on wolverine and its habitat.

Alternative 2 (Proposed Action)

Direct and Indirect Effects

A new road (0.7 miles) would be constructed on federal lands to access the resort development area on private lands. This road would not affect the existing 26 acres of security habitat for wolverines on federal lands within the Project Area. The current level of human activities (e.g., existing ski area access road, existing roads to access ski lifts, and existing roads on adjacent state and private lands) around the new road precludes it meeting security habitat criteria. The proposed expansion activities would reduce security habitat for wolverines by 6 acres on state lands within the Project Area.

The increased number of people in the Ski Area Expansion is likely to increase human use of the Nordic trail system by ATVs, motorcycles (where authorized), and non-motorized trail users and on existing roads and trails down to Squilchuck State Park. Because these activities are likely to occur on existing roads and trails, they would not reduce security habitat. However, the increase in human presence could lead to an increase in off-trail human activities that could result in displacement of wolverine.

The potential denning habitat for wolverines in the Project Area is located on state lands. Existing ski runs and lifts are located on approximately 10 acres of the potential denning habitat and the proposed ski runs, glading, and lifts would impact an additional 5 acres of the potential denning habitat. The disturbance associated with the existing and proposed ski development on federal and state lands would likely limit wolverine use of the area, and preclude wolverine denning.

Connected Actions

The proposed expansion activities would reduce security habitat for wolverines on private lands by 2.5 acres in the Project Area. Existing activities already results in a lack of security habitat on private lands in the Project Area. No additional potential wolverine denning habitat would be impacted by proposed activities on private lands.

Cumulative Effects

Cumulatively, the existing security habitat and potential denning habitat for wolverines in the Assessment Area would be reduced by less than 1% across all landowners. This is largely due to the existing high levels of human activities that precludes security habitat.

Summary of Effects
The direct, indirect, and cumulative effects of the proposed Mission Ridge Expansion Project is "not likely to jeopardize the continued existence of" the wolverine. This is due to a small reduction in the availability of security habitat and potential denning habitat for wolverines.

Region 6 Sensitive Species and Management Indicator Wildlife Species

Habitat Generalist Group

Alternative 1 (No Action)

Direct, Indirect and Cumulative Effects
There would be no direct or indirect effects on federal or state lands to habitat security for the habitat generalist group of species as a result of this alternative. There would be no additional cumulative effects from this alternative. Without the access road from federal lands to private lands, the private land development and associated ski area expansion would not occur and there would be no change in habitat. Conditions as described in Existing Condition would continue. The no action alternative would not affect the viability of any of the wildlife species associated with the habitat generalist group.

Alternative 2 (Proposed Action)

Direct, Indirect and Cumulative Effects
A new road (0.7 miles) would be constructed on federal lands to access the resort development area on private lands. This road would not affect any of the existing 26 acres of security habitat on federal lands within the Project Area. The current level of human activities around the new road precludes it meeting security habitat criteria. The proposed expansion activities would reduce security habitat by 6 acres on state lands within the Project Area. The increased number of people in the Ski Area Expansion is likely to increase human use of the Nordic trail system by ATVs, motorcycles (where authorized), and non-motorized trail users and on existing roads and trails down to Squilchuck State Park. Because these activities are likely to occur on existing roads and trails, they would not reduce security habitat. However the increase in human presence could lead to an increase on off-trail human activities that could result in displacement of wildlife that are sensitive to human disturbance.

Connected Actions
The proposed expansion activities would reduce security habitat on private lands by 2.5 acres in the Project Area. Existing activities already reduce security habitat on private lands in the Project Area.

Summary of Effects
Based on the direct, indirect, and cumulative effects associated with the proposed Mission Ridge Expansion Project, the project would not affect the viability of any of the wildlife species in the habitat generalist group (Table 3-33). The project is consistent with management direction for MIS species associated with this group.

Late-Successional Habitat in Mesic/Moist Forest Group

Alternative 1 (No Action)

Direct, Indirect and Cumulative Effects
There would be no direct or indirect effects on federal or state lands to late-successional habitats as a result of this alternative. There would be no additional cumulative effects from this alternative. Without the access road from federal lands to private lands, the private land development and associated ski area expansion would not occur and there would be no change in late-successional habitat. Conditions as described in Existing Condition would continue. The no action alternative would not affect the viability of any of the wildlife species associated with the late-successional forest habitat group.

Alternative 2 (Proposed Action)

Direct and Indirect Effects

The proposed ski area expansion activities would reduce the amount of late successional habitat on federal lands by 7 acres and on state lands by 8 acres. This represents 2% of the available late-successional habitat in the mesic/moist forest group within the Assessment Area. Mitigation measures to protect larger trees (Appendix B) would help to increase the potential for future late-successional habitat.

Connected Actions

The proposed ski area expansion activities on private lands would reduce the amount of mesic/moist forest late successional habitat by 51 acres.

Cumulative Effects

There are ongoing projects, not associated with the Mission Ridge Expansion, on county lands and WDNR lands for forest thinning and fuel reduction treatments that could reduce mesic/moist forest late successional habitat by 489 acres. The cumulative effects of the activities across all land ownerships would reduce the amount of mesic/moist forest late successional habitat by 627 acres (15%) within the Assessment Area.

Summary of Effects

Based on the direct, indirect, and cumulative effects associated with the proposed Mission Ridge Expansion Project, the project would not affect the viability of any of the wildlife species in the mesic/moist forest late successional habitat group (Table 3-33). The project is consistent with management direction for MIS species associated with this group. The project does not occur within a land allocation that emphasizes the viability of late-successional habitat associated wildlife species.

Open-Forest Habitat in Dry Forest Group

Alternative 1 (No Action)

Direct and Indirect Effects

There would be no direct or indirect effects on federal or state lands for wildlife species associated with dry forest-open canopy habitats as a result of this alternative. There would be no additional effects from this alternative. Without the access road from federal lands to private lands, the private land development and associated ski area expansion would not occur and there would be no change in Dry Forest habitat. Conditions as described in Existing Condition would continue.

Cumulative Effects

There are ongoing projects, not associated with the Mission Ridge Expansion, on county lands and WDNR lands for forest thinning and fuel reduction treatments that could reduce forest canopy, restore spatial pattern, and manage for restoration of large trees on 489 acres outside of the Project Area, but within the Assessment Area. This could increase the availability of habitat for wildlife species associated with open-canopied dry forests by 10% in the Assessment Area.

Summary of Effects

The no action alternative would not affect the viability of any of the wildlife species associated with the dry forest-open canopy habitat group.

Alternative 2 (Proposed Action)

Direct and Indirect Effects, and Connected Actions

There are no habitats associated with this group of wildlife on state, federal or private lands in the Project Area.

Cumulative Effects

There are ongoing projects, not associated with the Mission Ridge Expansion, on county lands and WDNR lands for forest thinning and fuel reduction treatments that could reduce forest canopy, restore spatial pattern, and manage for restoration of large trees on 489 acres outside of the Project Area, but within the Assessment Area. This could increase the availability of habitat for wildlife species associated with open-canopied dry forests by 10% in the Assessment Area.

Summary of Effects

Based on the direct, indirect, and cumulative effects associated with the proposed Mission Ridge Expansion, the project would not affect the viability of any of the wildlife species in the open-canopy dry forest habitat group (Table 3-33). The project is consistent with management direction for MIS species associated with this group.

Riparian/Wetland Habitat Group

Alternative 1 (No Action)

Direct, Indirect and Cumulative Effects

There would be no direct or indirect effects on federal or state lands wildlife species associated with riparian/wetland habitats as a result of this alternative. There would be no additional cumulative effects from this alternative. Without the access road from federal lands to private lands, the private land development and associated ski area expansion would not occur and there would be no change in riparian/wetland habitats. Conditions as described in Existing Condition would continue. The no action alternative would not affect the viability of any of the wildlife species associated with the riparian/wetland habitat group.

Alternative 2 (Proposed Action)

Direct and Indirect Effects

There are no wetland habitats on state or federal lands within the Project Area. There are 7.2 acres of stream-riparian habitat that would be impacted as a result of road construction and ski trail construction on federal lands. Long-term effects, such as permanent removal of riparian vegetation and habitat, would be mitigated by the restoration of degraded Riparian Reserve acreages (2:1 ratio) designed to help off-set direct impacts to Riparian Reserves from the Proposed Action. See Aquatic Resources for additional detail (Section 3.21).

Connected Actions

Mitigation of permanently disturbed riparian habitat on private land would be mitigated per Chelan County code. Two previously unmapped wetlands were assessed and delineated within the Project Area by qualified professional wetland biologists on private land. It was determined that the wetlands fit the Class III category. Category III wetlands are wetlands with a moderate level of functions and can often be adequately replaced with a well-planned mitigation project (Hruby 2014). The wetlands are within the Project Site and would be impacted. Per Chelan County Code (11.80.070), the Applicant will coordinate with Chelan County, WDFW and Washington Department of Ecology (11.80.110) to mitigate impacts to wetland habitats and species.

Summary of Effects

Based on the direct, indirect, and cumulative effects associated with the proposed Mission Ridge Expansion, the project would not affect the viability of any of the wildlife species in the riparian/wetland habitat group (Table 3-33). The project is consistent with management direction for MIS species associated with this group.

Talus Habitat Group

Alternative 1 (No Action)

Direct, Indirect and Cumulative Effects

There would be no direct or indirect effects on federal or state lands to wildlife species associated with talus habitats as a result of this alternative. There would be no additional cumulative effects from this alternative. Without the access road from federal lands to private lands, the private land development and associated ski area expansion would not occur and there would be no change in talus habitat. Conditions as described in Existing Condition would continue. The no action alternative would not affect the viability of any of the wildlife species associated with the talus habitat group.

Alternative 2 (Proposed Action)

Direct, Indirect and Cumulative Effects

None of the habitat on federal lands and about 10 acres of talus on state lands would be affected by lift tower installation and road construction. The project is outside of the range of both the larch mountain and Van Dyke's salamanders. The project impacts on talus habitat on state and federal lands would only affect <1% of the talus habitat in the Assessment Area.

Connected Actions

Approximately 30 acres of talus habitat would be impacted on private lands as a result of resort development. Cumulatively, across all lands, about 2.5% of the available talus habitat in the Assessment Area would be impacted by activities associated with the Mission Ridge Expansion Project. No cumulative effects would be anticipated.

Summary of Effects

Based on the direct, indirect, and cumulative effects associated with the proposed Mission Ridge Expansion, the project would not affect the viability of any of the wildlife species in the talus habitat group (Table 3-33). The project is consistent with management direction for MIS species associated with this group.

Snag and Logs Habitat Group

Alternative 1 (No Action)

Direct, Indirect and Cumulative Effects

There would be no direct or indirect effects to wildlife species associated with snag and log habitats as a result of this alternative. There would be no additional cumulative effects on wildlife species associated with snag and log habitats from this alternative. Without the access road from federal lands to private lands, the private land development and associated ski area expansion would not occur and there would be no change in snag and downed wood habitat. Conditions as described in Existing Condition would continue. The no action alternative would not affect the viability of any of the wildlife species associated with snag and log habitats.

Alternative 2 (Proposed Action)

Direct and Indirect Effects

Tree removal associated with ski run, ski lifts, roads, and Nordic ski trails would result in loss of some snag and log habitat on 45 acres of federal lands and 15 acres of state lands in the Project Area. In addition, glading would occur on 1 acre of state lands and 13 acres of federal lands and could result in loss of snag and log habitat. Snags larger than 20 inches would be retained unless they pose a safety hazard (see Appendix B. mitigations).

Connected Actions

Tree removal associated with Proposed Actions would result in loss of some snag and log habitat on about 124 acres of private lands, although snag habitat is limited on the private lands, particularly large

snags, as a result of past timber harvest. On private lands, design standards would be incorporated to limit large snag removal where it is safe to do so. Significant wind events have created a substantial amount of downed wood in portions of the Project Area and log habitat is not limited. Much of the log habitat is located in the southwest corner of Section 19 and would not be impacted by development.

Cumulative Effects

There are ongoing projects, not associated with the Mission Ridge Expansion Project, on county lands and WDNR lands for forest thinning and fuel reduction treatments that could reduce forest canopy, restore spatial pattern, and manage for restoration of large trees on 489 acres outside of the Project Area, but within the Assessment Area. These treatments would retain large snags, but could reduce smaller snag habitats.

Summary of Effects

Based on the direct, indirect, and cumulative effects associated with the proposed Mission Ridge Expansion Project, the project would not affect the viability of any of the wildlife species in the snag and log habitat group (Table 3-33). The activities associated with the Mission Ridge Expansion Project would reduce snag and log habitat in the Project Area, but this is only a small portion (<4%) of the habitat available in the Assessment Area. The project is consistent with management direction for MIS species associated with this group. The project is consistent with Forest Plan standards for snags and downed woody habitat.

Species of Management Interest

Elk

Alternative 1 (No Action)

Direct, Indirect and Cumulative Effects

There would be no direct or indirect effects to elk habitat quality or elk movements as a result of this alternative. Without the access road from federal lands to private lands, the private land development and associated ski area expansion would not occur and there would be no change in elk habitat. Conditions as described in Existing Condition would continue. There are ongoing projects, not associated with the Mission Ridge Expansion, on county lands and WDNR lands for forest thinning and fuel reduction treatments that could reduce forest canopy, restore spatial pattern, and manage for restoration of large trees on 489 acres outside of the Project Area, but within the Assessment Area. These activities could change elk habitat quality. The no action alternative would not affect elk habitat quality or movement patterns.

Alternative 2 (Proposed Action)

Direct and Indirect Effects

The proposed ski area expansion activities on federal lands within the Project Area would reduce elk habitat quality on approximately 272 acres while construction activities are occurring. The reduction in elk habitat quality would be a result of the disturbance (noise, human presence) associated with the construction activities. Once construction activities were completed, habitat quality on 253 acres on federal lands would improve to a moderate level because some maintenance activities (noise, human presence) may disturb elk. However, these activities could be timed to reduce impacts during critical time periods, such as elk calving and during spring and fall migration (Appendix B).

The removal of forest canopy in ski runs and gladed areas, and subsequent re-seeding, could enhance foraging area for elk on about 85 acres of federal lands and 20 acres of state lands.

The proposed expansion activities on State lands within the Project Area would reduce elk habitat quality on 295 acres as a result of disturbance (noise, human presence) during the construction phase of the project. Post-construction, 110 acres would return to a moderate level of habitat quality because some

maintenance activities could occasionally disturb elk (e.g. noise, human presence). However, these activities could be timed to reduce impacts during critical time periods, such as elk calving and during spring and fall migration.

The increased number of people in the Ski Area Expansion is likely to increase human use of the Nordic trail system by ATVs, motorcycles (where authorized), and non-motorized trail users and on existing roads and trails down to Squilchuck State Park. Because these activities occur on existing roads and trails, they would not reduce the amount of security habitat but could lead to increased off-trail human use that could displace elk.

Connected Actions
The proposed expansion activities on private lands within the Project Area would permanently reduce elk habitat quality on 524 acres as a result of activities associated with the Village and residential development. While elk could still continue to use these areas, they would be subject to relatively high levels of human disturbance.

Cumulative Effects
There are ongoing projects, not associated with the Mission Ridge Expansion Project, on county lands and WDNR lands for forest thinning and fuel reduction treatments that could reduce forest canopy, restore spatial pattern, and manage for restoration of large trees on 489 acres outside of the Project Area, but within the Assessment Area. These activities could change elk habitat quality.

Summary of Effects
Within the Assessment Area and across all landownerships, elk habitat quality would change, but only to a limited degree. The amount of area rated as low quality elk habitat would increase from 50 to 52% of the Assessment Area, the amount rated as moderate would be reduced from 44 to 42% of the Assessment Area, and the amount of high quality habitat would remain at 6% of the Assessment Area (Appendix E). While disturbance from the Mission Ridge Expansion Project could alter elk movement patterns and displace elk within portions of the Project Area, elk are highly mobile and capable of finding alternative routes between summer and winter ranges. There is not expected to be a population level reduction in the number of elk that use the Assessment Area and Colockum Elk herd objectives could still be met depending on a variety of other factors not related to the Mission Ridge Expansion proposal (e.g., climate change, wildfires, hunting associated mortality, etc.).

Mule Deer

Alternative 1 (No Action)

Direct, Indirect and Cumulative Effects
There would be no direct or indirect effects to mule deer habitat quality as a result of this alternative. There would be no additional cumulative effects as a result of this alternative. Without the access road from federal lands to private lands, the private land development and associated ski area expansion would not occur. There are ongoing projects, not associated with the Mission Ridge Expansion Project, on county lands and WDNR lands for forest thinning and fuel reduction treatments that could reduce forest canopy, restore spatial pattern, and manage for restoration of large trees on 489 acres outside of the Project Area, but within the Assessment Area. These activities could change mule deer habitat quality. The no action alternative would not affect mule deer habitat.

Alternative 2 (Proposed Action)

Direct and Indirect Effects

The proposed ski area expansion activities on federal lands within the Project Area would reduce mule deer habitat quality on approximately 272 acres while construction activities are occurring. The reduction in habitat quality would be a result of the disturbance (noise, human presence) associated with the construction activities and removal of forest cover. Once construction activities were completed, habitat quality on 253 acres on federal lands would improve to a moderate level as some maintenance activities (noise, human presence) could still disturb mule deer.

The proposed expansion activities on State lands within the Project Area would reduce mule deer habitat quality on 295 acres, as a result of disturbance (noise, human presence) during the construction phase of the project and removal of forest cover for ski runs and ski lifts. Post-construction, 110 acres would return to a moderate level of habitat quality because some maintenance activities could occasionally disturb mule deer (e.g. noise, human presence).

Connected Actions

The proposed expansion activities on private lands within the Project Area would permanently reduce mule deer habitat quality on 524 acres as a result of activities associated with the human development (houses, condos, road, etc.). While mule deer could still continue to use these areas, they would be subject to relatively high levels of human disturbance.

Cumulative Effects

There are ongoing projects, not associated with the Mission Ridge Expansion, on county lands and WDNR lands for forest thinning and fuel reduction treatments that could reduce forest canopy, restore spatial pattern, and manage for restoration of large trees on 489 acres outside of the Project Area, but within the Assessment Area. These activities could change mule deer habitat quality.

Summary of Effects

Within the Assessment Area and across all landownerships, mule deer habitat quality would change, similar to elk, but only to a limited degree. The amount of area rated as low quality habitat would increase by 2%, from 50 to 52% of the Assessment Area, the amount rated as moderate would be reduced from 44 to 42% of the Assessment Area, and the amount of high quality habitat would remain at 6% of the Assessment Area. While disturbance from the Mission Ridge Expansion Project could alter mule deer movement patterns and displace deer within portions of the Project Area, they are highly mobile and capable of finding alternative routes. There is not expected to be a population level reduction in the number of mule deer that use the Assessment Area.

Pollinators

Alternative 1 (No Action)

Direct and Indirect Effects

There would be no direct or indirect effects to pollinator habitats as a result of this alternative. There would be no additional cumulative effects as a result of this alternative. Without the access road from federal lands to private lands, the private land development and associated ski area expansion would not occur. There are ongoing projects, not associated with the Mission Ridge Expansion Project, on county lands and WDNR lands for forest thinning and fuel reduction treatments that could reduce forest canopy and enhance habitat for native pollinators (Dodson et al. 2008, Neill and Puettmann 2013) on 489 acres outside of the Project Area, but within the Assessment Area. The no action alternative would not affect pollinator habitat in the Project Area.

Alternative 2 (Proposed Action)

Direct and Indirect Effects

There are 30 acres of area that would be cleared for ski runs, ski lifts, and roads on national forest lands, and 14 acres on state lands. Although understory vegetation is lacking on much of the federal land due to the dense nature of the tree stands (see Botany Section 3.22), the understory vegetation that provides habitat for pollinators would be removed. These areas would be reseeded. In some cases, they are not likely to provide the same level of understory plant diversity and cover as was available prior to disturbance, while in others, the level of understory plant diversity and cover would increase substantially. In general, vegetation removal would result in a reduction in habitat for pollinators on about 44 acres. About 14 acres of glading would occur on state and federal lands that would improve understory plant diversity and abundance and enhance habitats for pollinators.

Connected Actions

On private lands in the Project Area, pollinator habitats would be reduced, but not eliminated on 125 acres as a result of clearing for ski runs, ski lifts and roads, and construction activities associated with the develop of the Village. These impacts may be reduced depending on the revegetation requirements imposed by county regulations.

Cumulative Effects

There are ongoing projects, not associated with the Mission Ridge Expansion Project, on county lands and WDNR lands for forest thinning and fuel reduction treatments that could reduce forest canopy and enhance habitat for native pollinators (Dodson et al. 2008, Neill and Puettmann 2013) on 489 acres outside of the Project Area, but within the Assessment Area.

Summary of Effects

The direct, indirect, cumulative effects and connected actions would result in a reduction in habitat for native pollinators, including the western bumblebee and butterflies. However, habitat for these species in the Assessment Area is likely to be enhanced through current and planned forest health and forest restoration treatments. The proposed Mission Ridge Expansion project would not affect the viability of any native pollinator species and is consistent with management direction for the Sensitive Species associated with this group.

Migratory Birds

Alternative 1 (No Action)

Direct, Indirect and Cumulative Effects

There would be no direct or indirect effects on federal or state lands to habitats for migratory birds as a result of this alternative. There would be no additional cumulative effects from this alternative. Without the access road from federal lands to private lands, the private land development and associated ski area expansion would not occur and there would be no change in habitats for migratory birds. Conditions as described in Existing Condition would continue. The no action alternative would not result in either intentional or unintentional take of a migratory bird (Federal Register 66(11): 3853-3856).

Alternative 2 (Proposed Action)

Direct and Indirect Effects

The proposed ski area expansion activities would reduce the amount of late successional habitat for migratory birds on federal lands by 7 acres and on state lands by 8 acres. This represents 2% of the available late-successional habitat in the mesic/moist forest group within the Assessment Area.

There are no wetland habitats for migratory birds on state or federal lands within the Project Area. There are four acres of stream-riparian habitat that would be removed as a result of road construction and ski trail construction on federal lands.

There are no open-canopied dry forest habitats for migratory birds on state, federal or private lands in the Project Area.

Connected Actions
The proposed ski area expansion activities on private lands would reduce the amount of mesic/moist forest late successional habitat by 51 acres.

Two previously unmapped wetlands were assessed and delineated within the Project Area by qualified professional wetland biologists on private land. It was determined that the wetlands fit the Class III category. Category III wetlands are wetlands with a moderate level of functions and can often be adequately replaced with a well-planned mitigation project (Hruby 2014). The wetlands are within the Project Site and would be impacted. Per Chelan County Code (11.80.070), the Applicant will coordinate with Chelan County, WDFW and Washington Department of Ecology (11.80.110) to mitigate impacts to migratory bird species.

Cumulative Effects
There are ongoing projects, not associated with the Mission Ridge Expansion Project, on county lands and WDNR lands for forest thinning and fuel reduction treatments that could reduce mesic/moist forest late successional habitat for migratory birds by 489 acres. The cumulative effects of the activities across all land ownerships would reduce the amount of mesic/moist forest late successional habitat by 627 acres (15%) within the Assessment Area. However, dry forest restoration treatments have been shown to have positive effects on many migratory bird species (Gaines et al. 2007, 2010) and these treatments would increase the availability of habitat for migratory bird species associated with open-canopied dry forests by 489 acres (10%) in the Assessment Area.

Summary of Effects
Based on the direct, indirect, and cumulative effects associated with the proposed Mission Ridge Expansion, the project would not result in the intentional or unintentional take of migratory birds. The project is consistent with management direction for migratory birds (FR 66(11): 3853-3856).

Forest Plan Consistency
There are no known conflicts between the alternatives discussed in this document and the Forest Plan. The Proposed Action BMPs, design criteria and mitigation measures were designed so the project would be consistent with the Forest Plan, as amended, as well as all recovery plans for listed species, at the Project Area and Assessment Area scales. In particular, timing restrictions would be employed as needed to mitigate impacts to elk and spotted owls.

3.4 Specifically Required Disclosures
There are no prime farmlands, rangelands, forestlands, or floodplains in the Project Area. There would be no potential or unusual expenditures of energy, conflicts with plans, policies or other jurisdictions. Public scoping did not identify any potential disproportionately high or adverse effects to consumers, civil rights, minority groups or women.

Chapter 4: Consultation and Coordination

Contracted Interdisciplinary Team to Develop Environmental Assessment for the Forest Service

Andrea Lyons – Team Leader
Bill Gaines– Wildlife Biologist
Sherrie Duncan – Fish Biologist/Hydrologist
James Begley – GIS Specialist
Robert Stoehr – Recreation Specialist, NEPA Specialist
Richy Harrod – Fire Ecologist, Fuels
Allison Rossman – Botany, Soils, Invasive Species
Sherrie Farmer – Writer/Editor

U.S. Forest Service District/Supervisors Office Interdisciplinary Team

Kristen Bail – Forest Supervisor
Jeffrey Rivera – District Ranger
Mason Schuur – Team Lead/Project Coordinator/Recreation
Les Moscoso- Recreation
Paul Kelley – NEPA Coordinator
Pete Wier, Michelle Satterfield – Silviculture
Don Youkey – Wildlife Biologist
Kathy McMillan – Fish Biologist
Matt Karrer – Hydrologist
Barbara Jackson – Forest Landscape Architect/Scenery Specialist
Pete Cadena – Forest Archaeologist
Lauri Malmquist, Brigitte Ranne – Botanist, Invasive Species
Michael Barajas – Fuels and Fire
Dennis Valdez– Contracting and Logging Systems
Debbie Kelly, Robin Demario – Public Affairs

The following tribal governments, agencies, and organizations were consulted and/or participated during project planning and analysis:

Yakama Nation
Confederated Tribes of the Colville Reservation
U.S. Fish and Wildlife Service, Wenatchee Office
Washington State Office of Historic Protection, Olympia Office
Washington Department of Fish and Wildlife, Ephrata Office and Wenatchee Office
Washington Department of Natural Resources, Ellensburg Office
Department of Ecology, Yakima Office
Chelan County, Department of Natural Resources
U.S. Department of Agriculture - Rural Development

Appendix A. Mission Ridge Expansion Project: Specifications for proposed alpine ski trails.

Trail	Vertical (feet)	Slope length (feet)	Average width (feet)	Acres	Average grade %	Ability Level
6A	300	2,008	72	3.30	15%	Begin.
6B	430	2,247	97	5.00	20%	Int.
6C	305	1,560	62	2.23	20%	Int.
6D	535	3,151	71	5.11	17%	Int.
6E	375	2,069	57	2.68	19%	Int.
7A	620	3,486	96	7.66	17%	Beg.
7B	210	592	135	1.84	38%	Int.
7C	480	1,537	124	4.38	33%	Int.
7D	325	1,042	135	3.22	33%	Int.
7E	370	2,517	80	4.64	15%	Beg.
7F	200	1,197	111	3.05	17%	Beg.
7G	380	4,150	28	2.7	11%	Beg
8A	410	3,102	97	6.88	13%	Beg.
8B	285	2,546	42	2.48	11%	Beg.
Magic Carpet	20	206	127	0.6	10%	Beg.
Platter Pull	60	504	98	1.14	12%	Beg.
Skiway 1	505	4,737	39	3.59	11%	Beg.
Skiway 2	140	1,412	61	1.97	10%	Beg.
Total	5,950	38,062		62		

7 Designated Glades Totals: 2,525 Vertical Feet/ 9,685 Slope length feet/ 17.7 acres

APPENDIX A-1 – Existing Alpine Ski Trails

Trail	Vertical (feet)	Slope length (feet)	Average width (feet)	Acres	Average grade %	Ability Level
Mimi	550	3,400	150	12	16%	Begin.
Tumwater	1,200	4,500	175	19	26%	Int.
Kiwa	1,000	4,100	100	9	24%	Int.
Toketie	900	3,100	125	9	29%	Int.
Skookum	1,250	4,500	100	10	28%	Int.
Katsuk	600	2,500	150	8	24%	Int.
Bomber Bowl	1,050	5,000	175	20	21%	Int.
Nastar	300	1,200	110	3	25%	Int.
Elip	500	1,890	100	4	26%	Int.
Ka-Wham	700	3,100	80	6	22%	Int.
Sitkum	1,100	5,000	105	12	22%	Int.
Chak-Chak	1,100	4,500	105	11	24%	Int.
Wounded Knee	200	500	105	1	26%	Int.
Upper Castle	425	2,500	90	5	17%	Int.
Bomber Cut-Off	150	1,200	40	1	12%	Int.
Toketie Spur	300	1,200	110	3	25%	Int.
Hyak	600	2,000	175	8	30%	Int.
Hyak West	200	600	150	2	33%	Int.
Tyee	300	1,000	125	3	30%	Int.
Lip-Lip	1,000	6,200	125	18	16%	Int.
Lip-Lip East	150	500	100	1	30%	Int.
Tillicum	900	3,200	110	8	28%	Int.
Mimi Bypass	450	3,000	25	2	15%	Int.
Maggi	300	2,500	40	2	12%	Int.
Alah	350	800	90	1.5	43%	Adv.
Lemolo	400	900	150	3	44%	Adv.
Castle Main	700	2,500	150	9	28%	Adv.
Upper Skookum	750	1,500	100	3	50%	Adv.
Upper Toketie	200	400	130	1	50%	Adv.
Wa-Wa	750	2,100	75	3	36%	Adv.
Lip-Lip Face	450	900	200	4	50%	Adv.
Johnson's	250	500	50	0.5	50%	Adv.
Bomber Chutes	500	900	100	2	55%	Adv.
Total	19,575	77,690		204		

Appendix B. Design Criteria, Mitigation Measures and Best Management Practices incorporated into the Mission Ridge Expansion Project.

Mitigation is a planning action taken to avoid an impact, minimize the degree or magnitude of the impact, reduce the impact over time, rectify the impact, or compensate for the impact (40 CFR 1508.20). Some mitigation may be required for compliance with laws, regulations, policies, or Forest Plans. When mitigation measures are part of a decision, those measures must be implemented (40 CFR 1505.3).

Best Management Practices (BMPs) for water quality are methods, measures, or practices to meet nonpoint source control needs. BMPs include, but are not limited to, structural and nonstructural controls, and operation and maintenance procedures. BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters (36 CFR 219.19).

Under the Wenatchee National Forest Land and Resource Management Plan, use of BMPs is a Forest Plan standard to protect water quality. The standard states: Comply with state requirement for protection of waters through planning, application, and monitoring of BMPs in conformance with the Clean Water Act, regulations, and federal guidance issues thereto (Forest Plan pages IV 94---95). BMPs are also listed for invasive plants and scenery.

In response to public comments and Forest Service concerns, design criteria, mitigation measures, and best management practices were applied to address potential impacts the Proposed Action may cause within the existing and expanded Special Use Permit area and adjacent lands.

Some of these mitigation measures mitigate for multiple resources; for instance, native plants would be used in restoration of both riparian (Aquatics) and upland (Botany) sites. All design criteria, mitigation measures, and BMPs apply during implementation, so it would be important for implementers to review and apply design features for all resources.

Monitoring

Monitoring during construction activities would be conducted by the Forest Service on National Forest and WDFW land. After construction, on-going monitoring of re-vegetation efforts and whitebark pine mitigation planting would be the responsibility of Mission Ridge, with brief annual reports submitted to the Forest Service. Monitoring responsibility could be shifted to other parties with approval from the Forest Service. Unless otherwise specified, on-going monitoring would be conducted once a year for five years after project completion.

Aquatics

1) Provide and maintain necessary stormwater and erosion control facilities to comply with applicable stormwater and erosion control regulations and to maintain access routes for this action.
2) Promptly install and appropriately maintain erosion and stormwater control measures prior to construction, particularly around sites where significant levels of erosion may enter the aquatic habitats directly or through road ditches. Suitable erosion control measures that stabilize disturbed areas and waterways would be installed prior to seasonal shutdown of project operations or when severe or successive storms are expected. Temporary erosion controls would be removed only after the site has been stabilized following construction activities.
3) Monitoring would include inspection of disturbed areas to verify that erosion and stormwater controls are implemented and functioning as designed and are suitably maintained.

4) Conduct operations during seasonally dry periods. Construction would be accomplished when moisture and soil conditions are not likely to result in excessive erosion and/or soil movement. Minimize disturbance footprint to the extent possible.
5) Cease construction work during heavy rains and wait to resume until conditions are suitable for the movement of equipment and materials.
6) Keep excavated materials and sidecast materials (soil/sediment) out of riparian habitat: 150 feet each side of stream channels.
7) Avoid sensitive areas, such as riparian areas, wetlands, stream crossings, inner gorges and unstable areas to the extent practicable. When sensitive sites cannot be avoided, coordinate with the District hydrologist or fisheries biologist and botanist to develop site-specific remediation measures for ground disturbance.
8) Avoid or minimize bank and riparian area excavation during construction to the extent practicable and minimize damage to existing vegetation, especially plants that are stabilizing the bank of the water-body. Trees cut in riparian reserves would be left on-site.
9) Consider growing season and dormant season for vegetation when scheduling activities within or near the water-body to minimize the period of time that the land would remain exposed, thereby reducing erosion risks.
10) Ensure all equipment operated in or adjacent to water-bodies is clean of aquatic invasive species, as well as oil and grease, and is well maintained.
11) Store, refuel and service equipment only in designated staging areas, outside of riparian reserves.
12) Inspect equipment daily for leaks. Promptly install and appropriately maintain spill prevention and containment measures.
13) Thoroughly clean equipment before operation below ordinary high water or within 50 feet of any natural water body or areas that drain directly to streams or wetlands and as often as necessary during operation to remain grease free.
14) Minimize sediment delivery to the Squilchuck Creek drainage during construction. Restrict sidecasting as necessary to prevent the introduction of sediment into the stream channel.
15) Reseed/replant disturbed areas in riparian habitat with native plants to help accelerate riparian recovery and minimize erosion. If planting of nursery-grown materials is anticipated for meeting recovery and erosion objectives, prior to disturbance, create an implementation plan in collaboration with Forest Service botanist to ensure native plant materials are available in a timely manner.

Additional Provisions from USFS and WDFW MOU NFS 17-MU-11062754-049:

Stream Crossings

16) Conduct work below the ordinary high water mark (OHWM) during in-water work windows.
17) Employ all erosion and pollution control BMPs required in the MOU and permits.
18) Minimize the disturbance to the bed and bank of the stream, using native materials wherever possible.
19) Design the stream crossing structure to have sufficient capacity to convey the design flow without appreciably altering streamflow characteristics.
20) Provide passage for aquatic organisms migrating in the stream at that time.
21) Install stream crossing structures at right angles to the stream channel when possible.
22) Minimize channel changes and the amount of excavation or fill needed at the crossing.

23) Limit construction activity to periods of low or normal flow.

24) Keep use of equipment in the stream to a minimum.

25) Anchor temporary structures so they do not float away during high water.

26) Use soil stabilization practices on exposed soil at stream crossings. Maintain these practices until the soil is permanently stabilized.

27) Divert road drainage into undisturbed vegetation outside of the Riparian Management Zone (RMZ) so that drainage does not directly enter the stream.

28) Construct bridges higher than the road approach to prevent surface road runoff from draining onto the crossing structure and into the stream.

Permanent Culvert Installation in Non-Fish Bearing Streams

29) Culverts shall be designed, installed and maintained to accommodate the 100-year peak flow with consideration of the sediment load and wood likely to be encountered.

30) Culverts shall be designed, installed and maintained to avoid negative channel changes such as inlet scouring or erosion of the streambed or banks downstream of the project.

31) The crossing structure shall consist of a single culvert.

32) Every effort shall be made to avoid stream crossings with heavy equipment. A single round-trip equipment crossing of the stream channel shall be allowed, if necessary.

33) Construction sites shall be dewatered or isolated from flowing waters to prevent delivery of sediment to watercourses.

Permanent Bridge Installation and Replacement in Non Fish Bearing Streams

34) Bridges shall be designed, installed and maintained to accommodate the 100-year peak flow with consideration of the sediment load and wood likely to be encountered.

35) Bridges shall be designed, installed and maintained to avoid causing negative floodplain or channel effects such as scouring or erosion of the streambed or banks.

36) No abutments or riprap shall be placed within the bankfull channel.

37) Construction sites shall be dewatered or isolated from flowing waters to prevent delivery of sediment to watercourses.

38) Every effort shall be made to avoid stream crossings with heavy equipment. A single round-trip equipment crossing of the stream channel shall be allowed, if necessary.

39) Bridges shall be designed to account for the lateral migration expected to occur during the bridge's lifespan.

Botany

Design features were generated for this specific project or adopted from “Ski Area BMPs” by the U.S. Forest Service (2001).

1) Continue to pursue certification as a Whitebark Pine Friendly Ski Area with the Whitebark Pine Ecosystem Foundation. Aim to achieve full certification within fifteen years. Interpretive signing would be erected on site for public education.

Tree and vegetation removal and whitebark pine planting

2) Prior to any project construction, mark all whitebark pine trees, saplings, and seedlings within 50 ft of planned disturbance in an obvious manner, so that they are not inadvertently damaged. Where at all possible, avoid cutting whitebark pine trees.

3) For every whitebark pine stem that is cut, plant whitebark seedlings at the rates in the following table. Follow guidelines in “Whitebark Pine Planting Guidelines” (McCaughey et al. 2009), available in the project record. Grow seedlings from seed collected in the Project Area or from the adjacent population on the plateau above the existing ski area. Plant in or adjacent to the Mission Ridge ski area, if suitable habitat can be found. Monitor planted seedlings for five years; if survivorship falls below 25% in this time period, plant additional seedlings at 25% the original rate.

Stem type	Stem size (DBH = diameter at breast height)	Outplanted mitigation seedlings per stem
Seedling	< 4.5' in height	5
Sapling	> 4.5' in height and < 3" DBH	10
Tree	3 - 7.9" DBH	50
Large tree	> 8" DBH	100

4) Educate maintenance personnel and operators of snow-grooming equipment on identification of whitebark pine and encourage them to avoid damaging whitebark pine and large trees left in alpine ski runs.

5) Erect temporary rope or fence and/or signage around whitebark pine trees remaining in alpine ski runs to discourage damage from snow grooming equipment, skiers, and snowboarders.

6) If other rare plants (threatened, endangered, Region 6 Sensitive, or Survey and Manage taxa) are found during project implementation, stop nearby work and map population extent in collaboration with Forest Service botanist. Following mapping, protect by avoiding disturbance within 50 feet of population.

7) Where possible, avoid cutting any tree larger than 20” in diameter at breast height, and especially those larger than 25”. Trees greater than 20” dbh would not be cut in gladed areas. Large trees may be cut for safety. If large trees are cut, boles would be left on-site (may be moved from cutting location for project purposes.)

8) Use chainsaws for felling trees. Operate heavy equipment for bole removal over sufficiently frozen soil or over snow, as specified in Soil Design Feature #29.

9) No glading activities (removal, thinning, or trimming of vegetation) would occur in the wetland area located on National Forest in the far southeast corner of Section 24.

10) Minimize vegetation removal and ground disturbance in all activities to no more than needed, to the extent practical and consistent with project objectives.

11) Do not pile debris or conduct burning on top of traditional plants of concern.

12) Follow all soil resource design features and BMPs to minimize soil disturbance and erosion (Appendix B, Soil Resources, Design Features 1-54).

Wetland and riparian protection

13) No contouring, construction, or fill shall occur in or within 50 feet of the wetland area near the center of the Project Area.

14) Vegetation removal for gladed runs shall occur at least 25 feet, and preferably 50 feet, away from the edge of the wetland area.

15) To discourage off-run skiing through the wetland area, a temporary rope or fence and signage prohibiting skiing would be erected above and around the area every season.

Re-vegetation of disturbed areas

16) Revegetate contoured ski runs, chairlift lines and towers, areas disturbed by installation of underground water piping and electrical conduit, temporary ("pioneer") roads, and other disturbed areas as appropriate.

17) Re-vegetate disturbed areas before seasonally moist periods by seeding and mulching before major precipitation events. If over-wintering of exposed soil is required, follow Soil Resources Design Feature 47 to have a contingency plan to protect soils from erosion over the winter.

18) Salvage and re-instate topsoil on contoured ski runs and chairlift tower installation areas in accordance with Soil Resources Design Features 18a-f.

19) For all re-vegetation, plant or seed with native species. The native seeds should be locally sourced and a genetically appropriate mix. Prior to the start of ground disturbance, contact seed source and plan for re-vegetation needs to ensure supply is sufficient and timely.

20) Only use seed mixes that are certified as being weed-free. There are plant species not on State and Federal noxious weed lists that the Forest Service would consider non-native invasive weeds. Check State and Federal lists to see if any local weeds need to be added prior to testing. Seed lots labeled as certified weed free at time of sale may still contain some weed seed contamination. Non-certified seed should first be tested before use.

21) Follow recommendations specific to the seed mix for application and maintenance.

22) Apply seed in late autumn to take advantage of snowmelt and rainfall the following spring. If fertilizer is needed, mix with seed and apply at the same time.

23) Aim to achieve establishment of 40 plants per square foot, so apply seeds at a rate of 100-200 per square foot.

24) Select seeding method based on terrain and accessibility. Large and accessible areas can be hydraulic seeded, gentle or moderate slopes can use equipment mounted on ATVs, and steep or inaccessible areas can be hand-seeded.

25) Completely cover seed with a thin layer of soil and follow by tracking or scarification (a snow cat can be used).

26) Cover these freshly seeded areas with a mulch product. If loose straw mulch is selected, it must be 4-6 inches thick (2.5 tons per acre) and "punched" or tracked into the ground with bull dozer tracks or snow cat cleats. On rocky or dry soils, straw mulch must be secured with either netting or chemical tackifiers. Blanket mulch may install quicker and last longer; they must be stabled firmly and in close contact with the underlying soil surface.

    a. Use only certified weed-free mulch materials. Certification can be by the State, North American Weed Free Forage Program standards or a similar certification process.

27) During re-vegetation activities, monitor seeding coverage to fine-tune seed mixes and determine if supplemental seeding is needed.

28) To enhance seedling establishment, additional fertilizer can be applied during the spring following initial seeding. Phosphorous fertilizer can be especially helpful in promoting deep root systems that help plants survive hot summer conditions.

29) Monitor reseeded areas in summer months for five years following construction. Apply supplemental seeding if seedling establishment is poor.

Cultural Resources

1) Cultural Resources surveys have been completed for the site and the Final Report has been filed with OWNF. In the event that cultural resources or human remains are discovered during project

implementation, all activities in the area of the discovery would stop and a Forest Archaeologist would be notified immediately. The area would be reasonably secured and protected during inspection and evaluation by the archaeologist. If the discovery is determined to be a National Register eligible site and avoidance during project implementation is not possible, site specific mitigation would be developed by the Forest Archaeologist in consultation with the State Historic Preservation Officer (SHPO) and the Tribal Historic Preservation Officers (THPO) for the Confederate Tribes and Bands of the Yakama Nation and the Confederated Tribes of the Colville Reservation.

2) If cultural plants are identified during project implementation, consult District biologist to reduce impacts. See Botany #12.

Fuels

1) Lop and scatter slash by hand in areas where continuous fuel concentrations do not exceed one foot in fuel bed depth.
2) Create slash piles not to exceed 6 by 6 by 6 feet in size where continuous fuel concentrations exceed one foot in depth. Construct piles to have a uniform arrangement perpendicular to the contour of the slope; pile larger vegetation on top to aid in compaction and water dispersion.
3) Place piles outside the drip-line of dominant trees, on the uphill side of those trees, or in areas where the pile would not serve as a ladder fuel. Do not pile higher than 1/3 of the lowest live limbs of the tree's crown.
4) When pruning lower branches of trees for glading or fuels reduction, flush cut branches at the tree bole to minimize skinning of the bark and cambium.

Geologically Hazardous Areas

1) Construction methods should be used which minimize risks to structures and do not increase the risk to the site, or to adjacent properties and their structures, from the geologic hazard. Development shall not increase instability or create a hazard to the site or adjacent properties, or result in a significant increase in sedimentation or erosion.
2) Site planning should minimize disruption of existing topography and vegetation, and should incorporate opportunities for phased clearing.
3) Disturbed areas shall be replanted before major precipitation events, in accordance with an approved revegetation plan.
4) Impervious surface coverage shall be minimized.
5) Excavation and grading shall be minimized. A clearing and grading schedule shall consider limitations based upon seasonal weather conditions.
6) Detailed drainage plans may be required for projects affecting areas of geologic hazard. These plans shall indicate the effect the project may have on the hazard areas and adjacent properties and mitigating measures, with stormwater detention standards based upon the technical studies required under this document.
7) Construction activities in geologic hazard areas would be monitored.
8) All authorized clearing for roads, utilities, etc., should be limited to the minimum necessary to accomplish engineering design. Alternatives should meet the following requirements:

   (i) Clearing, grading or filling of sloped sites containing erosion hazard areas shall be limited by weather conditions and an approved erosion control plan.

   (ii) The face of cut and fill on slopes shall be prepared and maintained to control against erosion.

9) A temporary erosion and sedimentation control plan, showing the location and control measures intended to minimize the effects of erosion and siltation due to construction operations, would be submitted with the construction plans and would conform to the requirements of Chelan County Code, the WSDOT Standard Plans and Specifications, and Ecology's Stormwater Manual for Eastern Washington. Temporary erosion and sedimentation controls shall be utilized during construction and until a permanent control measure is achieved. Further, to minimize blowing soil during development, appropriate water and/or mulch material should be applied to any areas without a vegetative cover.

10) To maintain the natural integrity of landslide hazard areas and to protect the environment, and the public health and safety, adequate vegetation shall be maintained around all sides of the landslide hazard area.

11) Development proposals that involve altering land upon areas identified as landslide or avalanche hazard areas must demonstrate the following for approval:

    (i) There is no evidence of recent landslides or avalanches in the vicinity of the proposed development and quantitative analysis of slope stability and/or other pertinent factors indicate no significant risk to the proposed development or other properties.

    (ii) The landslide or avalanche hazard areas can be modified or the project can be designed so that the landslide or avalanche hazard to the project is decreased.

    (iii) The development proposal would cause no increase in surface water discharge, sedimentation, or avalanche hazard to other properties, and would not decrease slope stability on other properties.

    (iv) Disturbance of trees and vegetation shall be the minimum necessary in order to prevent erosion and/or an increase in avalanche hazard, to stabilize slopes, and preserve the natural character of the area.

    (v) Structures and improvements shall be located to preserve the most sensitive portion of the site and its natural landforms and vegetation.

Invasive Plant Species

Many design features and BMPs were adopted from Ledoux and Martin (2013) and "Guide to Noxious Weed Prevention Practices" by the U.S. Forest Service (2001), while others were developed specifically for this project during analysis.

Priority invasive plant species are diffuse knapweed (*Centaurea diffusa*) and Canada thistle (*Cirsium arvense*), because infestations exist in the existing ski area and are the highest risk for spread into the expansion. However, other species may be introduced with construction activities and on-going recreation and should be regularly inspected for.

Construction practices

1) Minimize vegetation removal and ground disturbance in all activities to the extent practical and consistent with project objectives.

2) Prior to ground-disturbing activities, control weeds in existing parking area and along administrative access roads.

3) Where possible, begin work in un-infested areas and move toward infested areas.

4) Locate and use weed-free project staging areas. Minimize travel through weed-infested areas. Monitor and control new weeds in staging areas.

5) Clean all heavy equipment (bulldozers, graders, backhoes, dump trucks, excavators, etc.) prior to entering National Forest or WDFW lands. Clean equipment in an appropriate site, such as a designated and contained cleaning station in the existing parking area. Contain the wash or bag and then dispose of in garbage or by incineration.

6) Whenever moving equipment or vehicles from the existing parking area into the expansion area, inspect and clean the equipment and undercarriages of vehicles for invasive plant material.

7) Inspect, remove, and properly dispose of weed seed and plant parts found by construction crews on their clothing and equipment on a daily basis.

8) When cleaning equipment and clothing, weed seeds and plant parts must be bagged and incinerated or disposed of in the garbage.

Road construction and the use of fill materials

9) Use only gravel, fill, sand, and rock that are judged to be weed free by the State, North American Weed Free Forage Program, or Forest weed specialists.

10) Inspect material sources on site, and ensure that they are weed-free before use and transport. Treat weed-infested sources for eradication, and strip and stockpile contaminated material before any use of pit material.

11) Monitoring would include inspection and documentation of the area where material from treated weed-infested sources is used, annually for at least three years after project completion, to ensure that any weeds transported to the site are promptly detected and controlled.

12) Maintain stockpiled material in a weed-free condition.

13) Promptly re-vegetate disturbed areas with native plants along roadsides, landings, and cleaned culverts. Follow re-vegetation guidance in Appendix B, Botany, Design Features 18-31.

14) Grade roads in directions that do not encourage spread of seeds away from known, priority invasive plant sites.

15) Treat weeds in road decommissioning and reclamation projects before roads are made impassable. Reinspect and follow-up based on initial inspection and documentation.

On-going weed control

16) Amend the Special Use Permit to require on-going monitoring and treatment of invasive plants by Mission Ridge in the Project Area. This can be accomplished through the development and incorporation of a supplemental clause such as the following.

    a. “The holder shall be responsible for the prevention and control of noxious weeds and/or exotic plants of concern on the area authorized by this authorization and shall provide prevention and control measures prescribed by the Forest Service. Noxious weeds and exotic plants of concern are defined as those species recognized by Chelan County and/or Okanogan-Wenatchee National Forest, in which the authorized use is located. The holder shall also be responsible for prevention and control of noxious weed and exotic plant infestations which are not within the authorized area, but which are determined by the Forest Service to have originated within the authorized area. When determined to be necessary by the authorized officer, the holder shall develop a site-specific plan for noxious weed and exotic plant prevention and control. Such plan shall be subject to Forest Service approval. Upon Forest Service approval, the noxious weed and exotic plant prevention and control plan shall become a part of this authorization, and its provisions shall be enforceable under the terms of this authorization.” (Appendix 2 of USDA Forest Service 2001).

17) Expand existing Mission Ridge Invasive Plant Prevention and Management Program to include the new facilities and ground disturbance areas on all parts of the expansion (National Forest, WDFW, and private land). Ensure the plan includes:

    b. Carry out regular detection surveys and record the locations of invasive plants in the ski area and private development.

c. Establish periodic (at least annual) inspection and control of weeds on roads, parking areas, rights-of-way, chairlift terminals, trailheads, trails, and re-vegetated areas such as contoured ski runs and temporary roads.

d. Consider high-use summer recreation areas such as the trailhead and trails as high priority for weed eradication.

e. Schedule and coordinate blading or pulling of noxious weed-infested roadsides or ditches in consultation with the local weed specialist. Do not blade or pull roadsides and ditches that are infested with noxious weeds unless doing so is required for public safety or protection of the roadway. If the ditch must be pulled, ensure the weeds remain on-site. Blade from least infested to most infested areas. When it is necessary to blade noxious weed-infested roadsides or ditches, schedule activity when seeds or propagules are least likely to be viable and to be spread. Minimize soil surface disturbance and contain bladed material on the infested site.

18) Provide information, training and appropriate weed identification materials to employees and contractors potentially involved in weed introduction, establishment, and spread. Educate them to an appropriate level in weed identification, biology, impacts, and effective prevention measures.

19) Install educational signage at the trailhead on private parcel to increase weed awareness and encourage prevention practices.

f. Encourage users to inspect and clean motorized and mechanized trail vehicles of weeds and their seeds before recreating on public lands.

g. Require equestrian, pack, and saddle stock users to use only weed-free feed and hay on trails. Encourage them to feed stock only weed-free feed for several days before travel on trails.

h. Encourage users to inspect, brush, and clean tack, equipment, and animals, especially hooves and legs, before using trails.

i. Limit motorized use to trails only. Discourage all off-trail travel.

20) At the trailhead, install devices to tie or hold stock in ways that minimize soil disturbance and avoid loss of desirable native vegetation.

21) Inspect and document all ground-disturbing operations that occurred in weed-infested areas for at least three growing seasons following completion of the project. Conduct follow-up treatments based on inspection results.

Recreation

1) Summer use of the Nordic trail system would be multi-user, non-motorized and motorized (ATVs and motorcycles) on the private land and non-motorized on the National Forest and would include stock animals, mountain bikes, and hikers. Trails may be closed in coordination with WDFW to avoid disturbance to elk during calving season and during seasonally wet periods.

2) The general public would be permitted to use the Nordic trail system in summer months at no charge.

3) Monitoring: Signing and regular patrols would encourage the public to stay on the designated Nordic trail system in all seasons. Mission Ridge and USFS personnel would periodically patrol the trail system to ensure motorized and non-motorized vehicles stayed on the designated trail system and to enforce any closures. Alpine and Nordic ski operations would be monitored periodically during the winter season by Mission Ridge and USFS employees for safety and adherence to the Operating Plan and other regulations.

4) Winter use of the Nordic trail system and snow play/tubing area would be open to the general public with a use fee.

5) Winter use of the Nordic trail system would be non-motorized and include classic and skating Nordic skis, snowshoes, and fat tire bikes.

6) During summer months, no motorized vehicles would be permitted on the alpine ski runs or maintenance roads, except for administrative use.

7) During warm weather months, no organized events or activities under the Special Use Permit would be permitted on the new ski runs or chairlifts.

8) Persons with disabilities would have reasonable access to participate in all programs and activities at the ski area such as ski instruction, food service and equipment rental/sales as well as architectural accessibility.

Scenic

Access Road and Landform/Soils Modification

1) Minimize clearing limits for construction where the access road begins at the existing Mission Ridge Base Area.

2) Roads would be aligned and constructed to visually blend into the surrounding landscape. Road grades would be adjusted as feasible to reduce cut slopes. Efforts to minimize cut slopes would be done.

3) If there are large rock cut slopes, blend rock sculpting with natural rock slopes. To reduce visual contrast the color of rock cut slopes would be treated with Natina (or other coloring treatment) where they are seen from key viewpoints. https://www.natinaproducts.com

4) If guardrails are required, Natina (or other coloring treatment) would be used.

5) Retaining walls, bin or gabion baskets would use earth toned rocks that match the existing rock forms and would be treated with Natina (or other coloring treatment) to blend in where they are visible from key viewpoints.

6) Bridge design would appear rustic and would be subordinate in the landscape through use of materials, earth toned colors and scale.

Ski Facilities

7) Non-reflective paint would be used on lift towers, lift terminal buildings and all outbuildings.

8) Downcast lighting would be utilized as appropriate.

9) Chairlift terminal structures would be designed in the Cascadian style.

Vegetation Modification

10) Maintain the forested landscape character along edges of the proposed road as much as feasible, especially on the downhill side to provide screening of the road cut slopes.

11) Install tree wells to save large trees along new construction roads. Bin walls and textured retaining walls could be terraced to plant large trees to provide screening from key viewpoints.

12) Seed with local native species and use certified weed-free mulch on all disturbed cut and fill slopes to avoid surface erosion, ensure good re-vegetation, and reduce scenic impact. Utilize innovative bio-engineering techniques to increase success of vegetation growth and reduce erosion.

13) Cut stumps low to the ground (<6”) in immediate foreground (200’) of road or seen area.

14) To avoid a dominating contrast from vegetation clearing limits for access roads and ski runs, use undulating clearing limits and feather edges. Retain a variety of vegetation heights in clearing limits to blend in linear clearing limits.

15) Trees that are pulled up with intact root wads would be removed as identified by District personnel. The resulting holes would be filled flush with the surrounding ground and be seeded and mulched to avoid surface erosion and ensure good re-vegetation, or be filled as needed to accommodate road construction.

16) Remove slash from along the road-clearing limits. Locate slash piles out of seen area from Mission Ridge Lodge and ski runs.

17) Leave vegetation to screen the modified landscape character viewed from Mission Ridge Road and other key viewpoints (Hampton Lodge, Wenatchee Valley).

18) Persons with disabilities would have an equal opportunity to participate in all programs and activities at the ski area such as ski instruction, food service, and equipment sales and rental.

Soil Resources

Design features and BMPs were compiled from several sources, including “Ski Area BMPs” by the U.S. Forest Service (USFS 2001b) and “Prevention of soil compaction and rutting” by Sutherland (2003). For more information, reference to these resources is recommended.

Construction of utilities, buildings, and chairlifts

1) Use subsoil from nearby excavation for buildings, terminals, or the reservoir as fill for access roads or for coarse ski run grooming.

2) Locate temporary access roads and landings in previously disturbed areas wherever possible.

3) Pre-construct utilities (electrical, sewer, and water lines) along roads and lift corridors during the same construction season.

4) Locate utility lines under existing roads, previously disturbed areas, or areas otherwise planned for disturbance. For example, place water lines and electrical conduit under ski runs, not adjacent to them. Place co-locatable utilities in the same trench/corridor at the same time when feasible.

5) Install strawbale or sediment barriers around disturbed areas, particularly between foundation excavations and stockpiles, and nearby streams and wetlands.

6) When installing chairlift towers, salvage and stockpile topsoil following guidance in the following Soil Resource Design Features 18a-f. Reinstate and revegetate after each tower is installed.

Construction of permanent and temporary roads

7) Promptly install erosion-control measures (e.g., water bars) on the unsurfaced mountain access road servicing the top of Chairs 6 and 7.

8) Locate and design pioneer roads for chairlift construction in such a way as to minimize the scale of reclamation efforts, such as using a narrower, steeper trail instead of a higher standard road. If feasible, use crawler tractors instead of regular truck tractors because they can pull heavier loads up steeper graded temporary trails.

9) For temporary pioneer roads, salvage topsoil and stockpile salvage and stockpile topsoil following guidance in the following Soil Resource Design Features 18a-f. Reinstate and revegetate during road decommissioning.

10) Restore pioneer road prisms to the original ground slope and geometry by pulling fill slopes back against cut slopes.

11) Overly steep slopes are extremely difficult to revegetate. To enhance revegetation, avoid construction road cut / fill slopes at steeper gradients than 2:1.

12) Reduce road corridor widths by building vertical cut slopes and stabilizing with rock retaining walls.

13) Reuse stumps and slash from road clearing as temporary sediment filter windrow barriers at the base of road fill slopes and wherever a road approaches streams or wetlands.

14) Maintain all roads and trails so that runoff water drains readily and frequently off the surface, as desired for erosion objectives.

15) Facilitate design-level geotechnical analysis of construction of the access road to the private parcel, and follow all recommendations to minimize soil erosion and the potential for mass wasting.

16) Follow all recommendations provided in the SEPA Geologic Hazard Report by GN Northern, Inc. (SEPA Appendix F), including:

    a. Perform additional site-specific exploration and analyses to assess the actual stability of site slopes and ancient slide failure surfaces. Stability analyses of the slopes shall include an assessment of the potential risk from seismically induced slope failures.

    b. To mitigate the risk of rockfall debris, remedial efforts such as scaling of precarious areas during site grading, as well as delineation of appropriate setback (determined from a design-level analysis) should be implemented.

    c. Incorporate preventative measures to control runoff and reduce erosion into future site grading plans. Drainage design should direct stormwater runoff away from the identified slide mass, particularly along the upper surface of the various slump blocks and upper interface.

    d. Use remedial site grading, as recommended within a design-level geotechnical analysis, to develop appropriate cut/fill slopes and provide uniform competent support for future structures and infrastructure improvements.

    e. Protect all slope faces with appropriate erosion measures and BMPs to ensure long-term surficial stability.

    f. Incorporate slope set-backs for future structures and development into the final project planning and design, as recommended by design-level geotechnical analysis.

Construction and maintenance of ski runs and gladed zones

17) Minimize area subject to contouring or other soil disturbance. Favor clearing rather than contouring for ski runs whenever possible.

18) Prior to contouring and other activities as appropriate, salvage topsoil (organic and A horizons) and stockpile conveniently. Following contouring and/or blading, reinstate topsoil onto areas contoured. Measure depth of the reinstated organic layer and ensure it is at least 80% of the depth of the organic layer of the same soil type measured prior to development (reported in Chapter 3 of the EA).

    a. When working in rocky areas, maximize the amount of topsoil salvaged by separating topsoil from rocks; a screened trackhoe bucket or other sieve device can be helpful.

    b. For ease of reapplication, stockpile topsoils at the top of steep slopes.

    c. Protect reapplied topsoil, which is extremely vulnerable to wind and water erosion, with BMPs such as caterpillar track surface roughening, cross slope waterbars, and surface mulch blankets.

Map Unit Symbol	Depth of O horizon (inches): mean (range)
LoF	1.3 (0 – 2.5)
211	2.3 (1.25 – 4.0)
StE	1.3 (0.25 – 3.0)
47	0.4 (0 – 1.0)

d. Avoid traversing topsoil with construction equipment (other than for purposes intended for topsoil protection and re-vegetation).

e. If stored over the winter, topsoil stockpiles should be terraced and seeded with native seeds to reduce erosion losses, and then surrounded with sediment control measures such as berms, silt fencing, or straw bale dikes.

19) Following soil contouring, promptly plant or seed contoured areas with native species, preferably before heavy rainfall. Follow re-vegetation guidelines in Appendix B, Botany, Design Features 18-31.

20) When coarse grooming depression areas, fill with subsoil from nearby excavations.

21) Schedule and locate snow making water pipeline and electrical conduit to coincide with or follow ski run construction and placement. Bury utilities directly under planned ski runs where possible so that no additional area is disturbed.

22) Install sediment fence barriers and cross slope water bars to minimize soil erosion during ski run construction.

23) Monitoring would include patrol and maintenance of control measures early and often during the first snowmelt period following construction.

24) In gladed zones, remove coarse woody debris and trim, thin, and remove vegetation only in the lines selected for glading.

25) In gladed zones, maintain connected canopy cover over the top of gladed lines where feasible so that litter and woody debris input is maintained.

26) When initially clearing vegetation, leave root mass and other coarse woody debris as ground cover to reduce erosion.

27) Use hand tools such as chainsaws for felling of trees.

28) If heavy equipment is required for timber removal and yarding, operate only over sufficiently frozen soils or very deep snow to reduce soil compaction and disturbance. Follow guidance from Sutherland (2003) to minimize compaction and rutting. These BMPs include but are not limited to:

f. Ensure mineral soil (layers below the organic horizon) is frozen at least 15 cm deep for normal operations. Removing snow can encourage frost penetration into the soil. Alternatively, operate equipment over wet/compressible snow >60 cm deep, and frozen/crusty snow >40 cm deep (though this snow depth is unlikely in the dense forests at Mission Ridge). If soil is frozen less than 15 cm, consult with supervisor for options to avoid compaction and rutting.

g. Use a frost probe to test depth of frozen soil.

h. Choose equipment that would minimize soil compaction and rutting while achieving project objectives and budget.

i. Use designated skid tracks.

29) When piling fuels for burning, do not allow piles that include wood over 10” diameter to cover more than 30% of the area in a ski run or gladed line. Burning of these piles can adversely affect soil productivity. Scatter debris to decay in the forest if fuel piles exceed these levels.

30) Do not use any additives (e.g., chemicals) in artificial snow making.

Construction and maintenance of erosion-control measures

31) Cross-slope waterbars should be the first choice for the control of hill slope runoff and erosion.

32) Properly draining waterbars would be self-cleaning of sediment.

33) Begin waterbars at a 3 to 5 percent gradient and increase to a finished gradient of 5 to 7 percent.

34) On steeper slopes, frequent small waterbars work better than a few large ones.

35) Monitoring would include inspection and repair of waterbars during spring snowmelt, including cleaning of sediment following large rainstorms.

36) Carry the waterbar well off bare soil slopes into adjacent vegetation.

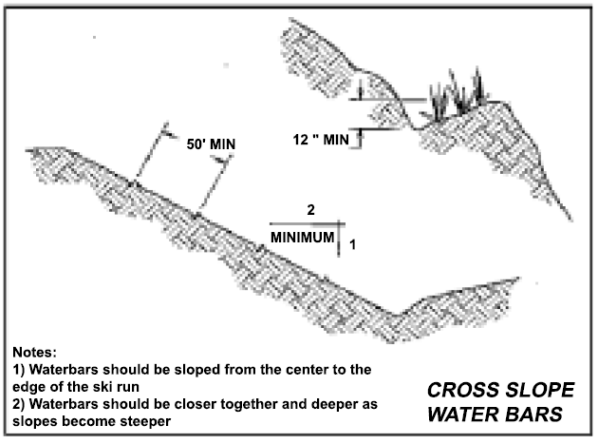
37) To prevent low spots, waterbars should be built with a slight curve.

38) Waterbars should be sloped from the center to the edge of the ski run.

39) Waterbars should be closer together and deeper as slopes become steeper. Spacing should range from 200 feet on flatter mountain roads to less than 50 feet on the steepest ski slopes.

40) Do not allow water to channelize on slopes where erosion control measures are being implemented.

41) Consider creating a detention basin beneath the unsurfaced mountain access road to collect fine sediment before it runs into streams.



Reclamation of ski runs, chairlift lines, and temporary roads

42) Start and finish all construction projects in one summer construction season, when feasible. If project completion is delayed by weather or equipment failure until the next construction season, have contingency plans for temporary erosion control over the winter.

43) To reduce erosion, revegetate disturbed areas before seasonally wet periods according to guidelines in Appendix B, Botany, Design Features 18-31.

44) Complete ski run construction and terrain modification project prior to or coincident with placing utility and snowmaking lines in them.

45) Delay entering previously-disturbed areas with vehicles until vegetation has completely recovered.

46) Cover freshly seeded areas with a certified weed-free mulch product to prevent erosion. If loose straw mulch is selected, it must be 4-6 inches thick and “punched” or tracked into the ground with bulldozer tracks or snow cat cleats. On rocky or dry soils, straw mulch must be secured with either netting or chemical tackifiers. Blanket mulch may install quicker and last longer; they must be stabled firmly and in close contact with the underlying soil surface.

Monitoring

47) During construction, Forest Service personnel would be on-site to monitor activities and to help ensure design features are followed.

48) Following construction, Mission Ridge is responsible for on-going monitoring and maintenance of erosion control features on all parts of the Project Area. Inspection should occur at least annually and in the summer months, prior to major precipitation events. Promptly maintain control features to ensure full function.

Wildlife

1) Protect all known listed Threatened, Endangered, and Sensitive species sites, and those discovered prior to or during implementation of project activities. Modify implementation activities, if protective

measures prove inadequate, listed species are discovered, or new species are listed that could be affected.

2) Operation of heavy equipment and chainsaws within 1⁄4 mile of active spotted owl nests or unsurveyed nesting or roosting habitat would be seasonally restricted between March 1 and July 31, unless field surveys indicate that birds are not nesting.

3) If an active wolf den or rendezvous site is discovered in the vicinity of the project, modify activities to avoid disturbance while being used during the breeding season.

4) In order to avoid disturbances and impacts to elk during calving season and seasonal migration, coordinate with WDFW to implement timing restrictions as needed.

5) Because large and old trees are limited in this area, leave trees and snags greater than 20 inches DBH whenever possible. If they are cut, leave logs on-site.

6) Incorporate sanitation measures to reduce potential for wildlife-human conflicts during construction and as part of community operations.

Appendix C. Existing Mission Ridge Vegetation Management Program (provided by Mission Ridge)

MISSION RIDGE Vegetation plan is grouped into three major categories:

1. Wildlife considerations
2. Maintenance Activities
3. Vegetation management (including fuels reduction, special forest products program, prescribed fire, and noxious weed management)

Activities Covered -

Activities to take place in the Special Use Permit (SUP) only.

- Run mowing, planting, sign placement, toilet pumping, road maintenance, trash collection, relocation/removal of fallen trees and limbs, painting/refinishing buildings
- Repair of minor water damage to slopes and roads.
- Repair and maintenance of facilities and structures and trails within original footprint.

Activities Not Covered -

- Any in-channel, bank or stream channel stabilization work other than planting vegetation or work that is associated with stream channel crossings are not covered in this plan.
- Construction of new facilities are not covered by this plan.
- Upgrades beyond the minimum necessary to avoid human health and safety concerns or those needed to prevent further resource damage are also not covered by this plan.

1. Wildlife

Mission Ridge follows the recommendations made by the U.S. Forest Service in the 2013 Programmatic Biological Assessment regarding the habitat concerning: gray wolf, deer and elk, wolverine, grizzly bear, Canada lynx, and Northern Spotted Owl. (see 2013 programmatic biological assessment for definitions)

2. Maintenance Activities

All activities within this program occur within an existing developed site as defined in this document. This activity includes many less frequent maintenance activities such replacement or reconstruction of facilities within the existing footprint of the facility.

For coverage under this assessment, proposed replacement of facilities in Riparian Reserves must move the site toward consistency with the ACS based upon site conditions and findings of the most recent watershed BA for the area; or be necessary to address immediate human health and safety issues.

Activities may entail use of power tools, chainsaws, augers, and/or heavy equipment. Resulting noise lasts for a few hours to a few days, and may be above normal ambient levels. Replacement or reconstruction of existing facilities is ongoing and is likely to occur year round. The duration of these activities varies greatly, from less than a day to several days.

New construction of viewing platforms, installation of benches or signs along established roads or trails, or construction of kiosks within the existing boundaries of developed SUP may also occur provided Conservation Measures are followed.

3. Vegetation Management Program

The vegetative structure and composition of the Mission Ridge SUP site is managed to be within the specific resource objective outlined by the Wenatchee National Forest guidelines. Management practices, such as restoring or protecting habitat for a particular wildlife species or species group (i.e. deer, elk, and bighorn sheep winter' range), controlling noxious weeds, reducing fuel loads, or enhancing the growth of one type of vegetation over another. This may involve practices such as thinning, pruning lower tree limbs from conifers, fertilizing, or removing competing brush in conifer stands to reduce competition. Vegetation may be managed for increasing stand diversity for ecosystem health, accelerating the development of mature trees and/or late successional forest habitat, reducing erosion, changing visual character of stands, and restoring landscapes to historical conditions less susceptible to severe fire. Vegetation management activities such as thinning, pruning and use of prescribed fire are expected to increase in response to forest health, habitat restoration, and fuels management issues.

Vegetation management is conducted using manual methods, mechanical methods, and/or prescribed fire. Manual methods are defined as techniques that are accomplished or applied with hand-held equipment that may be motorized. Examples include hand pulling undesired vegetation, use of hand tools, such as loppers, brush axes, and shovels, and motorized power tools, such as chainsaws. Manual methods do not usually result in exposed soils so the primary potential impact is to shade, horizontal and overhead cover and possibly bank stability. Some noise disturbance may occur as well. Mechanical methods are defined as techniques that are accomplished with the use of motorized machinery that is not hand-held. Examples include tractors, chippers, mowers, and excavators with a “forestry” head (to thin conifer stands). These methods have greater potential for ground and noise disturbance.

The Vegetation Management Program is divided into three categories:

1. Thinning and Fuels Reduction treatments (including prescribed fire)
2. Danger and Hazard Tree Felling
3. Plant Prevention and Management

1. Thinning and Fuels Reduction Activities

A. Pre-commercial Thinning

For the purposes of this plan, pre-commercial thinning is defined as the selective felling and/or removal of trees with a DBH generally <8 inches with no yarding of the material other than that material which can be removed from an existing road. Limbing of trees can be up to 18’. Deciduous tree stands should be removed as time permits. Pre-commercial thinning is conducted primarily with manual methods.

The objectives of thinning are to:

- Control the density and composition of immature stands.
- Maintain or improve growth rates on selected trees to achieve larger size (height and diameter) earlier than would be possible without treatment.
- Restore structure and composition to more sustainable conditions.
- Assist in achieving the objectives of non-timber resource management (FSH 2409.26c).
- Restore dry forest habitats.
- Create conditions for safe and effective use of prescribed fire.
- Create conditions that are less susceptible to catastrophic wildfire.
- Reduce fuels around privately owned structures and outbuildings.

Thinning often occurs in conjunction with fuels profile modification, primarily within dry forest types. Removal of ladder fuels (i.e. removing limbs) is included in the description of thinning activities. Thinned

material may be "lop-and-scattered" or left as is on site, removed from the site, chipped, or burned in prescribed fire. Thinned material may also be hand-piled and burned. Yarding is not considered in this the analysis unless the material can be accessed from an existing, open road. Some thinning may occur over snow to not disturb the soil.

B. Pile Burning

Often the debris resulting from vegetation management activities is piled and burned to reduce the fire hazard. The piles are usually burned in the fall when it is raining or when snow is on the ground.

Activities Covered -

Pile burning of vegetative debris may occur on Vegetation Management projects following the appropriate Conservation Measures.

Activities Not Covered -

Hand piling is covered in this plan. Machine piling could cause significant ground disturbance and is not covered by this assessment.

Pile burning within 100 feet of perennial streams or within 50 feet of intermittent streams is not covered, nor would it be consistent with no-cut prescriptions for above vegetation management project types.

Conservation Measures -

1. General Requirements and Conservation Measures apply.
2. Mitigate smoke effects when applicable and co-ordinate with the D.O E. and Forest Service before burning.

2. Danger and Hazard Tree Felling

The objective of danger and hazard tree felling is to reduce the potential that a tree falls onto members of the public, open roads, developed recreation sites, along developed, designated trials, and within existing SUP.

At all facilities within the Mission Ridge SUP, accessible trails, and roads, danger trees may be "high-topped" rather than felled, in order to maintain some habitat values for wildlife. This activity may include the use of explosives. Felling the entire tree occurs most frequently, with a chainsaw, although hazardous portions of a tree may be removed, rather than the entire tree, when there is not a safe place to fall the tree, or only parts of the tree are hazardous and falling is not necessary. Trees may be high-topped when the entire tree is not a danger.

Danger trees may be felled, limbed or high-topped, provided they meet the above definition of a hazard or danger tree and all Conservation Measures are followed. Danger and Hazard tree felling within Canada lynx habitat, northern spotted owl nesting, roosting, foraging (NRF) and dispersal habitat, and within Riparian Reserves is considered a low impact activity and is included within this analysis if there are no more than 2 trees/acre/year fallen.

3. **Invasive Plant Prevention and Management**

The Invasive Plant Program strategy proposes a multi-phase approach that provides for repeated treatment over time using one or a combination of the methods identified below. The principle objective of the invasive plant prevention and management program is to restore ecological structure and function to native communities.

Manual treatment, such as hand-pulling and grubbing with hand-tools, and mulching with organic materials as time permits. Other methods available are:

- Mechanical treatments such as mowing, weed eating, clipping, steam and propane torches;
- Cultural treatments such as planting and/or seeding of desirable vegetation;

- Use of herbicides

ROUTINE ROAD MAINTENANCE

Maintenance of roads focuses on ensuring that unsafe conditions are corrected, protecting the road investment, and minimizing potential adverse impacts to other resources, such as fish and wildlife habitats. Routine road maintenance includes using heavy equipment to grade roads, cut roadside brush, clean ditch lines, remove minor slide and slough material, clean, replace, add, or remove drainage culverts, and use of chainsaws to remove brush and logs that have fallen across roads or trails. Maintenance also includes road cut or fill slope stabilization and repair and/or installation of barricades (earthen barriers and gates).

Typical road maintenance activities are described below:

Blading and grading Blading restores the shape of the road surface (e.g. inslope, outslope, and crown) and redistributes aggregate evenly on roadbed. Blading eliminates potholes, tire ruts, and other features that tend to concentrate water and accelerate erosion. This activity helps make the surface of the roadbed more even and facilitate proper drainage. On roads with ditches, the grader may be used to clear or clean ditches to allow water to runoff more efficiently. Blading can be implemented so that road materials do not get too far off the roadbed which otherwise can widen the road surface. Surface blading can temporarily increase sediment production during intense rains and by creating dust.

Surface Rocking (rock replacement) - Over time and from multiple uses, original surface rock becomes washed, bladed, worn off, and pushed into sub-grade soil. Eventually surface rock needs to be replaced. This is accomplished by loading a dump truck with surface rock, hauling the rock to a designated site, and spreading material on the road. Subsequently, a roller may be used to compact and harden the road surface, Spot surfacing is similar, but generally limited to the dump truck spreading the rock at specific spots and grading. When the aggregate is dry, it is particularly important to add water prior to blading to prevent segregation and facilitate compaction.

Slide Removal -This can be accomplished with a grader, loader, backhoe, or bulldozer. The waste material is loaded into a dump truck and hauled to a designated waste area. Waste material is NOT placed where it can enter surface waters.

Roadside Brushing-This is done to prevent vegetation encroaching on the roadway whereby creating sight distance/ safety issues. Most roadside brushing is done by mechanical removal of trees, branches, and brush. Occasionally, hand tools such as chain saws are used. Mechanical brushing is generally done with a road brushing machine that may use a bar or rotating brush head

Ditch Cleanout-Ditch cleaning is necessary when ditches no longer meet the objective of transporting water to the next cross drain or away from a road or culvert. Water running down the road can increase sediment generated from the road surface and may overload the next drainage structure causing a fill failure. Grass, brush, and minor debris are left in place to stabilize the surface, and slow water velocity, as long as the ditch can adequately handle the expected flow without damage to other facilities. Excess material generated through these actions is loaded into a dump truck and hauled to pre-approved disposal sites. Sometimes suitable fines are used to replace lost ones in the aggregate surface of the road. A bulldozer or grader cleans ditches by dropping a corner of the blade into the ditch pushing material along. Occasionally an excavator or backhoe is used to clean itches that have been filled in by large amounts of material and/or wind to re-establish designed road drainages.

Culvert Maintenance-*.* Cleaning culvert inlets is done when the structures can no longer effectively handle expected water and storm events. A backhoe is used to clean debris and load material into a dump truck for disposal.

Material is NOT to be sidecast unless the material would not enter any stream or damage fill slope vegetation. Maintenance is not covered by Fisheries for wetted stream culverts within one-half mile of listed fish occupied and critical habitat. Maintenance may also include installation of new drainage

culverts, upgrades of existing undersized or damaged culverts, or removal of drainage pipes and/or drivable dip construction, particularly in cases where road maintenance level downgrades are made.

Established rock pits provide a source of rock for road repairs and improvements. On-site work may involve rock crushing, blasting to loosen rock, and use of heavy equipment such as front-end loaders and large trucks. Hauling and loading activities result in noise that is at or within ambient levels for open access roads, and above ambient on closed roads. Crushing and blasting, however, result in noise above ambient in most localities, and pose a greater risk of disturbance. Loading and hauling from existing pits can occur throughout the year.

Maintenance work is restricted to the existing road prism resulting in little new ground disturbance. However, activities such as grading, ditch and culvert cleaning, slide removal and resurfacing may generate insignificant amounts of sediment. Road maintenance activities often require heavy equipment (e.g., graders, bulldozers, backhoes, large trucks) that will temporarily raise noise levels generally within ambient levels for Maintenance Levels 3-5. Resultant noise may be above ambient levels for these roads. Maintenance of roads occurs on some roads all year and may last a few hours to a few days. Danger and hazard tree felling is specifically covered under the Vegetation Management Program.

Winter Road Maintenance

Routine maintenance of roads that receive established winter use primarily consists of plowing for vehicle access and removal of minor amounts of vegetation that may be blocking the road. This type of maintenance includes use of heavy machinery, such as plows, loaders, graders, snowcats, or tractors, to remove snow from the road surface and push it to the side.

Dust Abatement

Application of dust abatement (fugitive dust control) may occur via heavy machinery (i.e. water truck). The water is applied as the vehicle travels slowly down the road, so although ambient noise may increase briefly, any disturbance should be minimal relative to ambient levels.

Ski Areas Effect on the forest

The vegetation management effects to the forest outlined here were determined as: “May affect, but are Not Likely to Adversely Affect” wildlife, to “No Effect”. This is based on the June 2013 Programmatic Biological Assessment for the Okanogan Wenatchee National Forest.

Appendix D. Sources that were included in the review for Aquatics and Hydrology Analysis and project consistency with the Aquatic Conservation Strategy (ACS).

Sources:

- Chelan County Natural Resource Department. 2017. Stream Typing for Parcel Number 212019000000 Report.
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ACS Consistency

The following provides a list of the ACS objectives and a summary of the Proposed Action's consistency with the nine ACS objectives:

1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

Short term effects due to surface flow, erosion, and sedimentation during construction would be minimized with the use of BMPs, design criteria and mitigation measures. Long term effects are not anticipated to be significantly measurable with the implementation of BMPs, design criteria and mitigation measures that would control erosion and stormwater runoff. Ground disturbance and vegetation removal in Riparian Reserves would be minimized by siting permanent infrastructure outside of Riparian Reserves when practical and mitigated by restoration of degraded Riparian Reserve acreages designed to off-set direct impacts to Riparian Reserves from the proposed action (2:1 ratio).There would be no measurable negative effect to the aquatic ecosystem of the Assessment Area. The Proposed Action would maintain the distribution, diversity and complexity of the Assessment Area and Project Area scales.

2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

All stream crossings would be designed with hydraulic capacity to pass the 100-year flood event and associated debris flow to maintain hydrologic connectivity within the subwatersheds. All roads and stormwater systems would be built and maintained to Chelan County road standards. The Proposed Action would not create any barriers to fish or other aquatic and riparian species in the Assessment Area or the Project Area. Ground disturbance and vegetation removal in Riparian Reserves would be minimized by siting permanent infrastructure outside of Riparian Reserves when practical and mitigated

by restoration of degraded Riparian Reserve acreages designed to off-set direct impacts to Riparian Reserves from the proposed action (2:1 ratio). There would be no measurable negative effect to the spatial and temporal connectivity in the Assessment Area. The Proposed Action would maintain spatial and temporal connectivity within and between the Assessment Area and Project Area.

3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

All stream crossings would be designed with hydraulic capacity to pass the 100-year flood event and associated debris flow to maintain hydrologic connectivity within the subwatersheds. All roads and stormwater systems would be built and maintained to Chelan County road standards. Ground disturbance and vegetation removal in Riparian Reserves would be minimized by siting permanent infrastructure outside of Riparian Reserves when practical and mitigated by restoration of degraded Riparian Reserve acreages designed to off-set direct impacts to Riparian Reserves from the proposed action (2:1 ratio). None of the streams in the Project Area or larger Assessment Area would be altered or rerouted to change drainage paths and capacity. There would be no measurable negative effect to the physical integrity of the aquatic system in the Assessment Area. The Proposed Action would maintain the physical integrity of the aquatic system in the Assessment Area and Project Area.

4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

Short term effects due to surface flow, erosion, and sedimentation during construction would be minimized with the use of BMPs, design criteria and mitigation measures. Long term effects are not anticipated to be significantly measurable with the implementation of BMPs, design criteria and mitigation measures that would control erosion and stormwater runoff. Ground disturbance and vegetation removal in Riparian Reserves would be minimized by siting permanent infrastructure outside of Riparian Reserves when practical and mitigated by restoration of degraded Riparian Reserve acreages designed to off-set direct impacts to Riparian Reserves from the proposed action (2:1 ratio). Excavated materials and equipment fueling, and staging would be outside of Riparian Reserves. A project specific stormwater prevention plan including a spill prevention and response plan (SWPPP) would be developed and implemented. There would be no measurable negative effect to the water quality of the Assessment Area. The Proposed Action would maintain water quality in the Assessment Area and Project Area.

5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

Short term effects due to surface flow, erosion, and sedimentation during construction would be minimized with the use of BMPs, design criteria and mitigation measures. Long term effects are not anticipated to be significantly measurable with the implementation of BMPs, design criteria and mitigation measures that would control erosion and stormwater runoff. All stream crossings would be designed with hydraulic capacity to pass the 100-year flood event and associated debris flow to maintain hydrologic connectivity within the subwatersheds. All roads and stormwater systems would be built and maintained to Chelan County road standards. Ground disturbance and vegetation removal in Riparian Reserves would be minimized by siting permanent infrastructure outside of Riparian Reserves when practical and mitigated by restoration of degraded Riparian Reserve acreages designed to off-set direct impacts to Riparian Reserves from the proposed action (2:1 ratio). None of the streams in the Project Area or larger Assessment Area would be altered or rerouted to change drainage paths and capacity. There would be no measurable negative effect to the sediment regime in the Assessment Area. The Proposed Action would maintain the sediment regime in the Assessment Area and Project Area, in the existing condition, within the range of natural variability.

6. Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

Short term effects due to surface flow, erosion, and sedimentation during construction would be minimized with the use of BMPs, design criteria and mitigation measures. Long term effects are not anticipated to be significantly measurable with the implementation of BMPs, design criteria and mitigation measures that would control erosion and stormwater runoff. All stream crossings would be designed with hydraulic capacity to pass the 100-year flood event and associated debris flow to maintain hydrologic connectivity within the subwatersheds. All roads and stormwater systems would be built and maintained to Chelan County road standards. Ground disturbance and vegetation removal in Riparian Reserves would be minimized by siting permanent infrastructure outside of Riparian Reserves when practical and mitigated by restoration of degraded Riparian Reserve acreages designed to off-set direct impacts to Riparian Reserves from the proposed action (2:1 ratio). None of the streams in the Project Area or larger Assessment Area would be altered or rerouted to change drainage paths and capacity. There would be no measurable negative effect to the instream flows in the Assessment Area. The Proposed Action would maintain the instream flows in the Assessment Area and Project Area, in the existing condition, within the range of natural variability.

7. Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

Ground disturbance and vegetation removal in Riparian Reserves would be minimized by siting permanent infrastructure outside of Riparian Reserves when practical and mitigated by restoration of degraded Riparian Reserve acreages designed to off-set direct impacts to Riparian Reserves from the proposed action (2:1 ratio). All stream crossings would be designed with hydraulic capacity to pass the 100-year flood event and associated debris flow to maintain hydrologic connectivity within the subwatersheds. All roads and stormwater systems would be built and maintained to Chelan County road standards. None of the streams in the Project Area or larger Assessment Area would be altered or rerouted to change drainage paths and capacity. There would be no measurable negative effect to the timing, variability and duration of floodplain inundation and water table elevation in meadows and wetlands in the Assessment Area. The Proposed Action would maintain the timing, variability and duration of floodplain inundation and water table elevation in meadows and wetlands in the Assessment Area and Project Area, in the existing condition, within the range of natural variability.

8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

Ground disturbance and vegetation removal in Riparian Reserves would be minimized by siting permanent infrastructure outside of Riparian Reserves when practical and mitigated by restoration of degraded Riparian Reserve acreages designed to off-set direct impacts to Riparian Reserves from the proposed action (2:1 ratio). BMPs, design criteria and mitigation measures including seeding, replanting and restoration of riparian and wetland areas would be implemented. There would be no measurable negative effect to the species composition and structural diversity of plant communities in the Assessment Area. The Proposed Action would maintain the species composition and structural diversity of plant communities in the Assessment Area and Project Area, in the existing condition, within the range of natural variability.

9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

Ground disturbance and vegetation removal in Riparian Reserves would be minimized by siting permanent infrastructure outside of Riparian Reserves when practical and mitigated by restoration of degraded Riparian Reserve acreages designed to off-set direct impacts to Riparian Reserves from the proposed action (2:1 ratio). BMPs, design criteria and mitigation measures including seeding, replanting and restoration of riparian and wetland areas would be implemented. There would be no measurable negative effects to habitat that supports well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species in the Assessment Area. The Proposed Action would maintain habitat to support supports well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species in the Assessment Area and Project Area, in the existing condition, within the range of natural variability.

Appendix E. Description of the elk habitat quality assessment.

Introduction

Elk were identified as a Species of Management Interest by the Stemilt Partnership (TPL 2007). Therefore, elk were evaluated as one of several wildlife species in the Stemilt-Squilchuck Landscape Evaluation. The process used to evaluate elk habitat is documented in this appendix.

Some Key Assumptions

- The elk habitat assessment completed as a portion of the Stemilt-Squilchuck Landscape Evaluation provides an *interim* assessment of elk habitat quality until ongoing research on elk become available. There are two ongoing efforts of particular importance: the eastern Washington and Oregon elk habitat model that is likely to be adopted by the Forest Service, and the Colockum Elk Study being analyzed by the Washington Department of Fish and Wildlife.
- The elk habitat assessment relies on recent research showing the importance of late-summer/early-fall elk foraging habitat and elk habitat security on elk productivity and survival. This assumption is supported by a considerable body of research (Cook et al. 2001, 2004, 2018, McCorquodale 2015) and is the scientific basis for other elk modeling efforts (Cook et al. 2018, Rowland et al. 2018, Wisdom et al. 2018). There are other important elk life history aspects (e.g., calving, winter elk ecology) that are not assessed in the landscape evaluation and would need to be addressed in other research.
- Some aspects of the elk assessment would benefit from additional field evaluation, specifically, the forage quality and quantity components.

Key Components of the Elk Habitat Assessment

There are four interacting components of the elk habitat assessment. These follow closely components described in Rowland et al. (2018) but rely on data available for the Stemilt-Squilchuck subwatersheds from the landscape evaluation. The four components described in more detail below include: nutrition, cover, habitat security, and terrain.

Nutrition

The primary goal of this component of the assessment is to identify the vegetation types that have the greatest potential to meet or exceed the minimum nutritional requirements for an elk cow/calf pair (Cook et al. 2018). Data on forage productivity and elk use from Lehmkuhl et al. (2013) were used to classify vegetation types derived from the landscape evaluation into forage quality categories (Table B-1). These categories are used to assess which vegetation types had the greatest potential to provide the best forage quality and quantity. The vegetation data from the landscape evaluation that were used included cover type, potential vegetation type, structure class, and canopy closure.

Table B-1. The vegetation types derived from the landscape evaluation and the forage quality categories.

Vegetation Type	Forage Category
Herb – Dry Forest PVG	Moderate
Herb – Mesic Forest PVG	High
Herb – Cold Forest PVG	High
Shrub – Dry Forest PVG	Moderate
Shrub – Mesic Forest PVG	High
Shrub – Cold Forest PVG	High

Stand Initiation – Dry Forest PVG	Moderate
Stand Initiation – Mesic Forest PVG	High
Stand Initiation – Cold Forest PVG	High
Stem Exclusion Open Canopy – Dry Forest PVG	Moderate
Stem Exclusion Open Canopy – Mesic Forest PVG	Moderate
Stem Exclusion Open Canopy – Cold Forest PVG	High
Stem Exclusion Closed Canopy – Dry Forest PVG	Low
Stem Exclusion Closed Canopy – Mesic Forest PVG	Low
Stem Exclusion Closed Canopy – Cold Forest PVG	Low
Young Forest Multi-Story >40%CC – Dry Forest PVG	Low
Young Forest Multi-Story >40%CC – Mesic Forest PVG	Low
Young Forest Multi-Story >40%CC – Cold Forest PVG	Low
Young Forest Multi-Story <40%CC – Dry Forest PVG	Low
Young Forest Multi-Story <40%CC – Mesic Forest PVG	Moderate
Young Forest Multi-Story <40%CC – Cold Forest PVG	Moderate
Old Forest Single Story – Dry Forest PVG	Moderate
Old Forest Single Story – Mesic Forest PVG	Moderate
Old Forest Multi Story – Dry Forest PVG	Low
Old Forest Multi Story – Mesic Forest PVG	Low
Old Forest Multi Story – Cold Forest PVG	Moderate
Hardwood	Moderate
Dry Shrub - nonforest	Moderate
Dry Grassland – non forest	Moderate
Agriculture/Cropland	Zero
Non-vegetated/Rock/Water	Zero

Distance-to-Cover

Traditional views of the importance of cover to large ungulates, such as elk, have changed over time as a result of intensive research (Cook et al. 2005). Previously, cover was emphasized as an important component of habitat for elk with little attention paid to forage quality and quantity. Cover was traditionally thought to affect elk productivity and survival by mediating the effects of weather, creating warmer areas with less snow cover in the winter, and cooler, shaded areas in the summer. However, a considerable body of research has cast doubt on the relationship between cover and elk productivity and survival (see Cook et al. 2005 for a summary). Cover is still often shown to be an important variable in models of elk

habitat but is usually expressed as a distance-to-cover measure (Rowland et al. 2018). The distance-to-cover metric better expresses the role cover plays in providing area for elk to hide in and seek security in close proximity to non-cover foraging areas. We defined cover as areas with medium to large trees with at least 70% canopy cover and used three distance bands from cover in our habitat quality assessment: >200 meters from cover, 101-200 meters from cover, and <100 meters from cover.

Habitat Security

Habitat security is defined as areas that have a relatively low level of human activities (Hillis et al. 1991). Secure habitats provide places where elk can escape harassment from humans, thus reducing their energy expenditures and increasing their survival. Several studies have shown that elk use areas near human activities less than areas farther from human activities (Gaines et al. 2003, Montgomery et al. 2012, Proffitt et al. 2013, McCorquodale 2013, Ranglack et al. 2017, Thurfjell et al. 2017). We used data provided by the WDFW (W. Moore, pers. comm.) to identify secure and not secure areas. Roads and their status (open vs closed) were attributed in our GIS and then distance buffers (Gaines et al. 2003) were applied to open roads. The size of the buffer along each side of a road was constrained by the adjacent topography so that buffers did not extend over ridges, causing an under representation of secure habitats. The entire planning area was classified as either secure if the area was located outside a buffer or non-secure if located within a buffer.

Terrain Steepness

Elk tend to use gentle terrain more that steep terrain (Rowland et al. 2018). We used digital terrain data to classify the planning area into gentle (<30 degrees), moderate (30-60 degrees), and steep (>60 degrees) slope steepness classes.

Habitat Quality Index

The variables described above were used to score each 30 x 30 m pixel in the planning area from 0-10 to identify areas of low to high habitat quality. The ranking of each of the variables is shown in Table A-2 with areas of the highest potential nutritional value, in close proximity to cover, in secure habitats, and on gentle terrain having the highest habitat quality (Index = 11). Conversely, areas with zero nutrition values, >200 meters from cover, in non-secure areas, and on steep slopes having the lowest habitat quality (Index = 0).

Table B-2. The variables and the variable weighting used to index elk habitat quality.

Variable	Weighting
Nutrition Classes	
Zero	0
Low	1
Moderate	2
High	4
Distance-to-Cover	
>200 m from cover	0
101-200 m from cover	1
<100 m from cover	2
Habitat Security	
Not-Secure	0
Secure	2
Terrain Steepness	
Steep	0
Moderate	1
Gentle	2

Results

The application of the elk habitat quality index showed that 19,370 acres (50%) of the assessment area is in a low habitat quality condition, 17,030 acres (44%) in a moderate habitat quality condition, and 2,575 acres (6%) in a high habitat quality condition (Fig. B-1). Most of the high-quality habitat is currently located in the Stemilt subwatershed portion of the assessment area. The habitat quality could be enhanced by reducing the impacts of roads to create additional security habitat and by creating more openings in mesic and moist forest types to create better forage conditions.

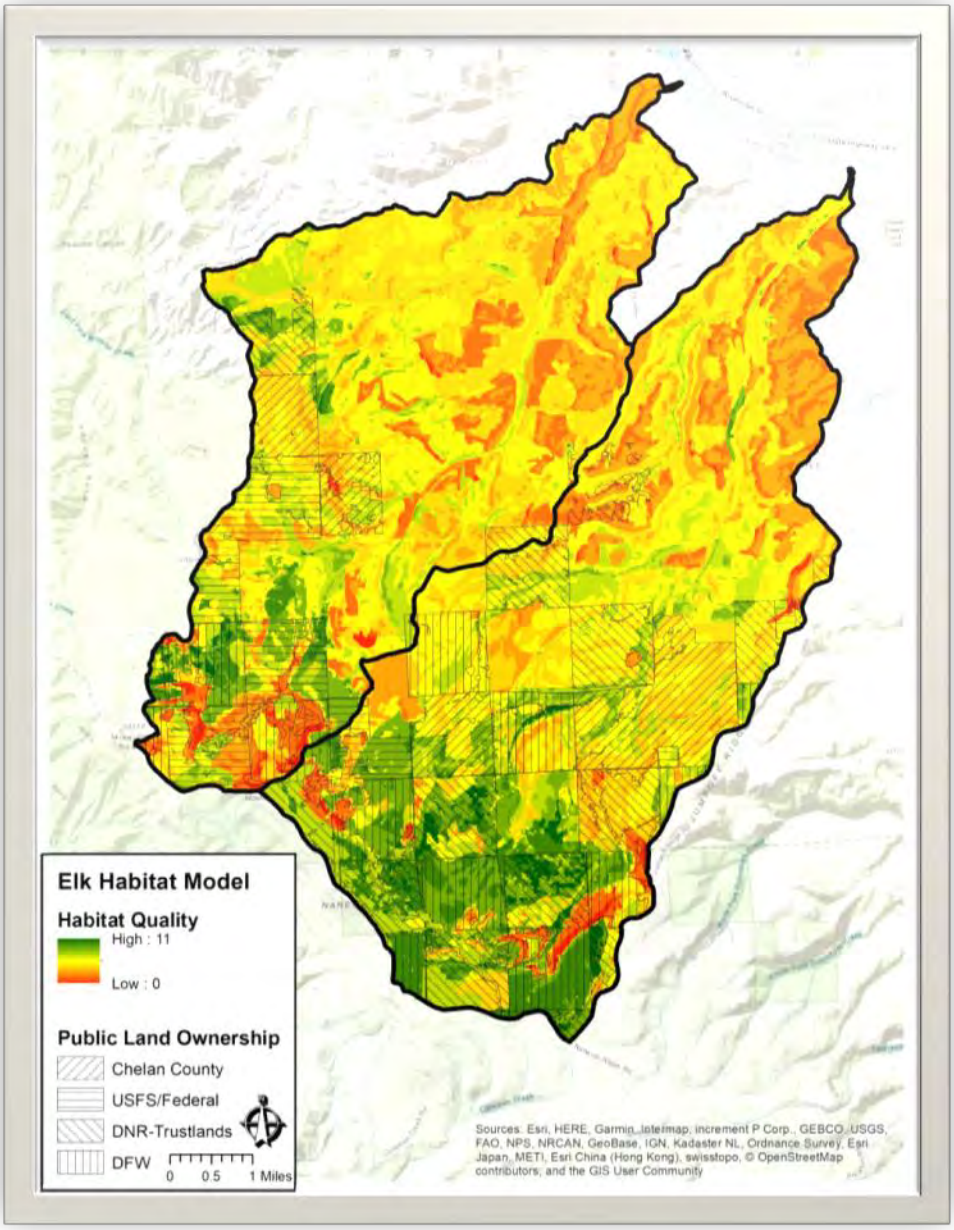

Fig. B-1. Elk habitat quality index score for the Stemilt-Squilchuck landscape evaluation area.

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Appendix F. Botanical Survey Species: Rare plant and fungi taxa with potential to occur in the Project Area

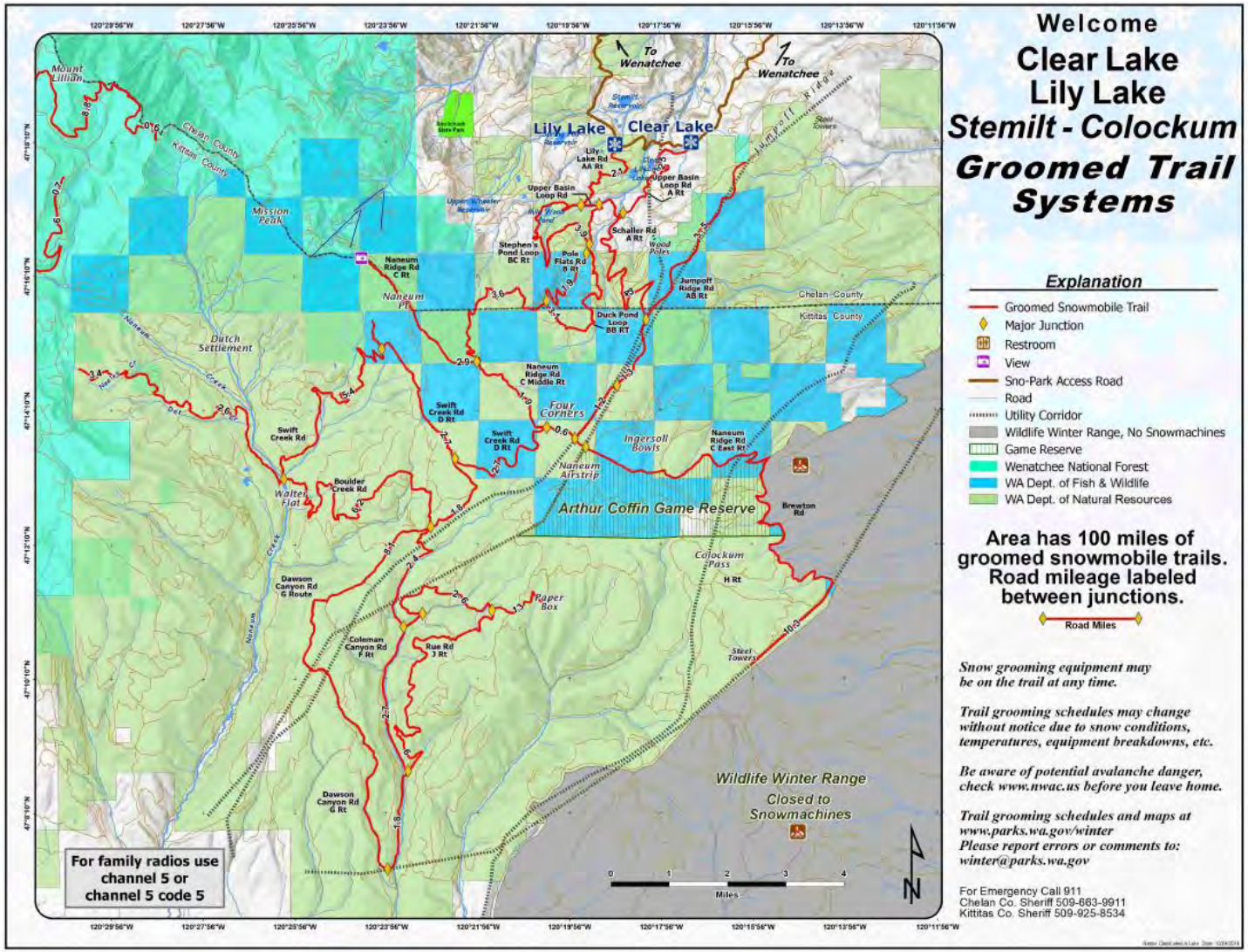
	Species	Common name	Family	Likeli-hood	Habitat notes	ID months	Fed status	State status	Synonym *if PLANTS accepted
1	**Agoseris aurantiaca var. carnea**	Pink agoseris	Asteraceae	3	Wet meadows, stream banks, fens, lake edges 4000-7000	mid-late summer fls, late July & Aug frts	S	S	Agoseris lackschewitzii
2	**Agoseris elata**	Tall agoseris	Asteraceae	2	Open woods, exposed rocky ridges, meadows . 500-7800.	Jun-Aug	S-OR	S	Aoseris x elata
3	**Alectoria nigricans**	Lichen	Parmeliaceae	5	Very little habitat info online. Found on mountain hemlock bark or on soil over rock. 5000-7000, Whatcom Co. and near Jim Hill Mt. near Stevens Pass.	NA		T	Gowardia nigricans
4	**Anemone patens var. multifida**	Pasqueflower	Ranunculaceae	1	PIPO or PSME forest, south facing slopes, open and wooded, near melting snow, meadows 2300-6600	late May-Aug	S	T	Anemone nuttalliana, Pulsatilla patens ssp. multifida
5	**Boechera cascadensis**	littleleaf rockress	Brassicaceae	4	Face of basalt cliffs on Table Mountain. 1 WA record from 1933.	June-Aug		SH	Arabis microphylla var. thompsonii*, Boechera microphylla
6	**Botrychium hesperium**	Western moonwort. Fern.	Ophioglossaceae	5	Sagebrush shrubland, moist and dry meadows, forest edges with lodgepole pine and Englemann spruce; dry gravelly sandy loam. Known range is not very near project area. 2500-6300	has leaves early spring to fall	S	S	
7	**Botrychium paradoxum**	Twin-spiked moonwort. Fern.	Ophioglossaceae	3	Perennial or intermittent stream terraces,dry or wet meadows, rocky slopes, lodgepole. <6550.	June-Aug	S	T	
8	**Carex proposita**	Smokey Mtn. sedge/ dreaded ovales	Cyperaceae	3	Talus, or granite near or above timberline,open dry rocky slopes and ridges, dry meadows 4500-7700	July-Aug	S	S	
9	**Carex scirpoidea ssp. scirpoidea**	Canadian single-spike sedge	Cyperaceae	5	Rock outcrops, talus slopes, moist alpine meadows, stream banks and rocky open slopes, above 4800-7600, often above timberline, generally surrounded by boulders, ridges, snowfields and scree.	June-Aug	S	S	
10	**Chaenactis thompsonii**	Thompson's chaenactis	Asteraceae	2	Dry rocky slopes and ridges, mostly serpentine. Sparse vegetation. 2900-7000'	early June-Aug	S	S	
11	**Cryptogramma stelleri**	Steller's rockbrake (maidenhair fern)	Pteridaceae	5	Only check the rock crevices on limestone cliffs 2000-6000	June-Aug	S	S	
12	**Delphinium viridescens**	Wenatchee larkspur	Ranunculaceae	2	Moist openings and microsites in open coniferous forests, seeps, springs, and riparian areas 1240-5700 '	Flowers midsummer	S	T	

	Species	Common name	Family	Likeli-hood	Habitat notes	ID months	Fed status	State status	Synonym *if PLANTS accepted
13	**Dermatocarpon meiophyllizum**	Lichen	Pteridaceae	4	On rocks in creeks and lakes in splash zone. 61-2300m. Skin-like lichen.	NA	S	T	
14	**Erigeron salishii**	Salish fleabane	Asteraceae	5	Alpine scree, over 6600 ft often scattered in small protected pockets or benches in areas with unstable soils. Ridgetop with granite, rock talus, sand.	July	S	S	
15	**Hackelia taylorii**	Taylor's stickseed	Boraginaceae	5	Unstable talus or gravel scree. Known from above 6500 ft but worth checking.	Blooms late July-early Aug	S	T	Hackelia sp. 2, Hackelia species novum
16	**Hackelia venusta**	Showy stickseed	Boraginaceae	3	Dry, loose granitic sand and crevices in talus or granite, low veg cover from unstabel slopes, periodic fires 1500-7400' Slope 25-70 degrees	May-July	E	E	
17	**Iliamna longisepala**	longsepal globemallow	Malvaceae	2	Gravel streamsides or open hillsides, PIPO or PSME. No state or federal status but of interest. 500-4900	June-Aug			
18	**Pellaea breweri**	Brewer's cliff-brake (maidenhair fern)	Polypodiacea e	5	Open rocky alpine areas;crevices, ledges and bases of cliffs and rock outcrops and rocky slides. Basalt, granite and sandstone; often south facing. 4700-6700'	NA	S	S	
19	**Peltigera hydrothyria**	Lichen, Eastern waterfan	Peltigeraceae	5	Lichen. Meadows at base of steep slope at 4800. Mostly westside. Rocks in creek.	NA		S	Hydrothyria venosa*
20	**Phacelia minutissima**	Dwarf phacelia	Hydrophyllac eae	3	Moist open places, stream banks, and meadows, 1400-8200', edge of meadow in dry rocky soil that stays moist into mid summer.	July	S	E	
21	**Pinus albicaulis**	Whitebark pine	Pinaceae	4	Survey because candidate spp; highest elevations of project are possible habitat (>5300ft)	NA	S		
22	**Potentilla glaucophylla var. perdissecta**	Blueleaf cinquefoil	Rosaceae	3	Moist gullies, glacial valleys and exposed rocky slopes and ridgesand in moist meadow at the margin of a coniferous forest, >5850	Jun-Aug	S-WA	S	P. diversifolia var. diversifolia*, P. diversifolia var. perdissecta, P. ovina var. ovina
23	**Pyrrocoma hirta var. sonchifolia**	Sticky goldenweed	Asteraceae	3	Meadows, open wooded slopes, rocky vernally wet places 1400-4700'	Aug-Sept	S	T	Haplopappus hirtus var. sonchifolius

	Species	Common name	Family	Likeli-hood	Habitat notes	ID months	Fed status	State status	Synonym *if PLANTS accepted
24	**Salix pseudomonticola**	False mountain willow	Salicaceae	4	Wet meadows, stream banks, fens, lake edges, thickets 2950-5500	early spring	S	S	
25	**Saxifraga hyperborea**	pygmy saxifrage	Saxifragaceae	2	Cliffs, crevices, talus >5200. single plants rather than clusters	July-Aug		S	Saxifraga debilis, Saxifraga rivularis
26	**Saxifragopsis fragarioides**	Joint-leaved saxifrage	Saxifragaceae	4	Up to 4300 ft, cracks and crevices of cliffs and rock outcrops; occationally in talus. Generally inaccessable	June-July	S	T	Saxifraga fragarioides
27	**Scouleria marginata**	Moss	Scouleriaceae	4	Moss on bedrock or boulders of perennial streams/rivers. Only known <4265ft.	NA	S	T	
28	**Silene scouleri ssp. scouleri**	Scouler's catchfly	Caryophyllaceae	4	Grassy ridege top, full sun, dry prairie, Gravel or talus slopes, timbered slopes, ~6000ft	Jun-Aug	S-WA	S	Silene grandis, Silene pacifica, Silene repens var. costata, Silene scouleri ssp. grandis
29	**Silene seelyi**	seely's silene	Caryophyllaceae	3	Shaded crevices in ultramafic, granitic or basaltic cliffs and rok outcrops, occationally amoung boulders or talus. Restricted to sites with poor nutrient and water availability. Sites stable. Canopy cover less than 30%, slopes 15-20% 1120-6300'	late May-Aug	S	S	
30	**Spiranthes porrifolia**	Western ladies-tresses	Orchidaceae	3	Only wet meadows, bogs, streams, seepages. To 6800 ft.	May-Aug	S	S	Spiranthes romanzoffiana var. porrifolia
31	**Swertia perennis**	Swertia	Gentianaceae	4	NW facing, above 6000', streambanks, wet meadows	July-Aug	S	T	
32	**Tholurna dissimilis**	Lichen	Caliciaceae	4	Lichen on windswept/krummholz subalpine fir and Englemann spruce.	NA	S	S	
33	**Umbilicaria phaea var. coccinea**	Naval lichen	Umbilicariaceae	3	Naval lichen. Rocky slopes to 4500. Bright red or red-orange.	NA		E	

Appendix G. Clear Lake/Lily Lake Stemilt – Colockum Groomed Trail Systems.

The following map was produced by Washington State Parks to provide information on groomed snowmobile trails in the area referred to as Clear Lake and Lily Lake. These trails are in the vicinity of the Mission Ridge Expansion Project. This map was accessed at: https://parks.state.wa.us/438/Blewett-I-90 (29 Jan 2020).



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Appendix I. Glossary and Acronyms

Glossary

Canopy cover: The proportion of over-head canopy of trees that covers the sky,

Complex patches: areas where remnants of the pre-treatment stand are retained to provide for habitat structure and complexity.

Comfortable Carrying Capacity (CCC): The number of skiers that can be safely supported by an area's lift and trail system, while providing a quality experience to each skier's ability level. CCC is determined via the integration of lift capacity, operating hours, acceptable slope densities, slope gradients, skier's skill classifications, and vertical feet of lift-service terrain.

Crown fuel: Overstory tree crowns that provide fuel for crown fires.

Crown Fire: The movement of fire through the crowns or tops of trees or shrubs, more or less independently of the surface fire. A fire is said to be "crowning" when the flames get up into the tops of trees and spreads.

Detachable Chairlift: An aerial chairlift, sometimes called a high-speed chairlift, which detaches from the cable at the top and bottom terminals, allowing the chair to slow to safely load and unload skiers.

Detrimental Soil Disturbance: Soil disturbances of concern include compaction, puddling, rutting, organic matter and topsoil displacement, and disruption of soil drainage. These disturbances may affect soil capacity for water infiltration and storage, tree growth, or soil erosion. Consequences depend on the severity and extent of disturbance, and on the soil and climate where disturbance occurs.

Double Chairlift: An aerial chairlift that carries two people.

Fixed grip Chairlift: An aerial chairlift where the chairs are permanently attached to the cable. This lift operates at slower speeds than a detachable chairlift to allow safe loading and unloading.

Dwarf mistletoe: a tree disease affecting primarily Douglas-fir and western larch.

Early seral: tree species that are abundant in early successional forests, such as ponderosa pine.

Ecosystem Restoration: The use and application of the full range of fuel treatments to promote plant community diversity and structure that are more resilient to disturbance, invasive species, and less likely to facilitate uncharacteristically intense wildland fires. Involves restoration of rangelands, short-interval, fire-adapted plant communities, and long-interval, fire-adapted plant communities.

Fire flow: general movement patterns of fire across landscape as determined by fire modeling and influenced by wind, topography, and fuels.

Future Range of Variability: Range of forest conditions expected under a hotter and drier climate scenario.

Gladed Terrain: A forested area that has been selectively cleared or limbed or naturally has sparser vegetation than the surrounding forest which provides a ski route.

Habitat juxtaposition: how habitats are spatially arranged across a landscape.

Hand Line: A fire line built with hand tools, such as shovels and pulaskis.

Historic Range of Variability: The historical pattern and abundance of structural stages within watersheds, using pre-settlement (1890- 1900) conditions as a reference point.

Ladder Fuels: Fuels, which provide vertical continuity between strata, thereby allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease. They help start and continue crowning on a fire.

Landscape restoration: large-scale restoration where treatments of individual stands or patches alter landscape dynamics

Late Successional Habitat: Forest structure with large and old overstory trees, deep tree canopies, more than two age classes, and abundant downed wood and snags.

Late Successional Reserve Assessment (LSRA): A document reviewed and approved by the Regional Interagency Executive Committee, characterizing each Late Successional Reserve on a National Forest and providing guidance for management activities within those LSRs.

Litter: Top layer of the forest, scrubland, or grassland floor, directly above the fermentation layer. It's composed of loose debris including sticks, branches, twigs, and recently fallen leaves or needles, little altered in structure by decomposition.

Magic Carpet: A conveyer belt at the surface of the snow, onto which a skier stands and is pulled uphill.

Mop-up: To make a fire safe or reduce residual smoke after the fire has been contained, by extinguishing or removing burning material along or near the control line, felling snags, or moving logs and large rocks so they won't roll downhill. Mop-up work is usually (but not always) handled by hand crews.

Off-piste Terrain: Skiable terrain between designated runs that has not been groomed or compacted.

Old Forest Multi-Story (OFMS): A forest structure with broken overstory canopy and > 2 strata, large overstory trees, and a high level of horizontal and vertical diversity. Many tree sizes are present.

Old Forest Single Story (OFSS): A forest structure with broken or continuous canopy cover of large, old trees, a single stratum, with little reproduction in the understory. Non-lethal natural or underburn fires limit natural regeneration.

Peak Day Visitor Capacity: Utilization that is at least 25% higher than the design capacity (CCC). This includes visitors who may not utilize the chairlifts and slopes, but may use the food service and other skier support facilities.

Plant Association: a vegetation classification based on the presence of indicator plants.

Pre-commercial Thinning: A below cost thinning operation used to release young stands < 8” in diameter so they can grow into larger size classes.

Platter Pull: A lift for pulling skiers uphill along the surface of the snow. Hanging from the cable are equally spaced vertical poles or cables attached to a platter that is placed between the skier’s legs and pulls the skier uphill.

Prescribed Fire: Any fire ignited by management actions under certain pre-determined conditions to meet specific objectives related to hazardous fuels reduction or habitat improvement. A written, approved prescribed fire plan must exist, and NEPA requirements must be met prior to ignition. Prescribed fires are ignited and managed within a "window" (see Prescription below) of very specific conditions including winds, temperatures, humidity, and other factors specified in the burn plan. Prescribed fire is also referred to as a "controlled burn" or "prescribed burn".

Pulsed Gondola: A fixed grip lift with cabins grouped together in pulses rather than being equally spaced along the cable. The entire line slows down or stops completely in terminals to allow passengers to embark or disembark.

Quad Chairlift: An aerial chairlift capable of carrying four people.

Re-burn: The burning of an area that has previously burned but that contains flammable fuels that ignite when burning conditions are more conducive to ignition.

Slash: Debris left after logging, pruning, thinning, or brush cutting; can include logs, chips, bark, branches, stumps and broken understory trees or brush.

Stem Exclusion Open Canopy (SEOC): A forest structure with 1 canopy layer, often broken with openings, and recruitment of saplings and poles is present.

Surface Fuels: Loose litter on the soil surface, normally consisting of fallen leaves or needles, twigs, bark, cones, and small branches that have not yet decayed; also grasses, forbs, low and medium shrubs, tree seedlings, heavier branchwood, downed logs, and stumps interspersed with or partially replacing the litter.

System Roads: Existing authorized roads that are part of the National Forest system of roads that are managed and maintained to different levels.

System Trails: Existing authorized trails that are part of the National Forest system of trails that are managed and maintained to different levels.

Unauthorized roads: Existing roads that have generally been user-built and are not part of the National Forest System of roads that are managed and maintained.

Taxa: Groups of one or more populations of organisms seen by taxonomists to form a unit.

Unauthorized trails: Existing trails that have generally been user-built and are not part of the National Forest System of trails that are managed and maintained.

Underburn: A fire that consumes surface fuels but not trees or shrubs.

Understory re-initiation: A forest structure with broken overstory, > 2 canopy layers, gaps in the overstory are creating regeneration patches in the understory.

Wet Line: A line of water, or water and retardant, sprayed along the ground, which serves as a temporary control line from which to ignite or stop a low-intensity fire.

Wildland/Urban Interface: The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. Often incorrectly referred to as the "interzone" or "urban/wildland interface."

Young Forest Multi-Story (YFMS): A forest structure type that is dominated by small trees, or when large trees comprise 10 to 30% of the canopy cover.

Acronyms

ACS – Aquatic Conservation Strategy
BIOP – Biological Opinion
BMP – Best Management Practice
CCC – Comfortable Carrying Capacity
CFS – Cubic feet per second
CWA – Clean Water Act
CWD – Coarse woody debris
DBH – Diameter at breast height
DF – Douglas-fir
DNR – Washington State Department of Natural Resources
DSD – Detrimental soil disturbance
EFH – Essential fish habitat
EO – Executive Order
ESA – Endangered Species Act

KOP – Key Observation Point
LSOF – Late Successional Old Forest
LSR – Late Successional Reserve
LSRA – Late Successional Reserve Assessment
MIS – Management indicator species
ML – Maintenance Level
MOU – Memorandum of Understanding
MPI – Matrix of population and habitat indicators
NOAA – National Oceanic and Atmospheric Administration
NFMA – National Forest Management Act
NRF – Nesting, roosting, foraging
NWFP – Northwest Forest Plan
OFMS – Old forest multi-story
OFSS – Old forest single story
OWNF – Okanogan-Wenatchee National Forest
PAG – Plant Association Group
PP – Ponderosa pine
REO – Regional Ecosystem Office
ROD – Record of Decision
RR – Riparian Reserve
SEPA – Washington State Environmental Policy Act
SI – Stand Initiation
SMS – Scenery Management System
SWPP – Storm water protection plan
TNC – The Nature Conservancy
UR – Understory re-initiation
USFS – United States Forest Service
USFWS – United States Fish and Wildlife Service
WDFW – Washington Department of Fish and Wildlife
WDNR – Washington Department of Natural Resources
WRIA - Watershed Resource Inventory Area
WNFLSRA – Wenatchee National Forest Late Successional Reserve Assessment
YFMS – Young forest multi-story

APPENDIX B

GEOLOGIC AND GEOTECHNICAL REPORTS

2016 Mission Ridge Landslide Report (GeoEngineers)

2017 Geohazards Report (GN Northern)

2017 Prelim. Geologist Site Reconn. Memo (GN Northern)

2018 Geologic/Geotechnical Feasibility Study Access Road Memo (GN Northern)

2019 Review of Revised Expansion Plans Memo (GN Northern)

2019 Seismic Refraction Survey Access Road (GN Northern)

2020 Geotechnical Report Access Road (GN Northern)

Geologic Services Report

Mission Ridge Landslide Project
Chelan County, Washington

for

Washington State Department of Fish and Wildlife

July 28, 2016

GeoEngineers
Earth Science + Technology

Geologic Services Report

Mission Ridge Landslide Project
Chelan County, Washington

for

Washington State Department of Fish and Wildlife

July 28, 2016

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Geologic Services Report

Mission Ridge Landslide Project
Chelan County, Washington

File No. 3730-162-00

July 28, 2016

Prepared for:

Washington Department of Fish and Wildlife
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Attention: Kristen Kuykendall, PE
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SWH:GHS:tt

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GeoEngineers

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Appendix A. Report Limitations and Guidelines for Use

INTRODUCTION

This report presents the result of our geologic services to evaluate a landslide that occurred in a portion of the Mission Ridge Ski area in Chelan County, Washington. Our understanding of the project is based on information provided by you, by Mission Ridge Ski Area personnel, and our experience in the site area. The approximate site area is shown in Figure 1.

We understand that the landslide occurred on sloping ground below (northeast) of Castle Peak, a topographic feature in the northeast portion of the overall ski area site. We understand that the slide occurred on or about April 27, 2016. Features that existed on or near the slide area prior to the landslide include a cat track near the toe of the slide and a cat track near the top of the slide area. We understand that significant snow melt had occurred/was occurring in the area prior to the slide.

We understand that some of the slide mass spilled onto a ski run (Mimi) at the base of the slope and that the material was still moving/creeping as of May 18, 2016.

We understand that Washington Department of Fish and Wildlife (WDFW) owns the land where the landslide occurred. This encompasses Section 25 within Township 21 North, Range 19 East. We also understand that Mission Ridge Ski Area and Resort operates the facility.

SCOPE OF SERVICES

Our services include a site visit, review of publically available documents and historical documents provided by you and Mission Ridge Ski Area staff. The scope of services completed for this study consisted of the following:

1. Review historical aerial photographs and topographic maps of the landslide site and adjacent areas. Light Detection and Ranging (LiDAR) coverage was not available for the site area.
2. Review published geologic data for the landslide site and adjacent areas.
3. Interview Mission Ridge Ski Area personnel regarding this landslide and the history of the areas adjacent to the landslide.
4. Review weather data for the site before, during and after the landslide occurrence. This data was provided by Mission Ridge personnel.
5. Perform a geologic reconnaissance of the landslide and nearby/adjacent areas.
6. Develop an opinion about the slide mechanism(s) and factors contributing to the slope instability based on the available information and our reconnaissance observations.
7. Develop an opinion on whether this is an isolated event or if indicators of ongoing landsliding are present in other areas adjacent to the landslide.
8. Develop an opinion regarding approximate dimensions of the recent landslide and potential for future slope movement.
9. Develop an opinion regarding the effects existing cat tracks may have had on initiating the landslide.

10. Develop an opinion on the effects cleanup activities (removal of slide debris) may have on future slope instability.
11. Develop general recommendations for measures that could be used to help stabilize the landslide, as appropriate.
12. Provide general recommendations for future management of the landslide area, as appropriate.

AREA CONDITIONS

The Mission Ridge Ski Area is generally located northeast of a northwest-southeast oriented ridgeline (Naneum Ridge) that is part of the Cascade Mountains. The southwestern part of the ski area is generally bowl shaped, which then narrows to a northeast-facing ridge slope which descends to the northeast, toward Squilchuck Creek. Elevations at the ski area site appear to range from about 6,600 feet in the southwest to about 4,700 feet in the northeast. Elevations used in this report reference topographic contours shown on the Mission Peak 7.5-Minute Quadrangle Map, 2014. The site and surrounding area are generally shown in the Vicinity Map, Figure 1. The landslide area is shown in Figures 2 through 4.

The landslide site is located in the northeasterly portion of the ski area on a north to northwest facing slope. The slope is steep and appears typical for the ski area. Other ski slopes in the landslide area are covered with basalt talus and scattered trees. Slopes to the east and west of the landslide are covered with fir and pine trees with an understory of brush. Ground surface on the landslide slope appears to range from about Elevation 5,160 feet to about Elevation 4,860 feet.

We understand that significant landslide movement occurred at the site on or about April 27, 2016. We also understand that landsliding occurred in at least two stages: the upper part of the slide area moved first (slump) and the lower part (debris flow) occurred later the same day based on anecdotal information provided by Mission Ridge staff.

SITE SURFACE CONDITIONS

We observed surface conditions during a site walk on June 23, 2016. We accessed the landslide area from the top and worked our way downward. Select photographs taken during our site walk are contained in this section. We also reviewed a drone video that was recorded by Mission Ridge personnel on May 6 and 16, 2016. Our interpretation of landslide features is shown in Figure 4.

The ground surface upslope of the landslide area, including an existing cat-track road, are covered with basalt talus that is cobble to boulder sized. Photos of the talus material in this area are shown below.

Photo 1. Photograph of the cat track above the landslide area.

The talus material is in a loose condition. Pore spaces between the cobbles/boulders are large as can be seen in photos 1 and 2. Castle Peak, a low feature comprised of weathered basalt, is located just upslope (southwest) of the cat track road and is shown in photo 3.

The blanket of talus material appears to thin and/or pinch out at or near the top of the landslide area as shown in photo 4, which was taken on the left side of the landslide.

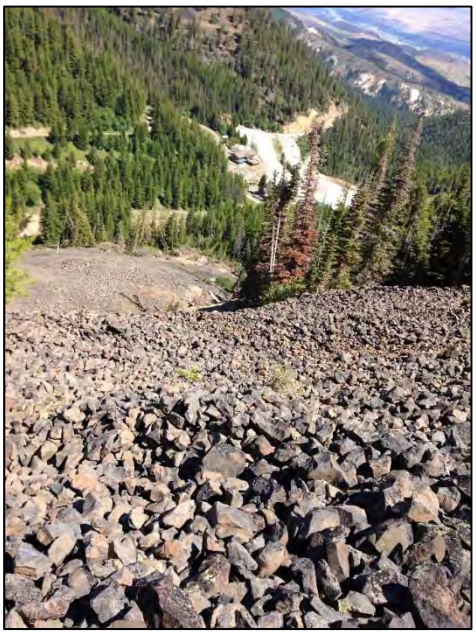


Photo 2. Basalt talus covered slope above the landslide.

Material exposed in the landslide scarp area appears to consist of tan to brown sandstone bedrock, as shown in photos 5 and 6. A layer of nearly white sandstone is also visible in this area. Striations visible on the bedrock surface may have resulted from landsliding basalt talus moving over the surface of the rock. The sandstone bedrock exposed appeared to be weakly cemented and moderately friable.

Photo 3. Castle Peak.

Photo 4. Upper part of landslide slope. Note split tree.

Photo 5. Landslide scarp.

We observed a large mass of basalt talus at the base of the head scarp (photo 7). Ground surfaces within the south portion of the slump slope backward into the hillside, indicating a possible rotational aspect to the mass movement in this portion of the landslide. The ground surface near the top of the slump feature is hummocky.

Photo 6. Landslide scarp, note striations on sandstone material.

Downslope of the slump the ground surface is covered with large basalt talus. We observed a zone within the talus that suggested past groundwater flow/springs through the talus which emanated at the ground surface. This was represented by tan soil-coated basalt talus, small localized slumps and other erosional features. These are shown in the photos 8 and 9.

Photo 7. Mass of basalt talus within slump area, at base of scarp.

Photo 8. Discolored area on talus slope below slump.

Photo 9. Discolored talus and eroded soil.

The debris flow portion of the landslide is located below the interpreted groundwater spring/seep zone and is approximately indicated in Figure 2. Materials exposed in this area appear to comprise a mixture of basalt talus and tan to brown sandstone/siltstone and possibly colluvial material derived from the sandstone/siltstone material. The percentage of the colluvial material appears to increase downslope within the debris slide area. These materials are shown in photos 10 and 11.

Photo 11. Debris slide material.

Photo 10. Debris slide area, looking north.

The toe of the debris flow portion of the landslide is located within the Mimi ski run, at the downslope margin of the landslide-affected area. The toe is shown in photo 12.

Photo 12. Toe of debris slide.

We visually estimated that the toe of the debris flow portion of the landslide was about 8 feet high during our site reconnaissance. We observed a small amount of groundwater flow exiting from portions of the landslide toe. It appears that groundwater flow from the toe was more significant in May based on our review of the drone video footage provided to us.

Published Literature Review

General

We reviewed select published geologic maps, aerial photographs and information provided by Mission Ridge and WDFW personnel that includes the area of the landslide. Our review of this data is summarized in the following sections.

Aerial Photograph Review

We reviewed aerial photographs of the site area dated 1998, 2003, 2005, 2006, 2009, 2011, 2013, 2014 and 2015. At the scale and resolution of the photographs reviewed, the landslide site appears similar in all of the photographs. The landslide area, as it existed in May 2015, is shown in Figure 3.

The ground surface within the slide area appears covered with basalt talus. The talus surface appears undulatory (wave like) in all of the photos, which suggests slow downslope movement of a somewhat viscous debris slide mass. Cat tracks above and below the landslide area are also visible in all of the photos. We understand that the lower cat track was destroyed during the landslide. A drainage channel appears to exist along the right edge of the landslide area in the 2009, 2011, 2013 and 2014 images. Small patches of tan-colored ground appear to exist in this area in the photos. The drainage channel may be hidden by shadows in the other photos.

We obtained an oblique aerial photo taken of the area from an internet search. The photo is dated June 2012. The drainage observed in the aerials is visible in this photograph (Photo 13). A leaning tree we observed near this drainage channel suggests that it is an area of active erosion.

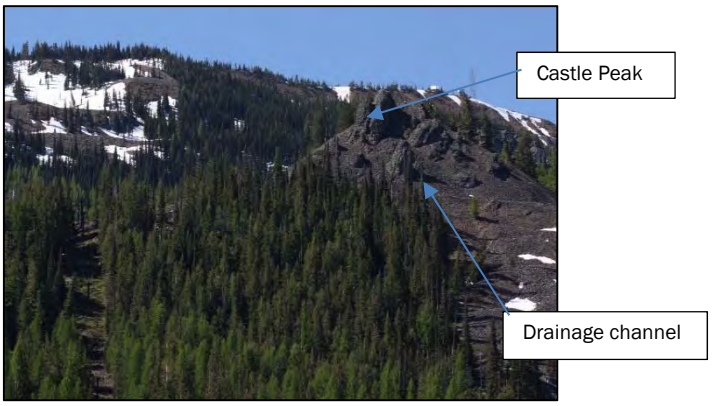


Photo 13. 2012 oblique photo of landslide area.

Mapped Geology

Geologic conditions at the site were evaluated by reviewing the following documents:

- Geologic Map of the Wenatchee 1:100,000 quadrangle, Central Washington, 1982

Geologic materials mapped at the landslide site comprise unit Qdy, Diamicton. This material is described as basalt clasts in an uncemented matrix, which were derived from debris flows. Diamicton is mapped over a large portion of the ski resort area.

Swauk Formation bedrock is mapped northwest of the ski area, at the approximate elevations of the landslide area, and in small patches southeast of the landslide. This material is described as dark gray weathering to tan sandstone.

Historic Mission Ridge Landslides

We understand that a landslide similar in general form to the 2016 slide occurred at Mission Ridge in 2006. This landslide occurred within/near the Skookum Ski Run, which is located upslope and to the southwest

of the 2016 landslide. We understand that the 2006 landslide occurred after weather conditions similar to the conditions noted prior to the 2016 landslide. Our June reconnaissance did not include this area.

The approximate locations of the 2006 and 2016 features are shown in Figure 4. The inset photos in this figure show close-ups of the two landslide features. The inset photos are dated 2016 and 2010.

Precipitation/Temperature Data

We reviewed precipitation and temperature data collected at three weather stations at Mission Ridge. The data indicates warm conditions at the ski area during April 2016. Temperatures at the weather stations appeared to be higher than freezing through most of April prior to the landslide. Temperatures exceeding 60 degrees Fahrenheit were recorded on April 18 through April 21. The high temperature reading during that time period was 74 degrees Fahrenheit on April 20. Temperatures were lower, in some cases sub-freezing, between April 21 and April 27, the reported date of the landslide.

Relatively small amounts of precipitation was measured at the ski area during April, 2016. About 0.3 inches of precipitation occurred on April 14 and about 0.07 inches on April 27.

The recorded snowpack depth at the ski area appeared to decline gradually from a high of 50 inches measured on April 1, 2016 to a depth of 16 inches measured on April 27, the day of the landslide.

Mission Ridge Anecdotal Information

We reviewed information provided by Mission Ridge personnel regarding the 2016 landslide and the previous 2006 landslide. We also reviewed notes prepared by State Department of Natural Resources personnel regarding observations during a site visit soon after the 2016 landslide occurred. We also reviewed a video shot during the landslide which showed movement of the debris slide portion of the event.

We understand from Mission Ridge personnel that unusually high temperatures occurred during the spring of 2016, leading up to the landslide. They also indicated that the ski area did not experience a “hard freeze” during the 2015–2016 ski season and that the snow melt during spring of 2016 was relatively rapid. The 2006 landslide, which occurred in the Skookum Run area, occurred during a relatively similar weather pattern, according to Mission Ridge personnel.

We understand that personnel observed tension cracks in the snow overlying the top of the landslide area on the morning of April 27. We understand that the upper part of the landslide (scarp and slump areas) moved during the morning of April 27. The lower landslide, (debris flow) occurred during the afternoon of April 27 at about 2:30 PM. Rockfalls and sounds of tree limbs cracking were reported during the upper landslide action. The video shot by Mission Ridge personnel of the debris flow suggests a relatively rapid movement of the flow.

DISCUSSION

General

Based on the geologic and topographic data, it appears that most of the Mission Ridge Ski area is located on or near an ancient landslide feature. Diamicton is mapped over a wide portion of the site. Diamicton is

a geologic unit derived from debris flows and landslides. A review of the entire Ski Area site is beyond the scope of this project.

Based on the information reviewed, and our observations, it appears that the 2016 landslide comprised three general parts. These include a semi-rotational slump, which occurred within the top portion of the landslide area, a lateral zone of springs and groundwater seepage downslope of the slump (Figure 2) and a debris flow downward of the spring/seepage zone that occurred after the slump. It also appears that movement of the talus material within the slump area occurred at the contact between the talus and the underlying sandstone bedrock. The talus material is very permeable with respect to water flow, much more so than the underlying sandstone bedrock. The talus is in a relatively loose condition, based on our site walk observations.

Some movement of the talus material appears to have occurred prior to the 2016 landslide event, based on the undulatory ground surface observed in this area visible on the historic aerial photographs. In addition, it appears that a drainage channel had been/was being cut along the eastern edge of the landslide area as evidenced in the aerial photos.

The debris flow appears to consist of a mixture of basalt talus and weathered Swauk formation material. This suggests that some thickness of weathered Swauk formation material present beneath the talus, was mobilized by water during the landslide.

Landslide Causes

It is our opinion that the chief mechanism of landslide movement was significant water flow into and through the very permeable basalt talus on top of the relatively impermeable and steeply inclined sandstone bedrock substrate, which then caused the talus and upper portion of the weathered sandstone material to mobilize downslope.

The site evidence suggests that groundwater flow within the talus deposit mobilized a mixture of weathered sandstone and talus into a debris flow within the lower part of the slide. The major, visible landslide events occurred on April 27, 2016; however, it is possible that some slow, creep movement of the landslide mass(s) may have occurred prior to that date. The aerial photos suggest some movement or movements had occurred/were occurring in the past.

Other talus covered slopes near the landslide area also exhibit undulatory topography, based on our review of the aerial photographs. Similar slopes likely exist throughout the ski area. The 2006 and 2016 landslide events indicate that future landsliding within the site area is possible, if not likely when weather conditions similar to the spring of 2006 and 2016 occur.

It appears unlikely that the cat tracks at either the bottom or top of the landslide area were significant or principal factors in the landslide. The lower cat track was visible in all of the historic aerial photographs.

We recommend that the identified landslide areas be monitored for additional movements. We also recommend that other areas similar in general landform to the 2016 landslide and the historic 2006 landslide be monitored, particularly when weather conditions similar to those that occurred prior to both landslide events occur within the site area.

Landslide Cleanup

We understand that Mission Ridge ski area wishes to remove some if not all of the landslide debris that was deposited within the Mimi Ski Run, which is located at the base of the landslide slope. Removal of all or part of the deposited debris within this area could cause debris flow material upslope of the removal operation to remobilize. Removal and or grading of some of the material is likely beneficial however, because the lobe of deposited material in the Mimi Ski run has a steeply inclined slope face that will likely erode during the next rainy/snow season and may begin to mobilize during wet conditions.

Landslide Stabilization

Because of the size and magnitude of the landslide, stabilizing the landslide through engineered means (retaining walls, grading) is likely not economically practical. Significant geologic engineering/geotechnical engineering design evaluations would be required that would include subsurface explorations and detailed slope stability analysis in order to develop an appropriate design. Promoting re-vegetation of the debris slide area would be of some benefit and might help stabilize this part of the landslide. However, even with this limited action the potential for future movement would remain.

Landslide Management

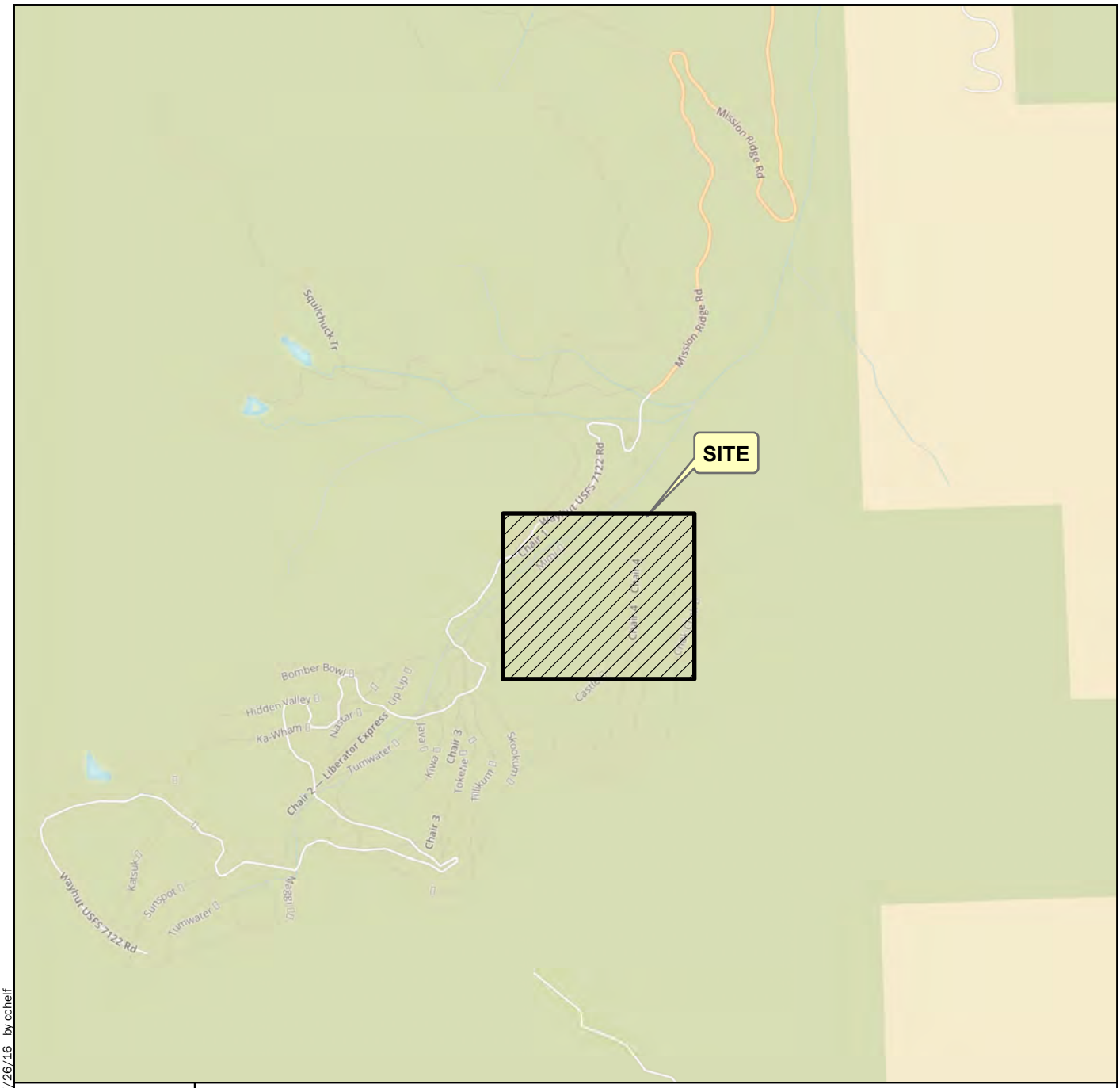
We recommend that the identified landslide areas be monitored through the ski season for indications of additional movement. Some instability and movement is more likely to occur during periods of heavy precipitation and/or during snow melt. If movement is detected, closure of the downslope areas that could potentially be affected, such as the Mimi ski run at the base of the 2016 landslide, should be considered. It is possible that landslides could occur in other locations of the ski area that have similar general landforms. Identification and assessment of actual landslide hazard presented by such potential areas is beyond the scope of this study.

LIMITATIONS

We have prepared this report for the exclusive use of the Washington State Department of Fish and Wildlife and their authorized agents for the project described above. Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Our services were provided to evaluate certain geologic risks for sloping property. Our recommendations are intended to reduce the potential for future property damage related to earth movements, drainage or erosion. Favorable performance of slopes in the near term does not imply a certainty of long-term performance, especially under conditions of adverse weather or seismic activity.

Please refer to Appendix A titled “Report Limitations and Guidelines for Use” for additional information pertaining to use of this report.



Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Mapbox Open Street Map, 2016

Projection: NAD 1983 UTM Zone 10N

Vicinity Map

Mission Ridge Landslide Project
Chelan County, Washington

GeoEngineers

Figure 1

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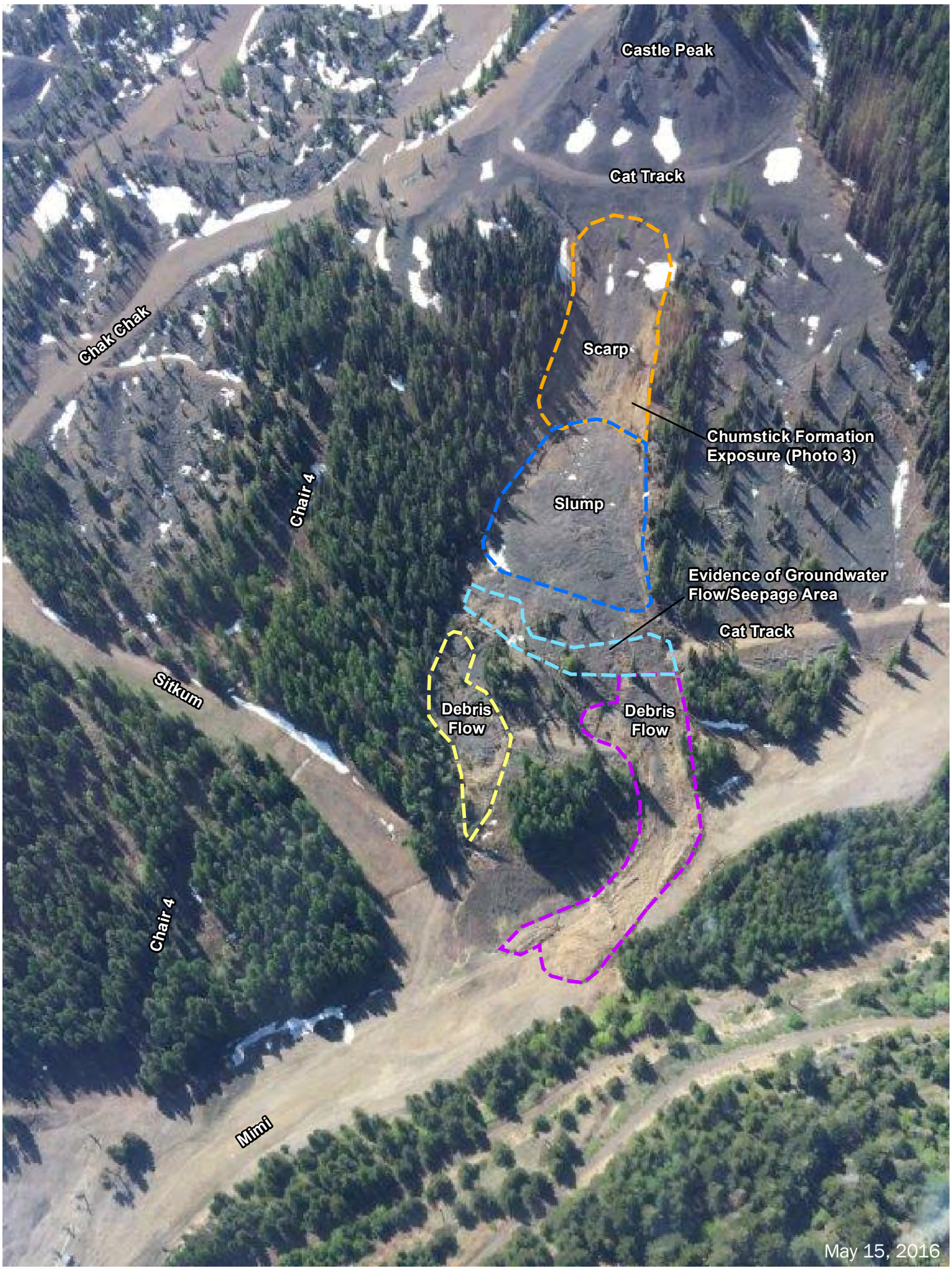

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SCALE IS APPROXIMATE

Feet

Oblique Aerial Photo Castle Landslide
May 15, 2016

Mission Ridge Landslide Project
Chelan County, Washington

GeoEngineers

Figure 2

Notes:

1. The locations of all features shown are approximate.
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Data Source: Oblique photo from May 15th, 2016

Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

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Feet

Aerial Photo Castle Landslide Area, May 07, 2015

Mission Ridge Landslide Project
Chelan County, Washington

GeoEngineers

Figure 3

Notes:

1. The locations of all features shown are approximate.
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Data Source: Aerial from GoogleEarth Pro May 7th, 2015

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Legend

- Landslide 2006
- Landslide 2016

Data Source: Aerial (left) from ESRI 2015, Aerial (right) from GoogleEarthPro 2006,

Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Location of 2006 and 2016 Landslides

Mission Ridge Landslide Project
Chelan County, Washington

GeoEngineers

Figure 4

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APPENDIX A
Report Limitations and Guidelines for Use

APPENDIX A
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

Geotechnical Services Are Performed For Specific Purposes, Persons and Projects

This report has been prepared for the exclusive use of the Washington State Department of Fish and Wildlife and their authorized agents. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

GeoEngineers structures our services to meet the specific needs of our clients. For example, a geotechnical or geologic study conducted for a civil engineer or architect may not fulfill the needs of a construction contractor or even another civil engineer or architect that are involved in the same project. Because each geotechnical or geologic study is unique, each geotechnical engineering or geologic report is unique, prepared solely for the specific client and project site. Our report is prepared for the exclusive use of our Client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client and generally accepted geotechnical practices in this area at the time this report was prepared. This report should not be applied for any purpose or project except the one originally contemplated.

A Geotechnical Engineering or Geologic Report is Based on a Unique Set of Project-Specific Factors

This report has been prepared to evaluate the landslide which occurred on Washington State Department of Fish and Wildlife property on April 27, 2016. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, do not rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

For example, changes that can affect the applicability of this report include those that affect:

- the function of the proposed structure;
- elevation, configuration, location, orientation or weight of the proposed structure;
- composition of the design team; or
- project ownership.

[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org.

If important changes are made after the date of this report, GeoEngineers should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

Subsurface and Surface Conditions Can Change

This report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. Always contact GeoEngineers before applying a report to determine if it remains applicable.

Most Geotechnical and Geologic Findings are Professional Opinions

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

Give Contractors a Complete Report and Guidance

Some owners and design professionals believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering or geologic report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might an owner be in a position to give contractors the best information available, while requiring them to at least share the financial responsibilities stemming from unanticipated conditions. Further, a contingency for unanticipated conditions should be included in your project budget and schedule.

Contractors are Responsible for Site Safety on Their Own Construction Projects

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and to adjacent properties.

Read These Provisions Closely

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering or geology) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

Geotechnical, Geologic and Environmental Reports Should Not be Interchanged

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding a specific project.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention, or assessment of the presence of Biological Pollutants in or around any structure. Accordingly, this report includes no interpretations, recommendations, findings, or conclusions for the purpose of detecting, preventing, assessing, or abating Biological Pollutants. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and/or any of their byproducts.

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.
CONSULTING GEOTECHNICAL ENGINEERS
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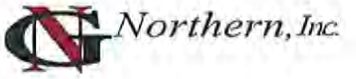

At GN Northern our mission is to serve our clients in the most efficient, cost effective way using the best resources and tools available while maintaining professionalism on every level. Our philosophy is to satisfy our clients through hard work, dedication and extraordinary efforts from all of our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

M. Yousuf Memon, PE
Geotechnical Engineer

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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.

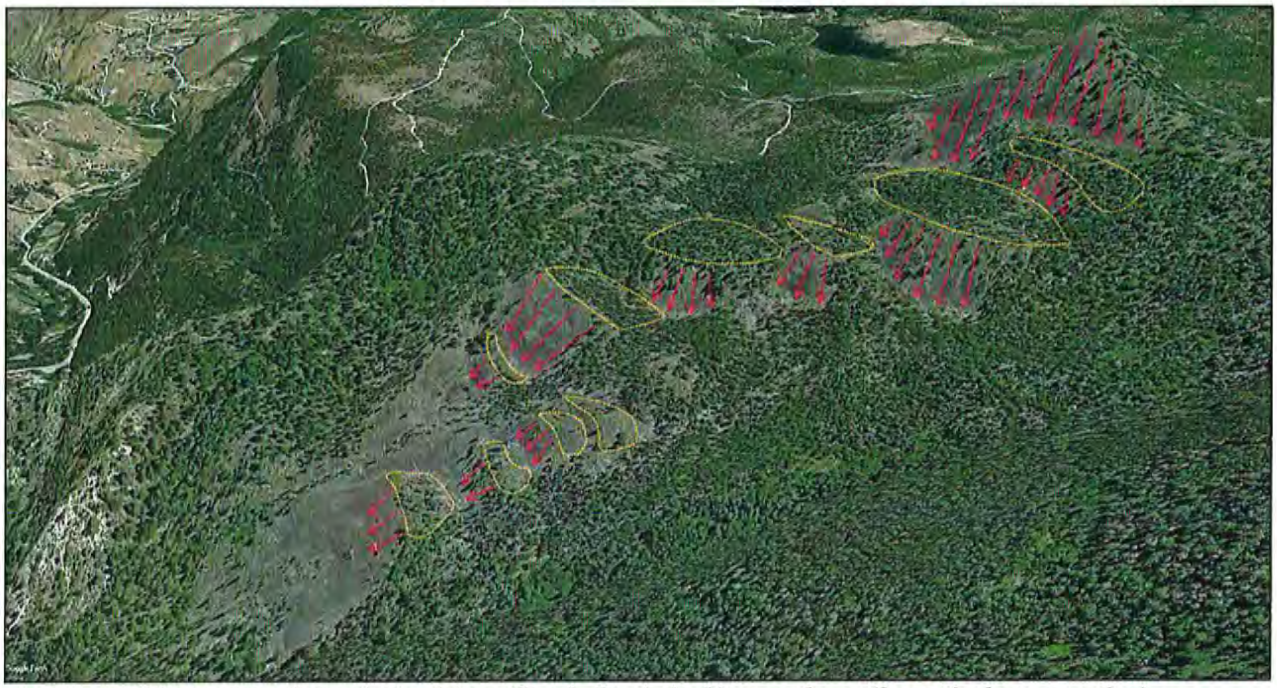
Local Geology:

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)

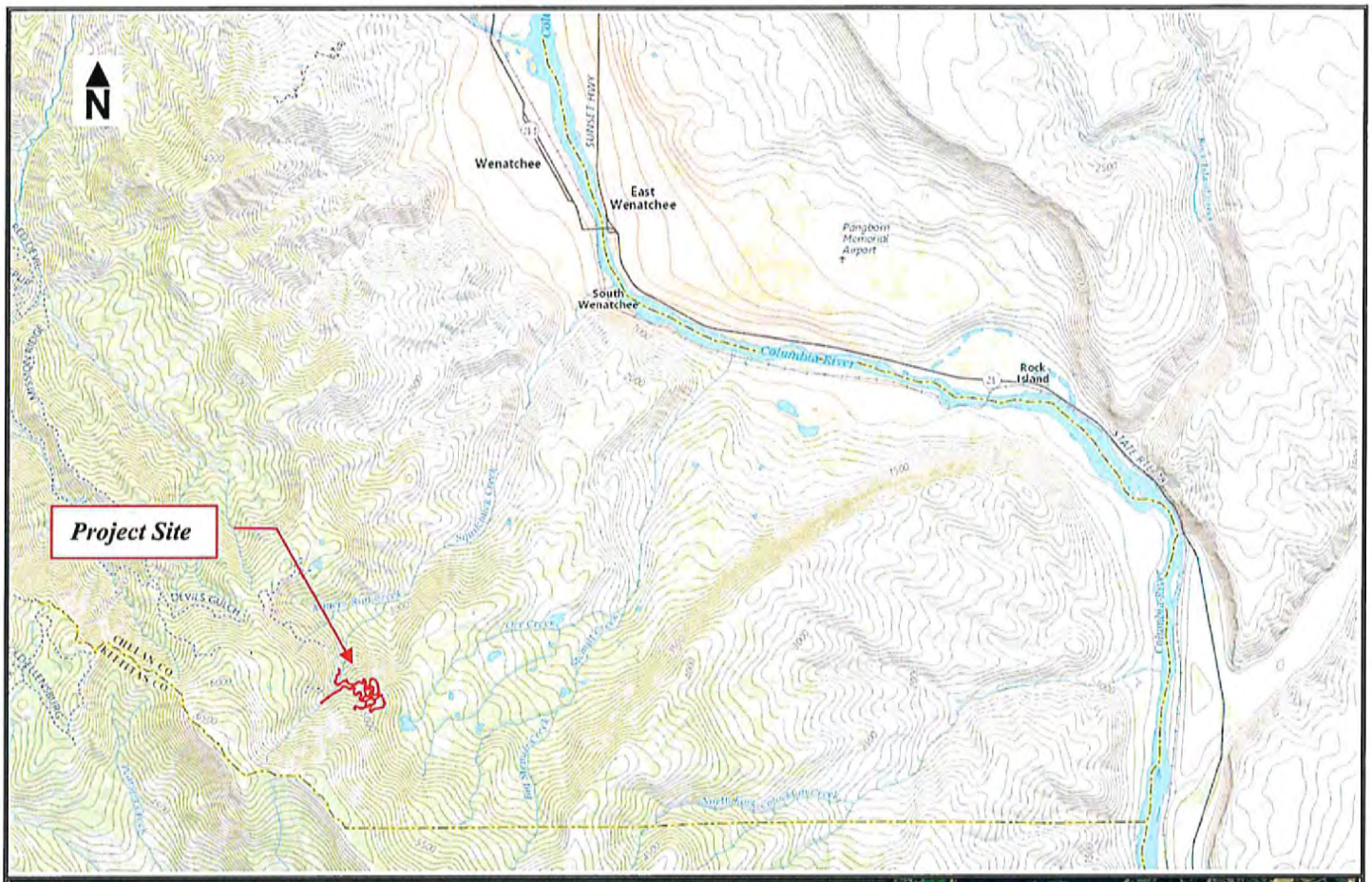
U.S. FISH & WILDLIFE NATIONAL WETLANDS INVENTORY MAP (FIG. 6)

WASHINGTON DNR FAULTS AND EARTHQUAKES MAP (FIG. 7)

SITE PHOTOGRAPHS

NRCS SOIL SURVEY MAP

WASHINGTON DEPARTMENT OF ECOLOGY WELL LOG



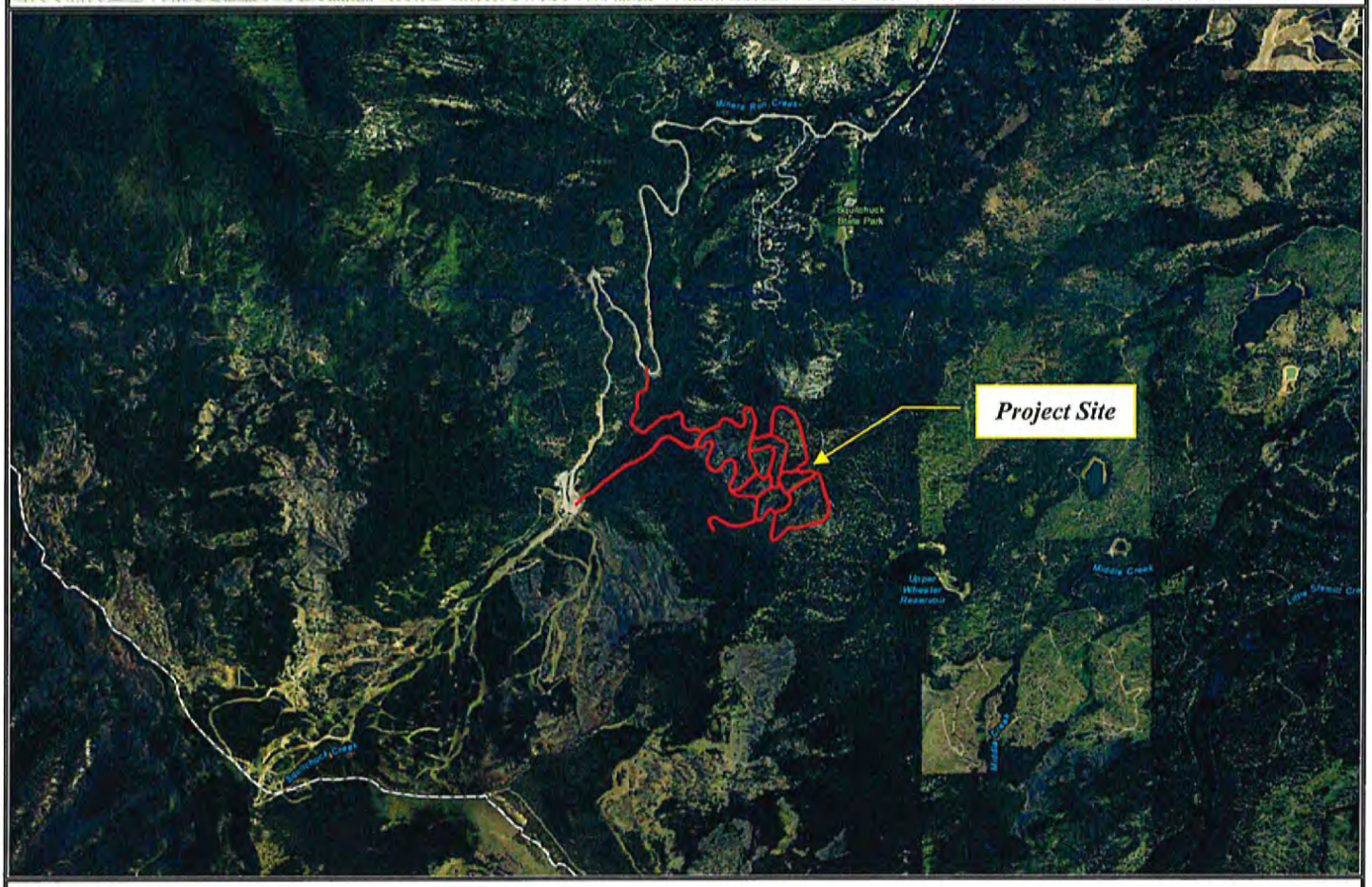
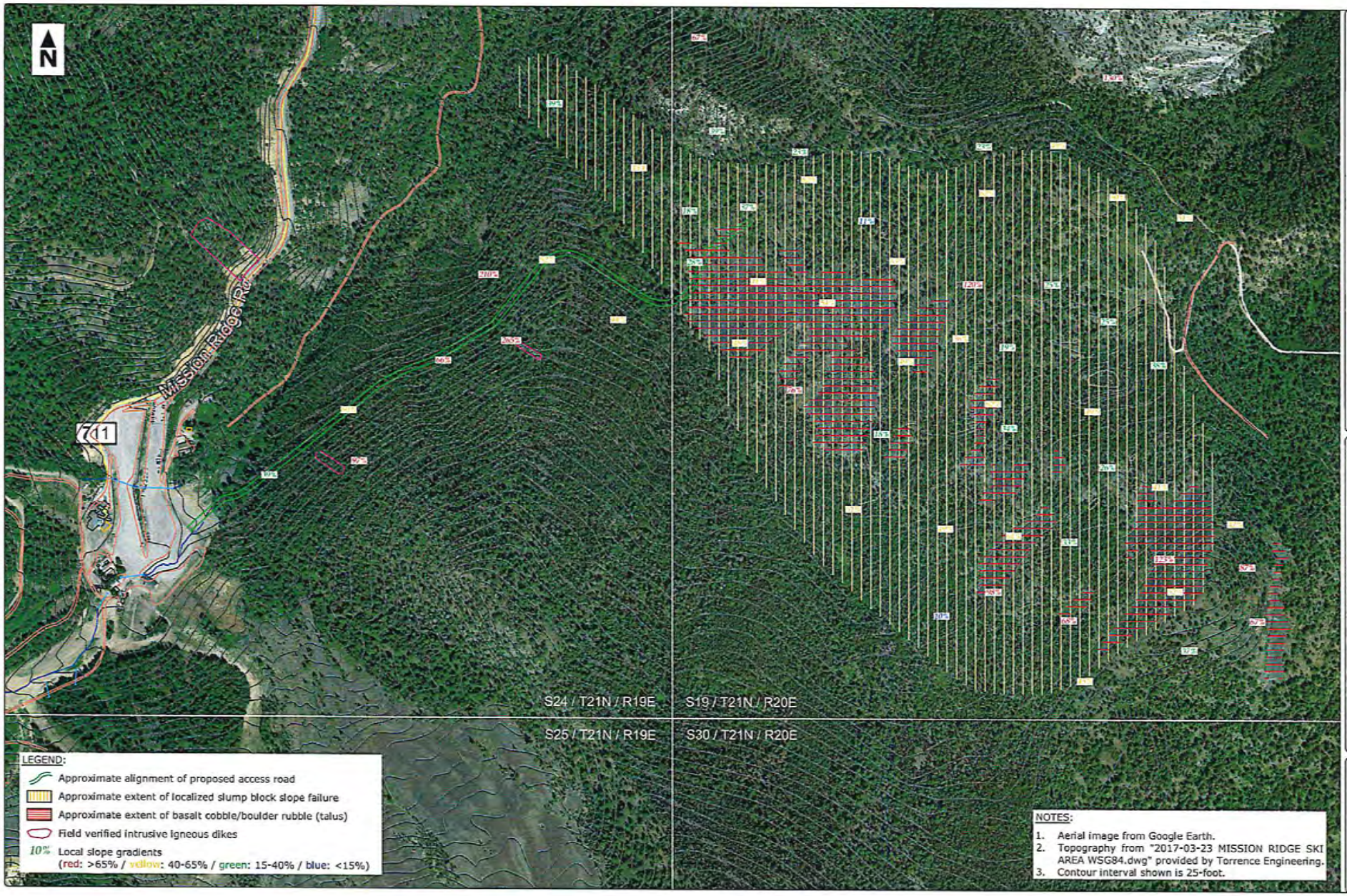


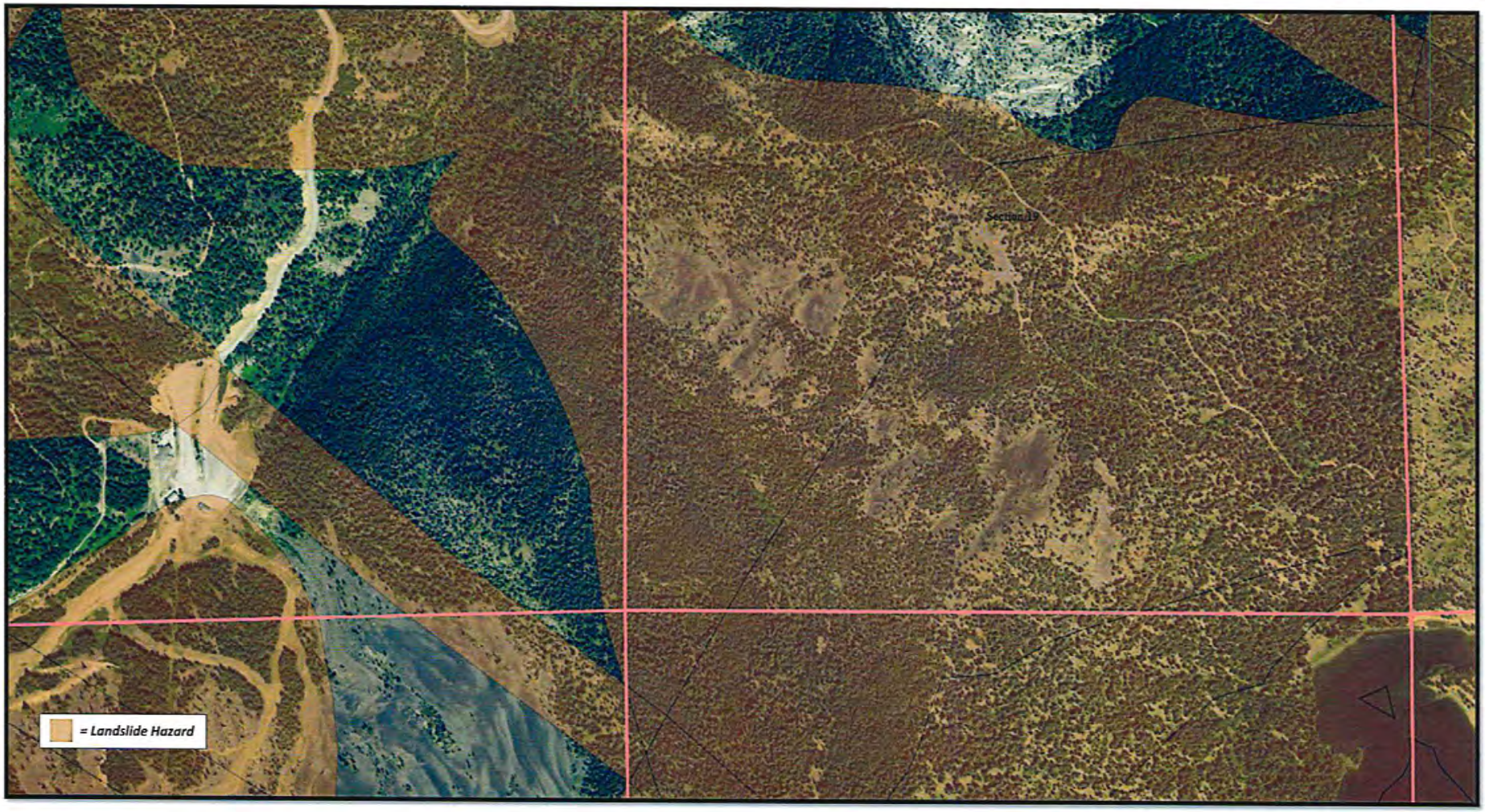
FIGURE 1: SITE VICINITY MAP **PROJECT NO. 217-854**



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

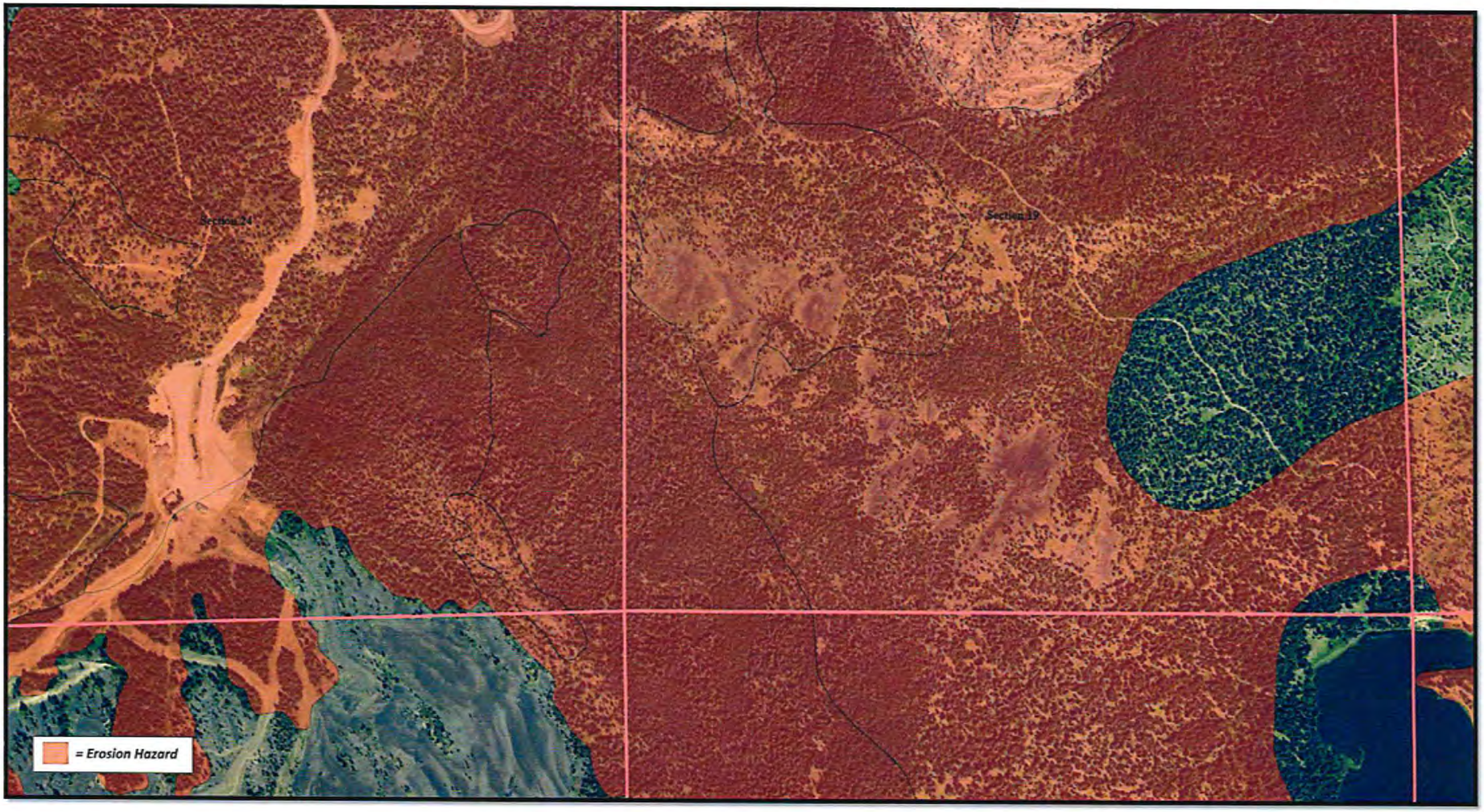
SITE FEATURES & GEOLOGIC CONSTRAINTS MAP
Village at Mission Ridge
Chelan County, Washington

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



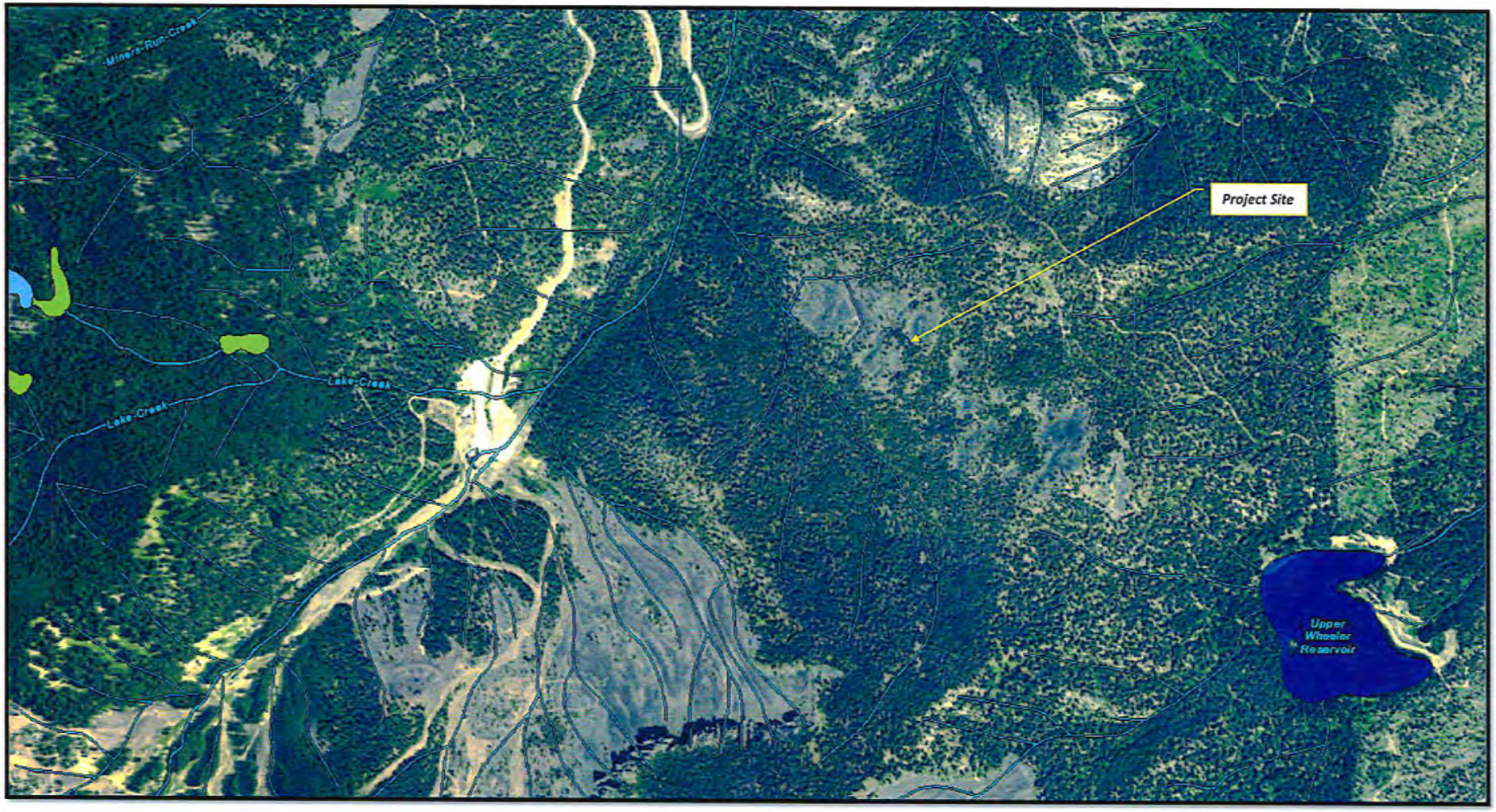
CHELAN COUNTY GIS – LANDSLIDE HAZARD OVERLAY MAP (FIGURE 4)

Village at Mission Ridge
Chelan County, Washington



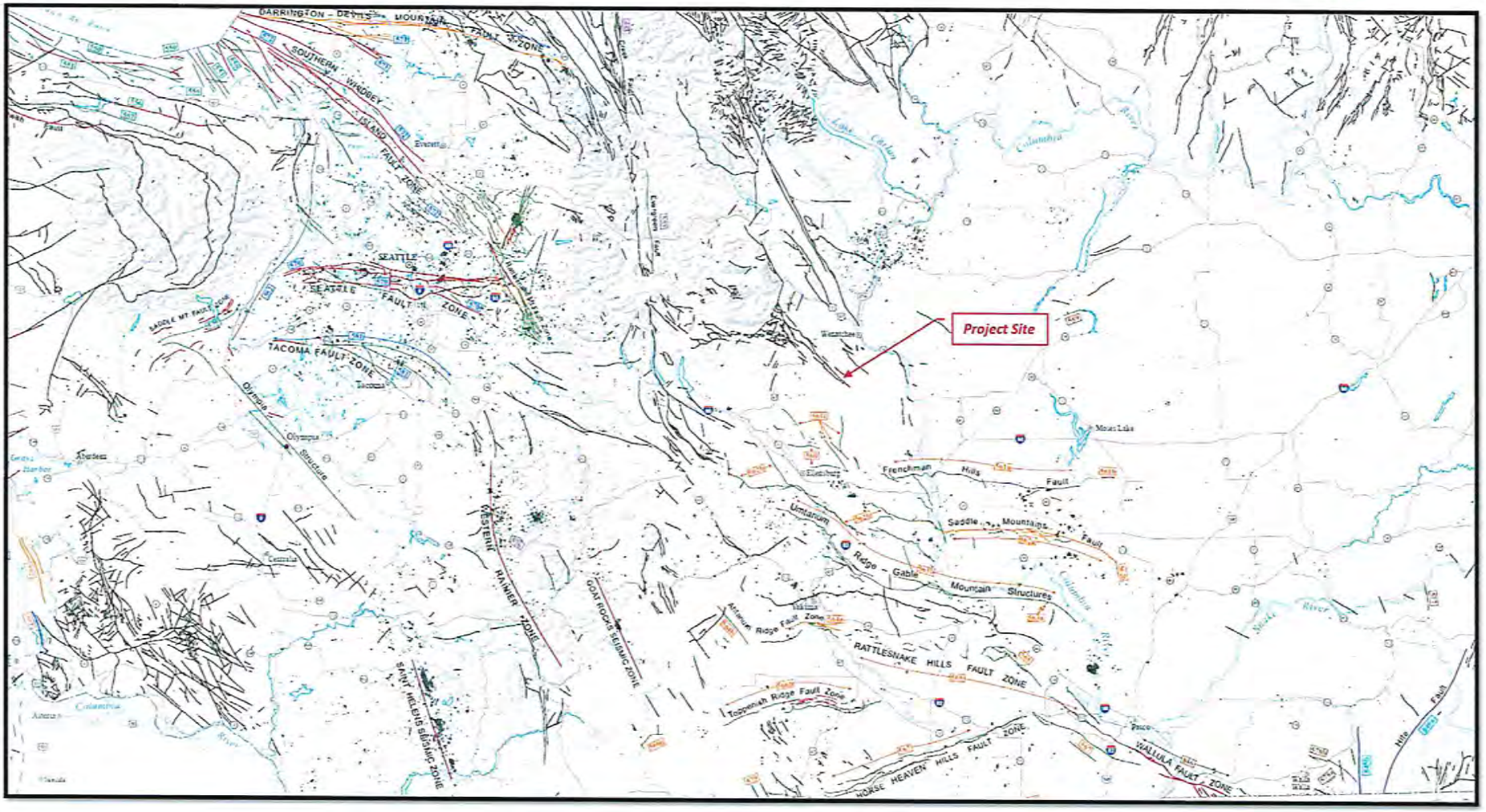
CHELAN COUNTY GIS – EROSION HAZARD OVERLAY MAP (FIGURE 5)

Village at Mission Ridge
Chelan County, Washington



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

Village at Mission Ridge
Chelan County, Washington



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

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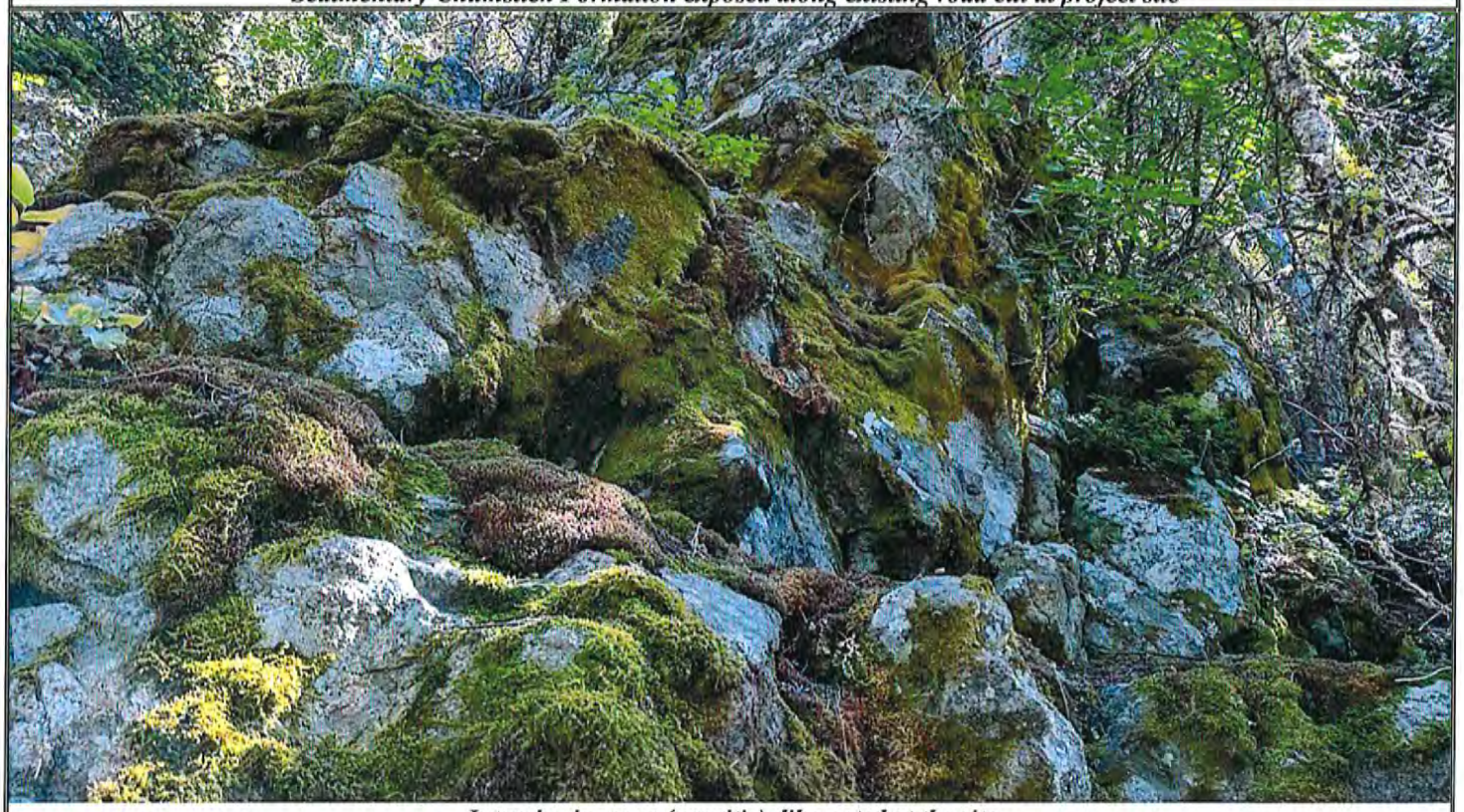
Job Number: 217-854

Site Photographs
The Village at Mission Ridge
Chelan County, Washington

Date	Mounted By:	Reviewed By:	Plate
11/15/2017	MYM	KAH	1

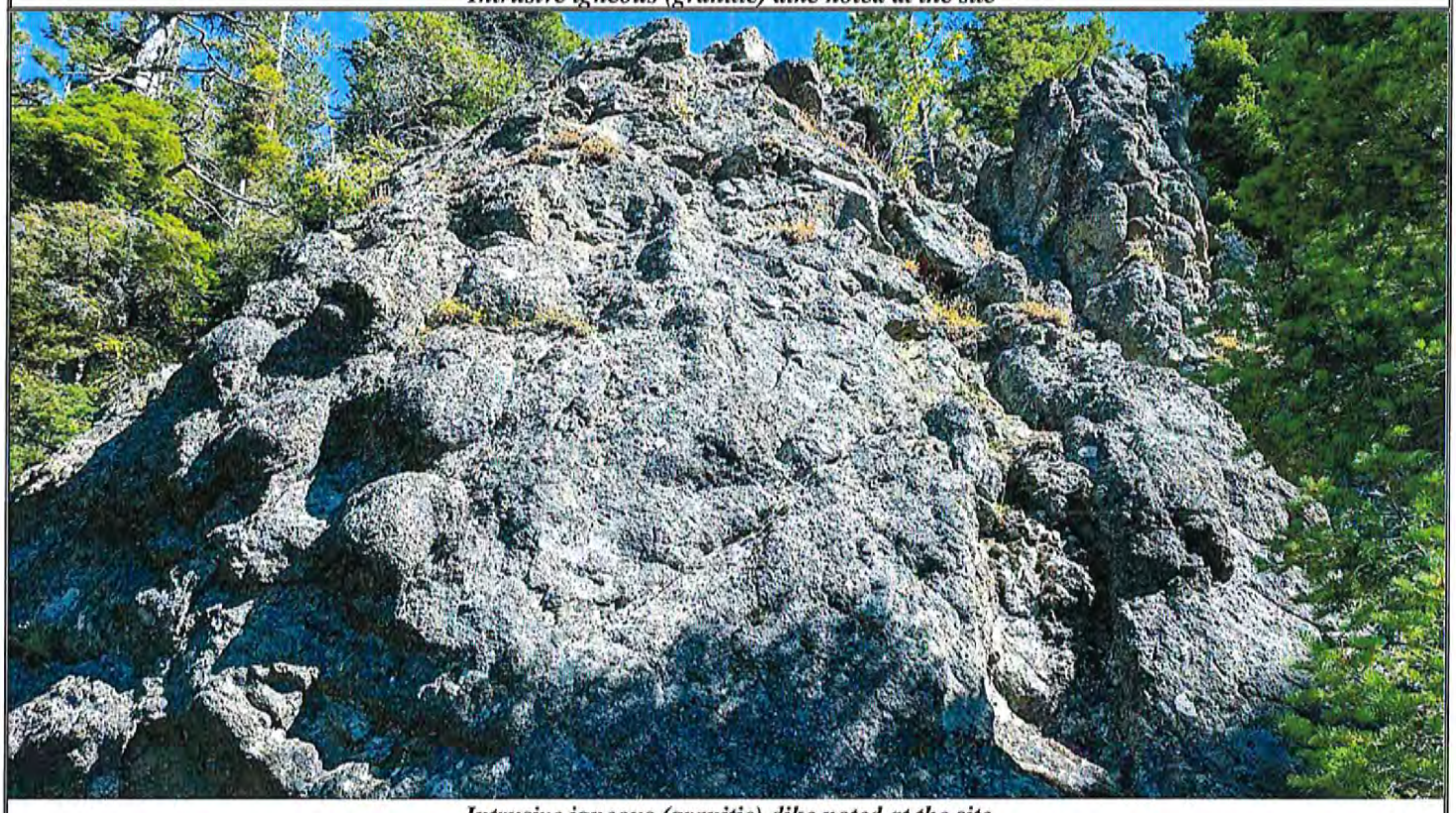
Sedimentary Chumstick Formation exposed along existing road cut at project site



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

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Site Photographs
The Village at Mission Ridge
Chelan County, Washington

Date	Mounted By:	Reviewed By:	Plate
11/15/2017	MYM	KAH	3

Sedimentary Chumstick Formation exposed along existing road cut at project site

View of basalt rubble (talus) at the site

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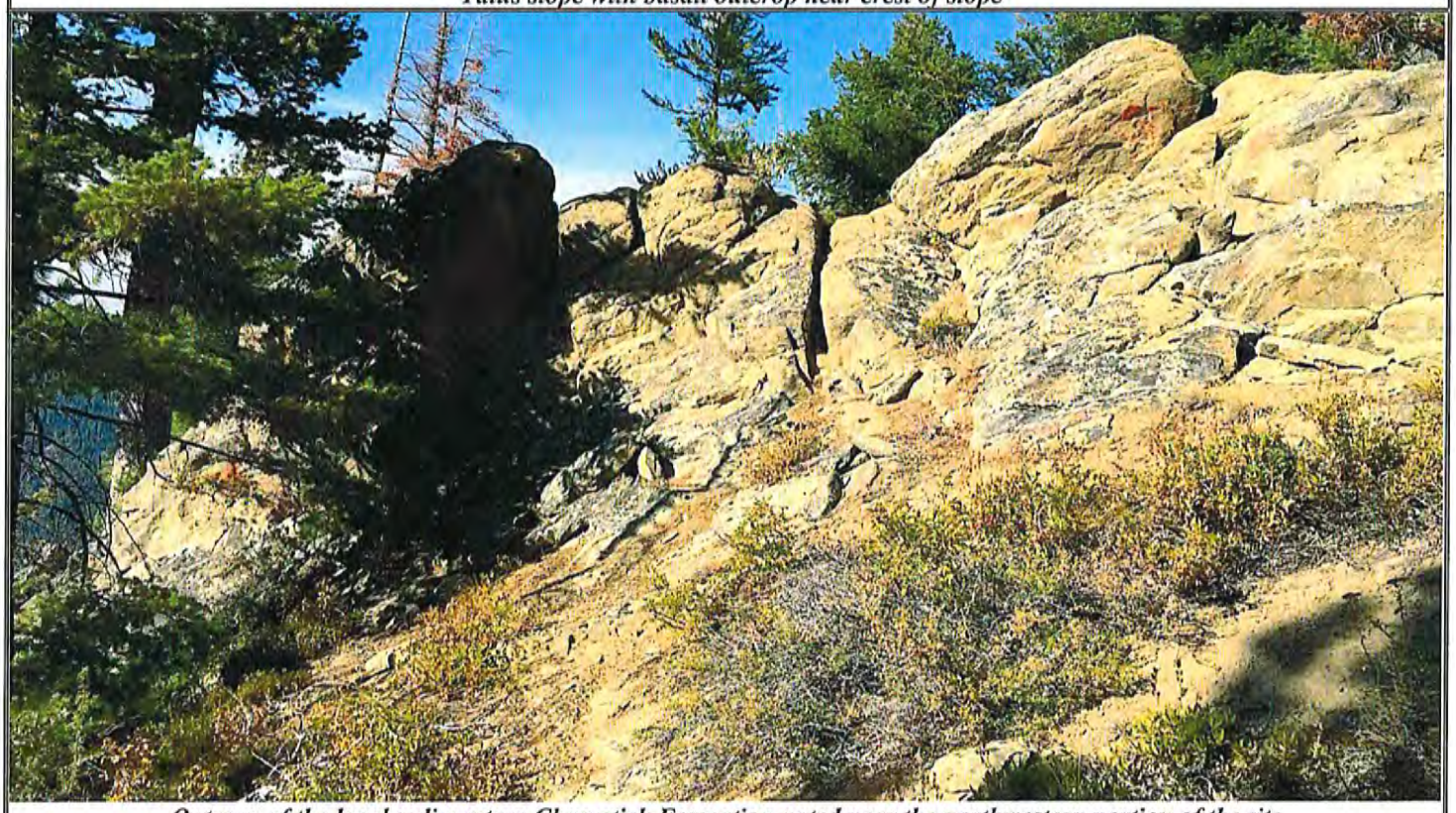
Site Photographs
The Village at Mission Ridge
Chelan County, Washington

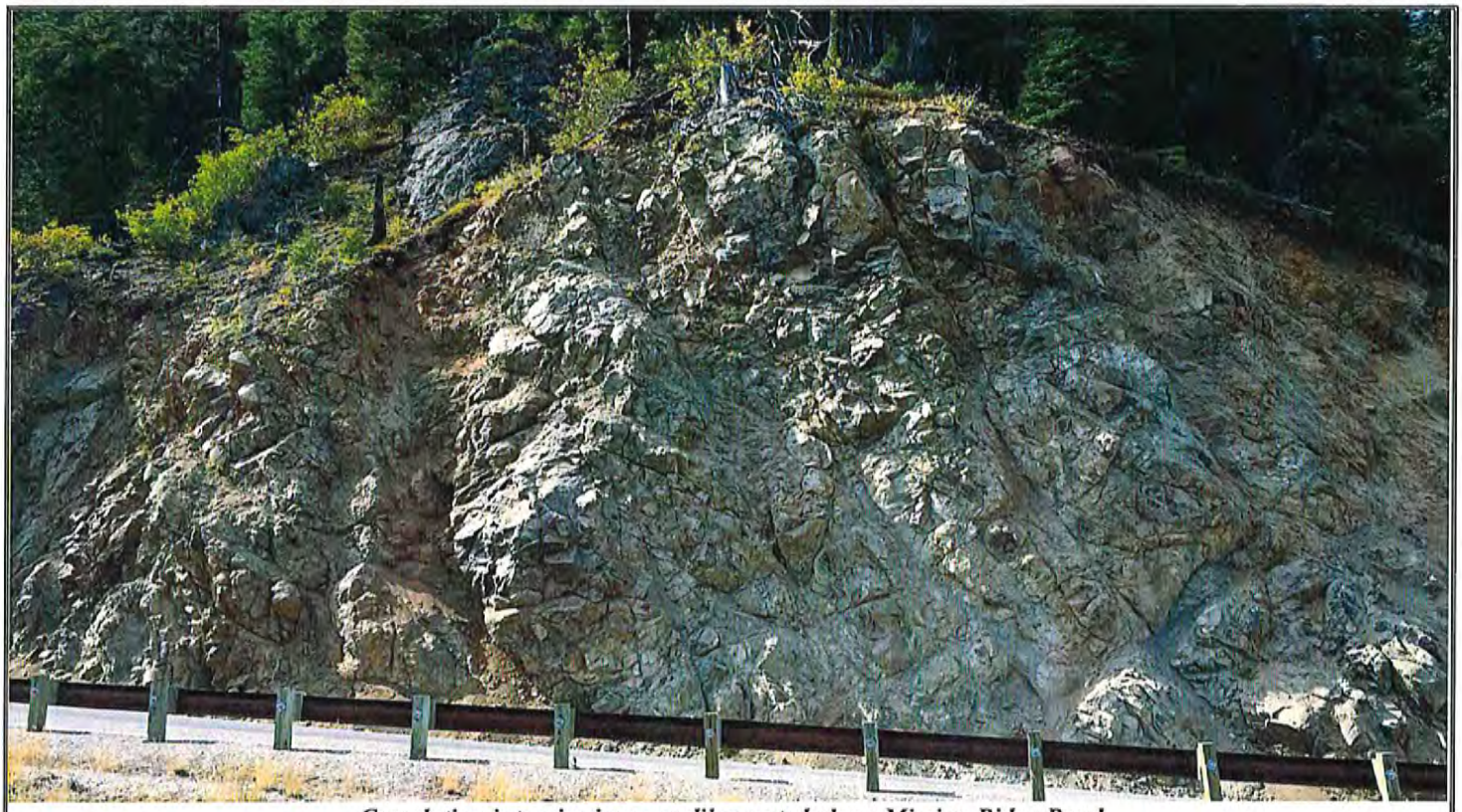
Date	Mounted By:	Reviewed By:	Plate
11/15/2017	MYM	KAH	4

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)

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

Northern, Inc.

Job Number: 217-854

Site Photographs
The Village at Mission Ridge
Chelan County, Washington

Date	Mounted By:	Reviewed By:	Plate
11/15/2017	MYM	KAH	7

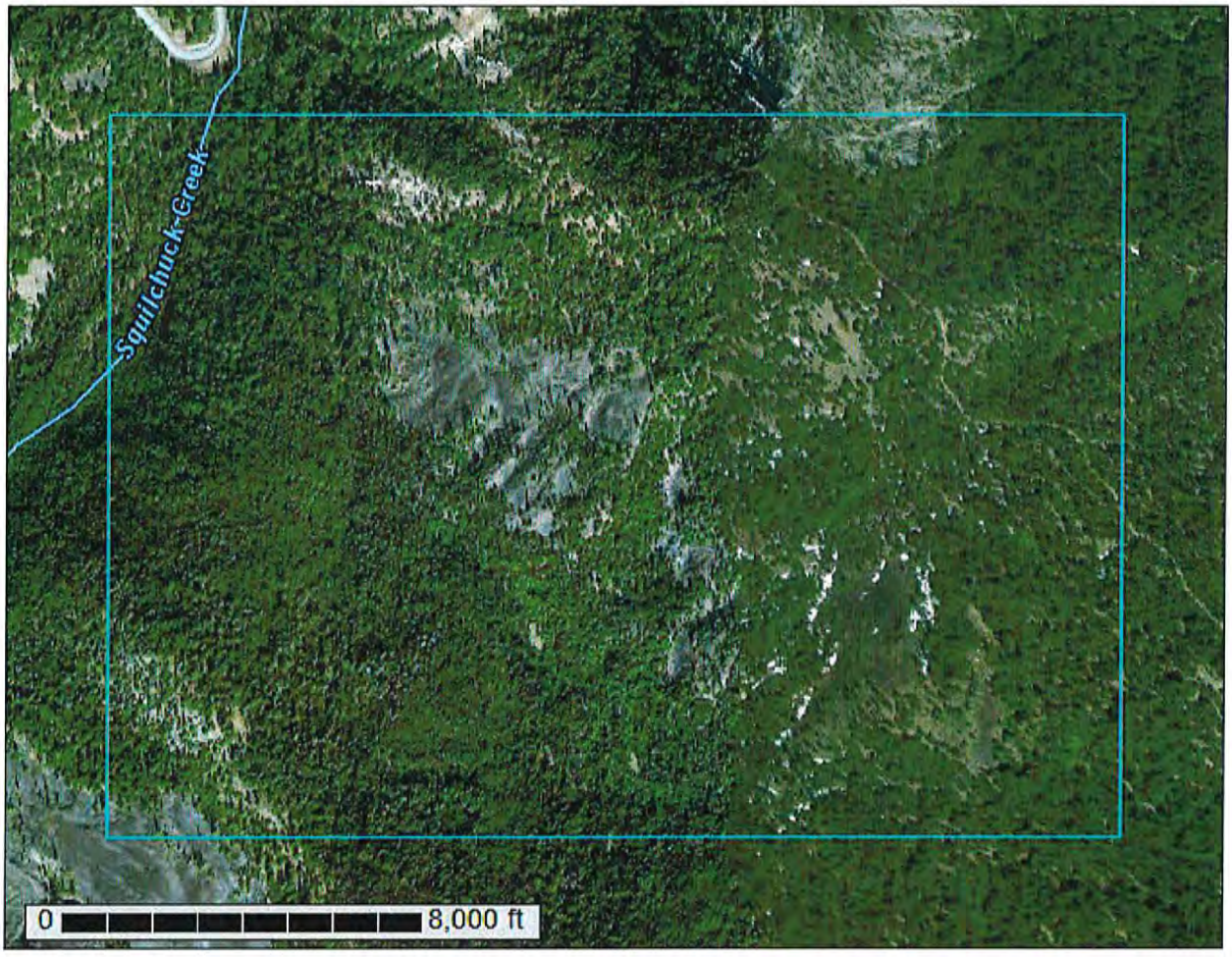
United States Department of Agriculture

NRCS

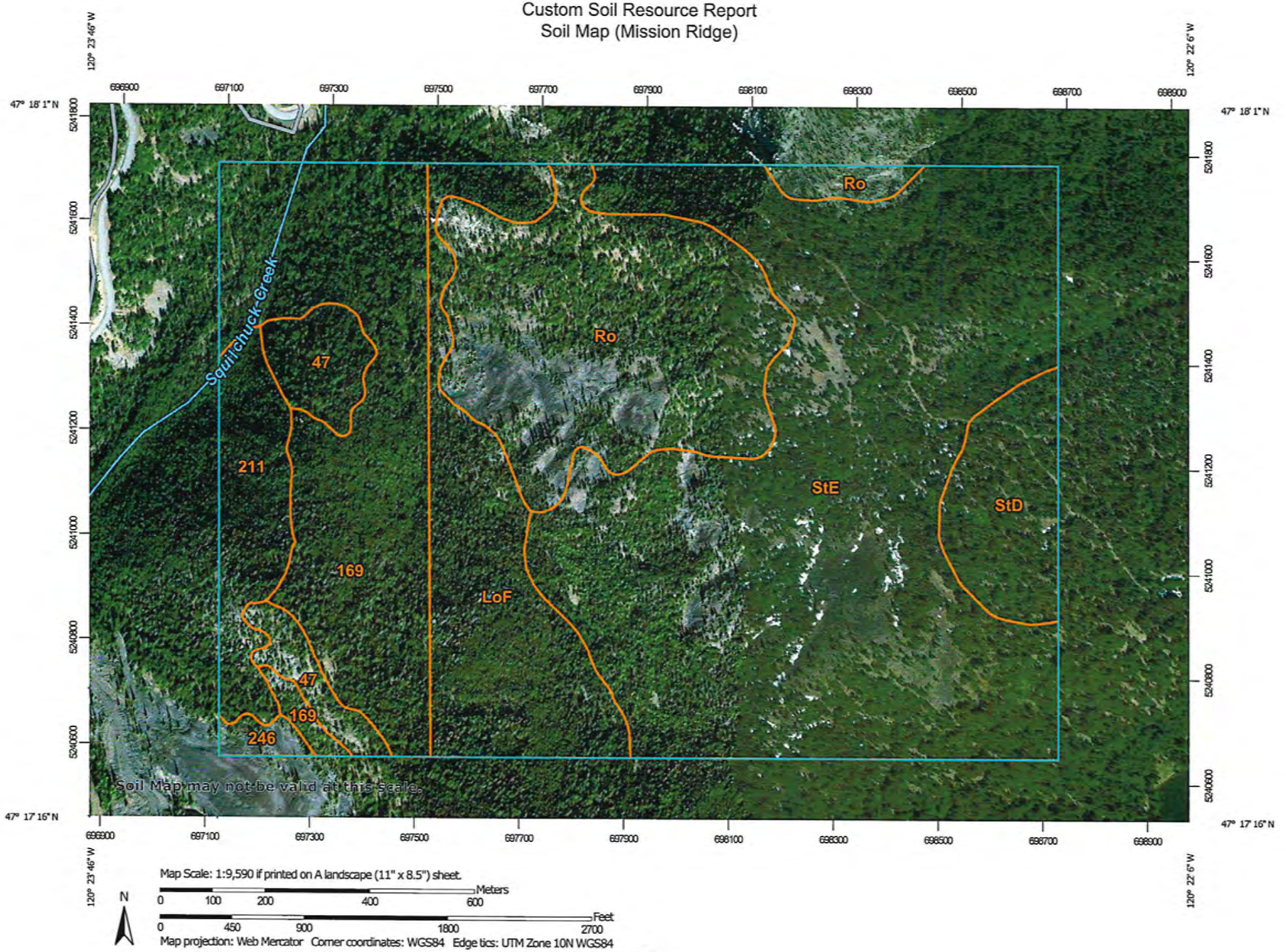
Natural Resources Conservation Service

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


120° 23' 46" W
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Squilchuck Creek
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169
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Meters
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Feet
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Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

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 19 E W.M. P

(2a) STREET ADDDRESS OF WELL (or nearest address) 7500 mission Ridge. Road Wenachee 98807

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

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

CENTRAL REGION OFFICE DEPT. OF ECOLOGY Received FEB 22 1999

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) _____ (WELL DRILLER) License No. 2359

Contractor's Registration No. HOLTDI*B606 Date 9-5-98, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

THIS REPORT MUST BE LEGIBLY AND ACCURATELY COMPLETED AND SIGNED WITHIN 30 DAYS AFTER COMPLETION OF WELL

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

Northern, Inc.
Consulting Engineers Environmental Scientists Construction Materials Testing

September 5, 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: **MEMORANDUM: Preliminary Geologic Site Reconnaissance**
Proposed Mission Ridge Ski Resort Expansion Project
Chelan County, Washington

Gentlemen,

As requested, GN Northern (GNN) has prepared this memorandum to summarize the preliminary findings of our recent site visits and reconnaissance of selected areas of the proposed Mission Ridge Ski Resort expansion project site near Wenatchee, Washington. We understand that the proposed expansion will include new resort development primarily within Section 19, Township 21 North, Range 19 East. The proposed access to the new resort expansion area will require a new roadway from the existing Mission Ridge resort base facilities extending through the SE ¼ of Section 24, T21N, R19E.

We understand that portions of the proposed expansion project site, including the proposed access roadway alignment, are located within areas designated by Chelan County as potentially geologically hazardous because of their possible susceptibility to erosion, sliding, earthquake, or other geological events, and will therefore require a geologic site assessment in accordance with Chapter 11.86 of the Chelan County Code.

GNN's senior engineering geologist/geotechnical engineer has conducted preliminary site reconnaissance along the alignment of the proposed access roadway that will extend from the main parking area of the existing Mission Ridge facilities up to the area of proposed expansion. The site walk for the proposed access roadway was conducted on July 24th and the upper area of the proposed expansion within Section 19 was conducted on July 25, 2017. The purpose of the preliminary reconnaissance was to gain an overview of the site conditions and constraints to determine possible

appropriate options and methods for exploration and evaluation of the existing geologic/geotechnical site conditions.

Based on a cursory review of published maps and documentation along with onsite observations, geologic units along the access roadway consist primarily of Eocene sedimentary rock of the Chumstick Formation overlain in places with mass wasting deposits including surface colluvium and talus debris. Two distinct areas of crystalline plutonic rock outcrops were noted along the alignment that present as steep cliffs and pinnacles. Based on preliminary observations, no apparent indications of recent slope instability were noted along the proposed access roadway alignment. The upper main area of proposed development consists of large areas of mass wasting deposits, consisting primarily of large cobble and boulder sized basalt talus with other areas of colluvium over the buried sedimentary rocks.

Detailed evaluation of the geologic units and associated risks of geologic hazards will require some degree of surface and subsurface exploration. Exploration techniques at the site may include exploratory test-pits, borings, and/or geophysical surveys such as seismic refraction. Due to the noted steep terrain and densely vegetated/wooded conditions, access for exploration will require a temporary road to be pioneered along the alignment of the proposed access roadway. The temporary road will allow access for subsurface exploration equipment such as a truck- or track-mounted drill rig, as well as provide a surface area for possible performance of geophysical surveys. Additionally, the limited upslope cuts of the temporary road may expose the near surface geologic units sufficiently enough to require only minimal additional exploration and inspection. At this time, the precise number, locations and methods for necessary points of exploration cannot be determined for certain until a temporary access road is pioneered and observed/documented.

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

Respectfully submitted,

GN Northern, Inc.

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

Northern, Inc.
Consulting Engineers Environmental Scientists Construction Materials Testing

November 9, 2018

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

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

Subject: **Feasibility-Level Geologic/Geotechnical Study of Proposed Access Roadway**
Proposed Mission Ridge Ski Resort Expansion Project
Chelan County, Washington

GNN Project No. 217-854

Reference: GN Northern, Inc., *Reconnaissance-Level Evaluation of Geologic Hazards Report, Proposed Mission Ridge Ski Resort Expansion Project, The Village at Mission Ridge, Chelan County, WA*, GNN Project No.: 217-854, dated April 10, 2018

Gentlemen,

As requested, GN Northern (GNN) has prepared this summary report presenting the findings of our feasibility-level geologic/geotechnical study of the proposed access roadway alignment that will extend through the SE ¼ of Section 24, T21N, R19E between the existing Mission Ridge Ski Resort base camp area and the proposed expansion project site. This report should be considered a supplement to the above-referenced April 2018 Geologic Hazards Report.

As previously noted, portions of the proposed expansion project site and access roadway alignment are located within areas designated by Chelan County as potentially geologically hazardous because of their possible susceptibility to erosion, sliding, earthquake, or other geological events, and therefore require a geologic site assessment in accordance with Chapter 11.86 of the Chelan County Code.

An initial site reconnaissance of the recently pioneered trail along the access roadway alignment was performed on October 2, 2018. At the time of this visit, excavation efforts were ongoing and the full alignment of the trail had not been pioneered-in. The purpose of this initial site visit was to observe the exposed geologic conditions of the cut faces and formulate a program for field exploration.

Additional detailed reconnaissance and field exploration was completed on October 10, 2018 after the excavator had completed the roughed-in trail to near the east end tie-in point of the proposed expansion area. Eight (8) exploratory test-pits were excavated using a CAT 307E excavator to depths ranging from approximately 8 to 16 feet BGS on the cut side of the trail with the surface referenced at the top of the cut. Exploratory test-pits were logged by a GNN field geologist. Upon completion, the test-pits were loosely backfilled with the excavated soils. The attached test-pit logs include more detailed descriptions of the soils/rock encountered. The exploratory test locations are shown on *Site & Exploration Map* (Figure 1).

Based on a review of published maps and documentation, geologic units along the access roadway are mapped to consist of Eocene sedimentary rock of the Chumstick Formation overlain in places with mass wasting deposits including surface colluvium and talus debris. However, site-specific field observations reveal that the primary underlying geologic unit along the majority of proposed access roadway alignment consist primarily of granitic plutonic bedrock. The noted granitic rock exhibited varying degrees of weathering, ranging from completely weathered/residual soil to fresh hard rock including very competent exposed outcrops that present as steep cliffs and pinnacles. Site observations provide no apparent indications of recent slope instability along the alignment of the access roadway.

Based on our site reconnaissance observations and test-pit exploration, it is evident that while the majority of the central portion of the roadway alignment between the base camp and the proposed expansion area consists of granitic rock exposed at or near the surface, slopes near the northeast (area near test-pit TP-1) and southwest (from base camp to near test-pit TP-7) ends of the alignment typically include a variably thick layer of colluvium and mass wasting deposits. These mass wasting deposits consist primarily of large cobble and boulder sized basalt rocks within a silty/ashy matrix and/or coarse basalt talus as discussed in the referenced report. Our delineation of the areas that included surficial mass wasting deposits was noted to correlate fairly well with the 'Landslide Hazard' overlay from the Chelan County GIS map.

The new roadway will require cut and fill grading for construction of the road surface along with development of stable cut and fill slopes above and below the alignment. In general, cuts into the onsite competent granitic rock at/near vertical gradients should meet or exceed minimum recommended slope stability safety factors. The in-place weathered granitic rock will typically be stable at slope gradients

ranging from relatively steep to 1H:1V, depending on the degree of weathering. Depending on the height of the cut, the mass wasting deposits (including localized colluvium and talus chutes) will likely require grading at gradients of approximately 2H:1V or shallower in order to meet minimum recommended slope stability safety factors, and/or the use of retaining structures. However, determination of safe cut slope gradients into weathered granitic rock and mass wasting deposits will require slope stability analysis. Appropriate grading with keying and benching and placement of engineered fill per the recommendations of a design-level geotechnical engineering report will be required to develop stable project fill slopes.

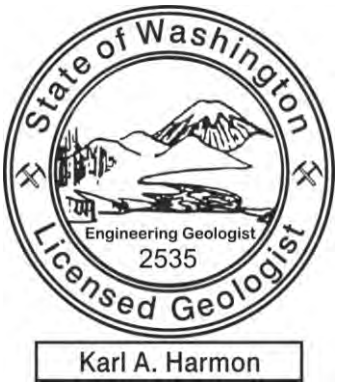
Based on the findings of our preliminary investigation of the apparent geologic/geotechnical site constraints that will affect the proposed roadway, it is our professional opinion that the new access road project is feasible and can be engineered and constructed in a manner that will appropriately mitigate any significant concerns related to potential geologic hazards. A full design-level evaluation will be required for appropriate design of the new access roadway including additional subsurface exploration with the use of exploratory rock coring borings and seismic refraction geophysical surveys. The currently prepared temporary pioneered trail alignment will be required to provide the necessary access to accommodate a truck- or track-mounted drill rig to perform additional geotechnical/ geophysical exploration.

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

Respectfully submitted,

GN Northern, Inc.

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



Attachments:
- *Site & Exploration (Figure 1)*
- *Test-Pit Logs*
- *Site & Exploration Photographs*

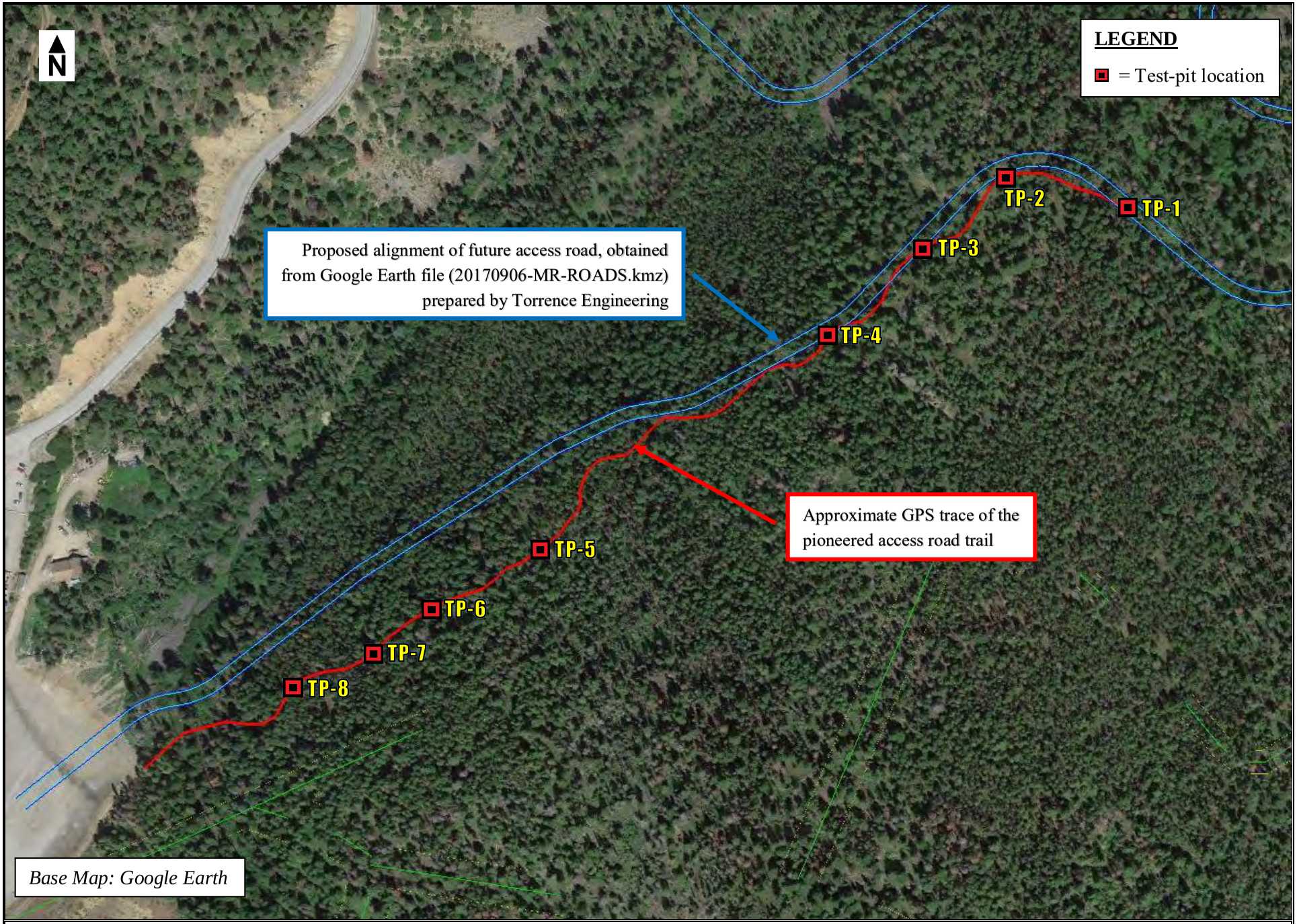


FIGURE 1: SITE & EXPLORATION MAP **PROJECT NO. 217-854**

GN Northern Inc.
11115 E. Montgomery, Suite C
Spokane Valley, WA, 99206
Telephone: (509) 248-9798
Fax: (509) 248-4220

TEST PIT NUMBER TP-1

CLIENT Mission Ridge Ski and Board Resort
PROJECT NAME Proposed Mission Ridge Ski Resort Expansion Project
PROJECT NUMBER 217-854
PROJECT LOCATION 7500 Mission Ridge Road, Wenatchee, WA 98801
DATE STARTED 10/10/18 **COMPLETED** 10/10/18
GROUND ELEVATION 4492 ft **TEST PIT SIZE** 24 X 96 inches
EXCAVATION CONTRACTOR Client Provided
GROUND WATER LEVELS:
EXCAVATION METHOD CAT 307E Excavator
AT TIME OF EXCAVATION ---
LOGGED BY MBB **CHECKED BY** KAH
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 47°17'45.65"N, 120°23'20.70"W
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0				TOPSOIL/COLLUVIUM, dark brown, with organics	
1.0					4491.0
		SM		SILTY SAND, (SM) dark brown, fine to coarse grained, damp, appears loose to medium dense, with cobbles, with roots, (COLLUVIUM)	
5					
6.0					4486.0
				HIGHLY/MODERATELY WEATHERED GRANITIC BEDROCK, friable to SILTY SAND (SM), light brown, coarse grained	
10				- becomes moderately weathered, gray, fine grained	
14.5					4477.5

- Groundwater not encountered at time of excavation
- Referenced elevations are approximate and based on Google Earth topography

Bottom of test pit at 14.5 feet.

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 11/8/18 16:23 - \\SEAGATE-3FEB68\PUBLIC\4-PROJECT ARCHIVE\217-854 MISSION RIDGE SKI RESORT\LOGS.GPJ

GN Northern Inc.
11115 E. Montgomery, Suite C
Spokane Valley, WA, 99206
Telephone: (509) 248-9798
Fax: (509) 248-4220

TEST PIT NUMBER TP-2

CLIENT Mission Ridge Ski and Board Resort
PROJECT NAME Proposed Mission Ridge Ski Resort Expansion Project
PROJECT NUMBER 217-854
PROJECT LOCATION 7500 Mission Ridge Road, Wenatchee, WA 98801
DATE STARTED 10/10/18 **COMPLETED** 10/10/18
GROUND ELEVATION 4490 ft **TEST PIT SIZE** 24 X 96 inches
EXCAVATION CONTRACTOR Client Provided
GROUND WATER LEVELS:
EXCAVATION METHOD CAT 307E Excavator
AT TIME OF EXCAVATION ---
LOGGED BY MBB **CHECKED BY** KAH
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 47°17'46.08"N, 120°23'24.60"W
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			TOPSOIL/COLLUVIUM, dark brown, with organics	
1.0				4489.0
			COMPLETELY WEATHERED GRANITIC BEDROCK/RESIDUAL SOIL, friable to SILTY SAND (SM), with cobbles, dark brown, fine to coarse grained, damp to moist, appears medium dense, with roots	
5			- becomes highly weathered, light brown, coarse grained	
8.0			- becomes moderately/slightly weathered	4482.0

- Test-pit terminated at ~8' BGS due to excavator bucket refusal
- Groundwater not encountered at time of excavation
- Referenced elevations are approximate and based on Google Earth topography

Bottom of test pit at 8.0 feet.

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 11/8/18 16:23 - \\SEAGATE-3FEB68\PUBLIC\4-PROJECT ARCHIVE\217-854 MISSION RIDGE SKI RESORT\LOGS.GPJ

GN Northern Inc.
11115 E. Montgomery, Suite C
Spokane Valley, WA, 99206
Telephone: (509) 248-9798
Fax: (509) 248-4220

TEST PIT NUMBER TP-3

CLIENT Mission Ridge Ski and Board Resort
PROJECT NAME Proposed Mission Ridge Ski Resort Expansion Project
PROJECT NUMBER 217-854
PROJECT LOCATION 7500 Mission Ridge Road, Wenatchee, WA 98801
DATE STARTED 10/10/18 **COMPLETED** 10/10/18
GROUND ELEVATION 4468 ft **TEST PIT SIZE** 24 X 96 inches
EXCAVATION CONTRACTOR Client Provided
GROUND WATER LEVELS:
EXCAVATION METHOD CAT 307E Excavator
AT TIME OF EXCAVATION ---
LOGGED BY MBB **CHECKED BY** KAH
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 47°17'44.45"N, 120°23'27.02"W
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TOPSOIL/COLLUVIUM, dark brown, with organics
1.0			4467.0
			COMPLETELY WEATHERED GRANITIC BEDROCK/RESIDUAL SOIL, friable to SILTY SAND (SM), with cobbles, dark brown, fine to coarse grained, damp to moist, appears medium dense, with roots
5			- becomes highly/moderately weathered, light brown, coarse grained
8.0			4460.0

- Test-pit terminated at ~8' BGS due to excavator bucket refusal
- Groundwater not encountered at time of excavation
- Referenced elevations are approximate and based on Google Earth topography

Bottom of test pit at 8.0 feet.

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 11/8/18 16:23 - \\SEAGATE-3FEB68\PUBLIC\4-PROJECT ARCHIVE\217-854 MISSION RIDGE SKI RESORT\LOGS.GPJ

GN Northern Inc.
11115 E. Montgomery, Suite C
Spokane Valley, WA, 99206
Telephone: (509) 248-9798
Fax: (509) 248-4220

TEST PIT NUMBER TP-4

CLIENT Mission Ridge Ski and Board Resort
PROJECT NAME Proposed Mission Ridge Ski Resort Expansion Project
PROJECT NUMBER 217-854
PROJECT LOCATION 7500 Mission Ridge Road, Wenatchee, WA 98801
DATE STARTED 10/10/18 **COMPLETED** 10/10/18
GROUND ELEVATION 4452 ft **TEST PIT SIZE** 24 X 96 inches
EXCAVATION CONTRACTOR Client Provided
GROUND WATER LEVELS:
EXCAVATION METHOD CAT 307E Excavator
AT TIME OF EXCAVATION ---
LOGGED BY MBB **CHECKED BY** KAH
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 47°17'42.50"N, 120°23'29.82"W
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TOPSOIL/COLLUVIUM, dark brown, with organics
1.0			4451.0
			COMPLETELY WEATHERED GRANITIC BEDROCK/RESIDUAL SOIL, friable to SILTY SAND (SM), with cobbles, dark brown, fine to coarse grained, damp to moist, appears medium dense, with roots
5			
10			- becomes highly weathered, light brown, coarse grained
			- becomes gray
15			
16.0			4436.0

- Groundwater not encountered at time of excavation
- Referenced elevations are approximate and based on Google Earth topography

Bottom of test pit at 16.0 feet.

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 11/8/18 16:23 - \\SEAGATE-3FEB68\PUBLIC\4-PROJECT ARCHIVE\217-854 MISSION RIDGE SKI RESORT\LOGS.GPJ

GN Northern Inc.
11115 E. Montgomery, Suite C
Spokane Valley, WA, 99206
Telephone: (509) 248-9798
Fax: (509) 248-4220

TEST PIT NUMBER TP-5

CLIENT Mission Ridge Ski and Board Resort
PROJECT NAME Proposed Mission Ridge Ski Resort Expansion Project
PROJECT NUMBER 217-854
PROJECT LOCATION 7500 Mission Ridge Road, Wenatchee, WA 98801
DATE STARTED 10/10/18 **COMPLETED** 10/10/18
GROUND ELEVATION 4574 ft **TEST PIT SIZE** 24 X 96 inches
EXCAVATION CONTRACTOR Client Provided
GROUND WATER LEVELS:
EXCAVATION METHOD CAT 307E Excavator
AT TIME OF EXCAVATION ---
LOGGED BY MBB **CHECKED BY** KAH
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 47°17'37.47"N, 120°23'38.30"W
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TOPSOIL/COLLUVIUM, dark brown, with organics
1.0			4573.0
			HIGHLY WEATHERED GRANITIC BEDROCK, friable to SILTY SAND (SM), light brown, coarse grained
5			
10			
			- becomes highly/moderately weathered, gray
14.5			4559.5

- Groundwater not encountered at time of excavation
- Referenced elevations are approximate and based on Google Earth topography

Bottom of test pit at 14.5 feet.

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GN Northern Inc.
11115 E. Montgomery, Suite C
Spokane Valley, WA, 99206
Telephone: (509) 248-9798
Fax: (509) 248-4220

TEST PIT NUMBER TP-6

CLIENT Mission Ridge Ski and Board Resort
PROJECT NAME Proposed Mission Ridge Ski Resort Expansion Project
PROJECT NUMBER 217-854
PROJECT LOCATION 7500 Mission Ridge Road, Wenatchee, WA 98801
DATE STARTED 10/10/18 **COMPLETED** 10/10/18
GROUND ELEVATION 4565 ft **TEST PIT SIZE** 24 X 96 inches
EXCAVATION CONTRACTOR Client Provided
GROUND WATER LEVELS:
EXCAVATION METHOD CAT 307E Excavator
AT TIME OF EXCAVATION ---
LOGGED BY MBB **CHECKED BY** KAH
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 47°17'36.03"N, 120°23'41.50"W
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TOPSOIL/COLLUVIUM, dark brown, with organics
1.0			4564.0
			HIGHLY WEATHERED GRANITIC BEDROCK, friable to SILTY SAND (SM), light brown, coarse grained
5			
10			- becomes highly/moderately weathered, gray
15			15.0 4550.0

- Groundwater not encountered at time of excavation
- Referenced elevations are approximate and based on Google Earth topography

Bottom of test pit at 15.0 feet.

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GN Northern Inc.
11115 E. Montgomery, Suite C
Spokane Valley, WA, 99206
Telephone: (509) 248-9798
Fax: (509) 248-4220

TEST PIT NUMBER TP-7

CLIENT Mission Ridge Ski and Board Resort
PROJECT NAME Proposed Mission Ridge Ski Resort Expansion Project
PROJECT NUMBER 217-854
PROJECT LOCATION 7500 Mission Ridge Road, Wenatchee, WA 98801
DATE STARTED 10/10/18 **COMPLETED** 10/10/18
GROUND ELEVATION 4563 ft **TEST PIT SIZE** 24 X 96 inches
EXCAVATION CONTRACTOR Client Provided
GROUND WATER LEVELS:
EXCAVATION METHOD CAT 307E Excavator
AT TIME OF EXCAVATION ---
LOGGED BY MBB **CHECKED BY** KAH
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 47°17'34.99"N, 120°23'43.24"W
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0				TOPSOIL/COLLUVIUM, dark brown, with organics	
				1.0	4562.0
		SM		SILTY SAND/SANDY SILT, (SM) tan to gray, damp, appears loose to medium dense, with angular basaltic cobbles & boulders (COLLUVIUM)	
5					
10					
				12.0	4551.0
				HIGHLY/MODERATELY WEATHERED GRANITIC BEDROCK, friable to SILTY SAND (SM), light brown, coarse grained [note: contact slopes up towards the surface on east end of test pit]	
				14.0	4549.0

- Groundwater not encountered at time of excavation
- Referenced elevations are approximate and based on Google Earth topography

Bottom of test pit at 14.0 feet.

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GN Northern Inc.
11115 E. Montgomery, Suite C
Spokane Valley, WA, 99206
Telephone: (509) 248-9798
Fax: (509) 248-4220

TEST PIT NUMBER TP-8

CLIENT Mission Ridge Ski and Board Resort
PROJECT NAME Proposed Mission Ridge Ski Resort Expansion Project
PROJECT NUMBER 217-854
PROJECT LOCATION 7500 Mission Ridge Road, Wenatchee, WA 98801
DATE STARTED 10/10/18 **COMPLETED** 10/10/18
GROUND ELEVATION 4545 ft **TEST PIT SIZE** 24 X 96 inches
EXCAVATION CONTRACTOR Client Provided
GROUND WATER LEVELS:
EXCAVATION METHOD CAT 307E Excavator
AT TIME OF EXCAVATION ---
LOGGED BY MBB **CHECKED BY** KAH
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 47°17'34.18"N, 120°23'45.67"W
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0				TOPSOIL/COLLUVIUM, dark brown, with organics	
				1.0	4544.0
		GM		SILTY GRAVEL, (GM) brown, angular, moist, appears loose to medium dense, (COLLUVIUM)	
5				5.0	4540.0
				HIGHLY WEATHERED GRANITIC BEDROCK, weathers to stiff clay, light brown	
10					
				14.0	4531.0

- Groundwater not encountered at time of excavation
- Referenced elevations are approximate and based on Google Earth topography

Bottom of test pit at 14.0 feet.

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Observed conditions near northeast end of pioneered trail, looking east/southeast

Exposed profile at test-pit TP-1, including colluvium atop the buried granitic rock

Exposed profile at test-pit TP-2, with relatively shallow weathered granitic rock

Exposed profile at test-pit TP-3, with relatively shallow weathered granitic rock

Exposed cut profile at test-pit TP-4, with residual soil/completely weathered granitic rock

Exposed profile within excavation for test-pit TP-4, with highly weathered granitic rock

PLATE 1: SITE & EXPLORATION PHOTOGRAPHS **PROJECT NO. 217-854**

Resistant granite outcrop (pinnacle) up-slope of pioneered trail near test-pit TP-4, looking southwest

Close-up view of exposed granitic outcrop (pinnacle)

Exposed profile within excavation for test-pit TP-5, with highly weathered granitic rock

Exposed profile within excavation for test-pit TP-6, with highly weathered granitic rock

Exposed profile at test-pit TP-7, showing contact between colluvium atop the weathered granitic rock

Exposed profile at test-pit TP-8, including colluvium atop the highly weathered granitic rock

PLATE 2: SITE & EXPLORATION PHOTOGRAPHS **PROJECT NO. 217-854**

Northern, Inc.
Consulting Engineers Environmental Scientists Construction Materials Testing

September 5, 2019

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

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

Subject: **Report of Seismic Refraction Survey of the Proposed Access Roadway**
Proposed Mission Ridge Ski Resort Expansion Project
Chelan County, Washington

GNN Project No. 217-854

Reference: GN Northern, Inc., November 9, 2018. Feasibility-Level Geologic/Geotechnical Study of Proposed Access Roadway, Proposed Mission Ridge Ski Resort Expansion Project, Chelan County, WA, GNN Project No.: 217-854.

Torrence Engineering, LLC, June 9, 2019. Mission Ridge – Ski Area, Site Improvements, preliminary civil drawings, 3 sheets.

Gentlemen,

As requested, GN Northern (GNN) has prepared this summary report presenting the findings of the geophysical survey performed along segments of the as-pioneered trail for the proposed access roadway alignment to extend between the Mission Ridge Ski Resort base camp area and the proposed expansion project site. The scope of these services included seismic refraction surveys to collect velocity data for the subsurface soil/rock conditions to assist with a plan for additional deeper exploration if/as necessary, to ultimately aid in cut slope analysis and design for the proposed access road.

Based on preliminary plans prepared by Torrence Engineering, we understand that the current concept for the proposed access roadway primarily includes cut grading into the existing hillside. The plans currently show limits of proposed regrading for cut slopes laid-back at 1H:1V to 1.5H:1V. We understand that an approximately 2,800-foot long retaining wall is planned along the fill (down-slope) side of the roadway, ranging in exposed heights from less 4 feet to 20 feet tall.

Prior to performing the seismic refraction survey lines along the trail, GNN conducted an initial site reconnaissance on July 2nd to determine the areas to be tested and pre-marked the planned seismic survey line locations. The planned lengths and locations were selected to augment the information obtained from the previous test-pit explorations performed at the site (see referenced report). During our site reconnaissance, we noted several areas of recent localized back-cut slope failures.

The seismic refraction method is based on the measurement of arrival times of seismic energy from a source (shot) to a receiver (geophone). The seismic energy travels as a body wave through the subsurface and when the wave encounters a transition to denser (higher velocity) material, it is refracted into the lower layer as a head wave according to Snell's Law. When the wave's ray-path is incident to the density transition at the critical angle, the refracted wave travels along the interface between the two layers at a higher velocity (V2). The direct body wave arrivals, traveling at a slower velocity (V1), are recorded at the geophones. At some distance from the source, the refracted head waves, traveling at a velocity of V2, arrive before the body waves. This distance is called the crossover distance. The first-arrival times from several shot locations are picked from data recorded on a seismograph and plotted on graphs of travel-time versus distance. The shot-receiver geometry, measured travel times, and calculated velocities (p-wave velocity, V_p) are then analyzed to produce profiles of the depth to, and topography of, the density interface and velocity layering of the subsurface.

The geophysical survey, consisting of seven (7) seismic refraction lines, was completed on July 25th & 26th, 2019 by our subconsultant Global Geophysics (see attached report). The seismic lines varied in length from approximately 115 to 200 feet and were widely spaced along the full length of the existing trail in an attempt to correlate with the test-pit information as well as fill the gaps of missing subsurface data. The full report provides cross-section of all the seismic refraction lines showing the compressional wave velocity (p-wave) profile with depth.

The interpretation of the seismic refraction data generally reveals three (3) subsurface geologic units with various depth profiles. The noted geologic units include the [i] variably thick upper mantle of mass wasting deposits and/or colluvium ($V_p \approx$ 500 to 3,000 ft/sec), the [ii] completely to moderately weathered granitic rock ($V_p \approx$ 3,000 to 7,000 ft/sec), and [iii] more competent (less weathered) granitic rock ($V_p >$ 7,000 ft/sec). Based on a comparison of the seismic refraction data and previously completed test-pits, it appears that the transition from the upper colluvial overburden soils to the top of the weathered granitic rock correlates fairly well with a $V_p \approx$ 3,000 ft/sec. Furthermore, it appears that test-pits excavated using the CAT 307E excavator encountered refusal on moderately weathered to competent granitic rock ($V_p \geq$ 6,000 ft/sec).

Interpreted depths of the near-surface colluvium generally vary from less than 5 feet to as great as approximately 20 to 25 feet, underlain by the upper weathered zone of the buried granitic rock. Depths to the lower competent granitic rock vary from less than approximately 5 to 30 feet across the central portions, and notably deeper, on the order of 40 to 50 feet or greater, along the west and east ends of the alignment as previously understood. The shallowest depths of the two upper units generally align with the areas of exposed resistant/competent rock outcrops (steep cliffs and pinnacles).

Based on ripper performance charts prepared by CAT (attached), velocities of the moderately weathered to competent granitic bedrock generally correlate to marginally 'rippable' rock using a CAT D8R, D9R & D10R rippers and 'rippable' rock using a CAT D11R ripper. Competent granitic rock with velocities in excess of 8,000 to 9,000 ft/sec are generally considered 'non-rippable' and will require blasting.

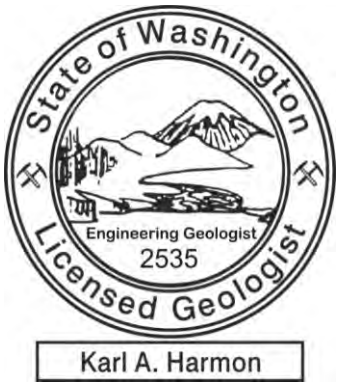
The findings of the seismic refraction survey generally confirm that proposed cuts into the competent granitic rock will likely be stable at near vertical gradients, while the weathered rock zone should allow for slope gradients on the order of 1H:1V or steeper. However, the overlying colluvium and mass wasting deposits will require remedial grading and reduced slope gradients, as well as the possible use of retaining structures to accommodate design grades. In order to provide the necessary design-level geotechnical engineering input for final civil design of the proposed roadway project, selected additional deeper points of exploration by means of soil borings and rock coring will be required. Design-level geotechnical services will include necessary retaining wall design and slope stability analyses to determine appropriate cut slope geometries based on site-specific strength/engineering parameters.

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

Respectfully submitted,

GN Northern, Inc.

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



Attachments:
- *Seismic Refraction Lines & Test-Pit Exploration (Figure 1)*
- *Report of Seismic Refraction Survey (prepared by Global Geophysics)*
- *CAT Ripper Performance Charts*

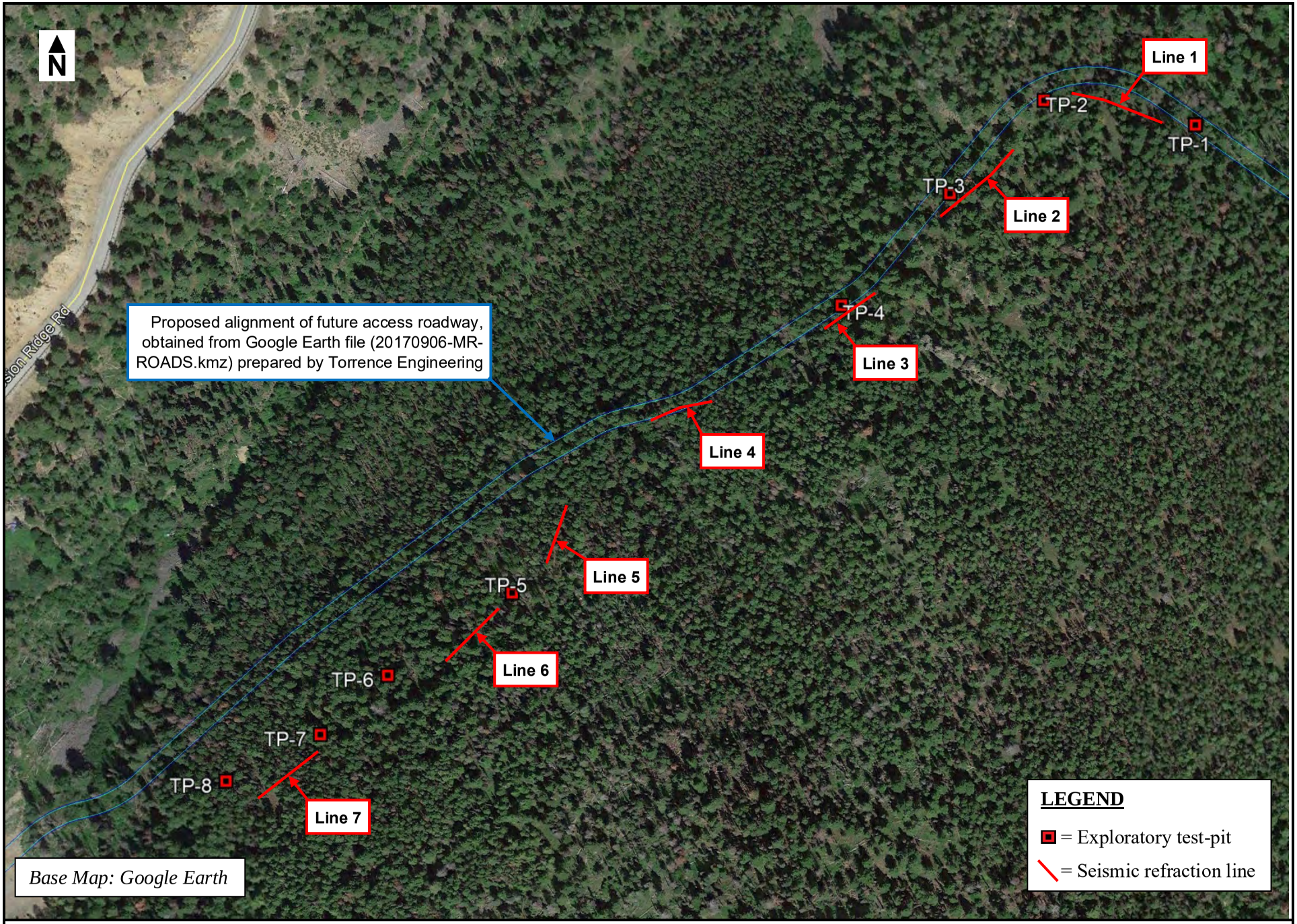


FIGURE 1: SEISMIC REFRACTION LINES & TEST-PIT EXPLORATION **PROJECT NO. 217-854**

Global Geophysics

P. O. Box 2229
Redmond, WA, 98073-2229
Tel: 425-890-4321
Fax: 360-805-0259

August 28, 2019 Our Ref.: 109-0705.000

GN Northern Inc.
722 North 16th Avenue, Suite 31
Yakima, WA 98902

Attention: Mr. Imran Magsi

RE: REPORT ON THE GEOPHYSICAL SURVEY FOR PROPOSED MISSION RIDGE ROAD, WENATCHEE, WA

Dear Mr. Magsi:

This letter report presents the results of the geophysical survey performed by Global Geophysics. The seismic refraction survey was carried out along 7 transects in August, 2019 along proposed Mission Ridge Road, near Wenatchee, WA. The objective of the geophysical survey is to depth to bedrock at this location.

GEOPHYSICAL METHODS AND FIELD PROCEDURES

Seismic refraction was used to determine the depth to bedrock and measure compressional wave velocities. The following paragraphs describe the method and field procedures.

Seismic Refraction

Seismic refraction is the traditional method for determining the rock velocity for rock rippability using a controlled energy source (hammer, blank shotgun shells, or chemical explosives) to generate a seismic signal. The seismic signals are received by a series of geophones (24, for example) that are connected to a seismic cable laid on the surface in a linear manner. The geophones, evenly spaced along the geophone cable, are placed on the ground surface. The seismic energy source (explosive) is discharged at several places along the array and off both ends.

The seismic wavelets travel through the earth to the geophones that convert the acoustic energy in the ground to an electric signal in the geophone cable. The seismograph detects the arriving electric signals with respect to time and stores the records for future data processing. The seismic data is processed to determine the seismic velocity of the earth material through which the energy has traveled and to model the subsurface geology. This geophysical model depicts the earth in cross-section showing the velocity and thickness of the subsurface layers below the seismic line.

The seismic refraction survey was conducted using a Geometrics Geode 24-channel digital seismograph. The sensors used were Mark Products 4.5-Hz vertical geophones and the seismic energy source was a 20 lb. sledgehammer. The typical field procedure consisted of laying out the cables and planting the geophones at 5 ft intervals. The shots were set off at seven locations along the geophone array. Data was collected and saved in digital format and a field record was produced on the computer screen to check the data quality in real time.

ANALYSIS AND RESULTS

The seismic refraction was conducted along 7 transects. The locations of the transects are shown in Figure 1.

The interpreted depth profiles are presented in Figures 2 and 3. Three geological units were interpreted.

- The surface layer: 500 ft/s to 3000 ft/s; overburden to extremely weathered rock;
- 2nd layer: 3000 ft/s to 7000 ft/s; highly weathered rock to competent rock
- Competent bedrock: 7000 ft/s

CLOSURE

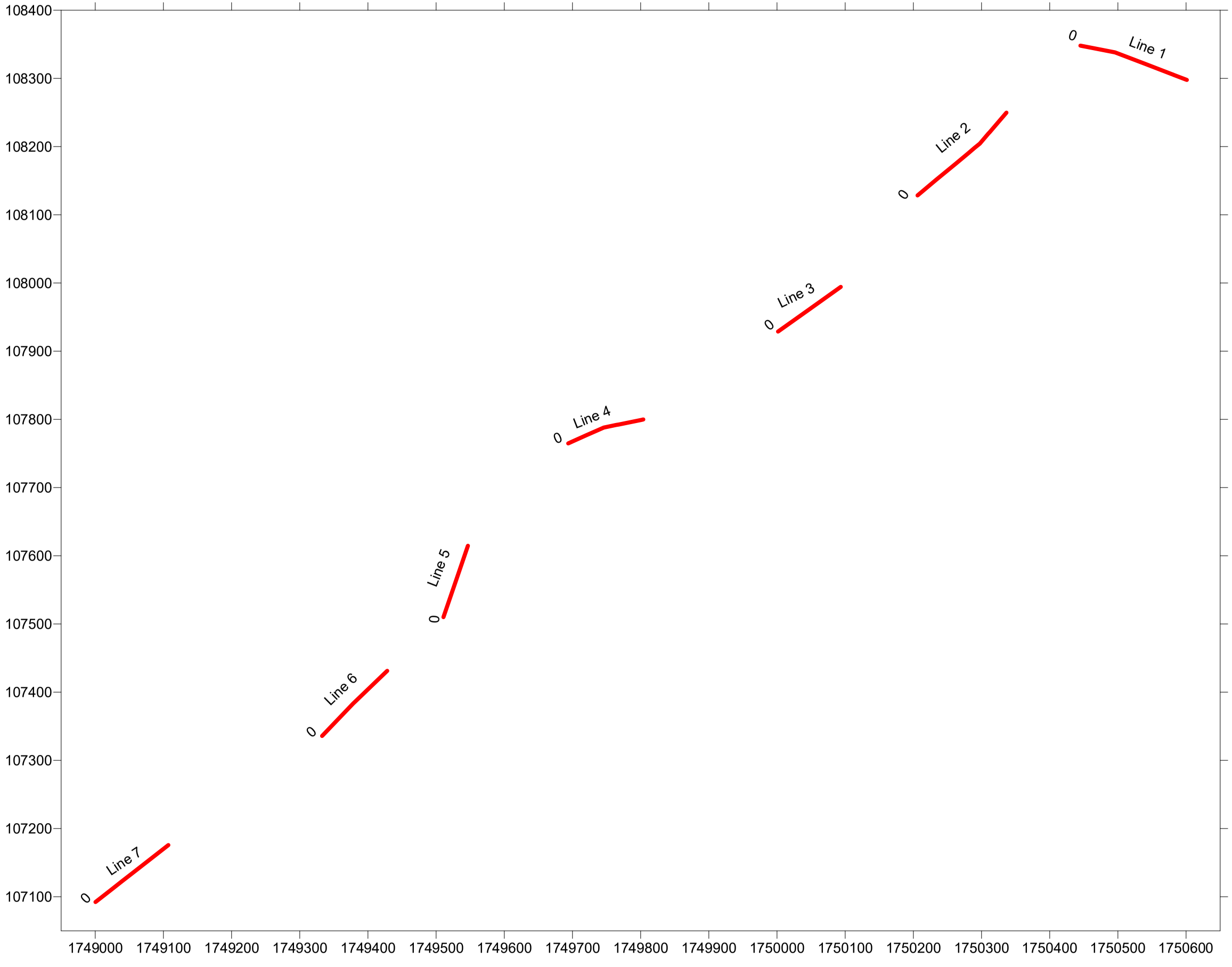
Global Geophysics services will be conducted in a manner consistent with the level of care and skill ordinarily exercised by other members of the geophysical community currently practicing under similar conditions subject to the time limits and financial and physical constraints applicable to the services. However, seismic refraction is a remote sensing geophysical method that may not detect all subsurface conditions. Furthermore, velocity inversion and hidden layers are the limitations of seismic refraction. In general, the errors in the interpreted depths and velocities, dependent on the resolution of the technique, are estimated to be approximately ±15 % of the true depths and velocities.

We appreciate the opportunity to work with you on this project, and we hope that you find the results of the geophysical survey useful to your investigation. If you have any questions regarding this report, please call the undersigned at 425-890-4321. We look forward to providing you with additional geophysical services in the future.

Sincerely,

Global Geophysics.

John Liu, Ph.D., R.G.
Principal Geophysicist



PROJECT

Seismic Refraction Survey
Mission Ridge, Wenatchee, WA

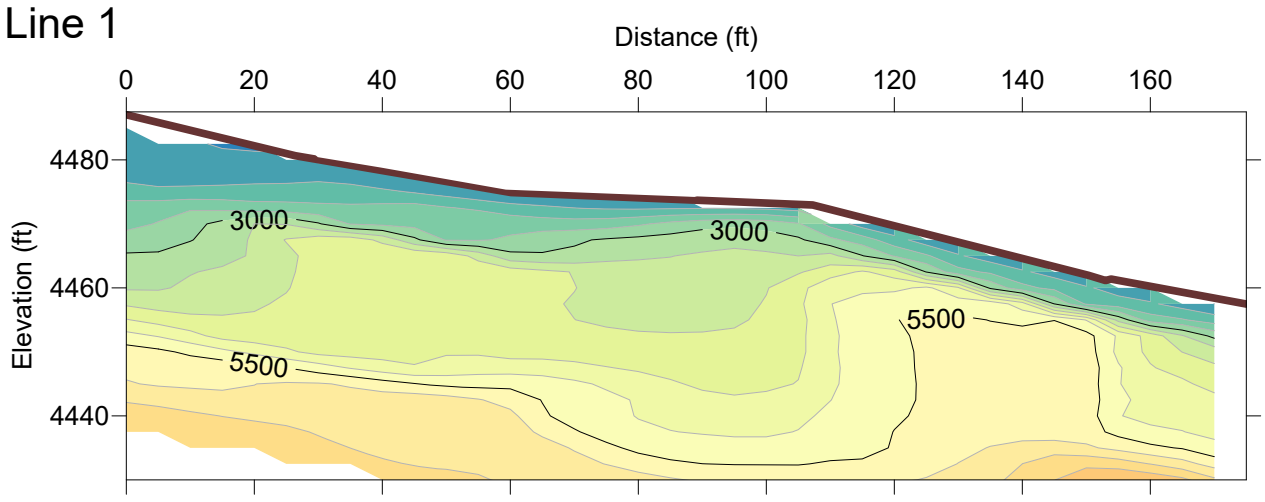
TITLE

Site Map

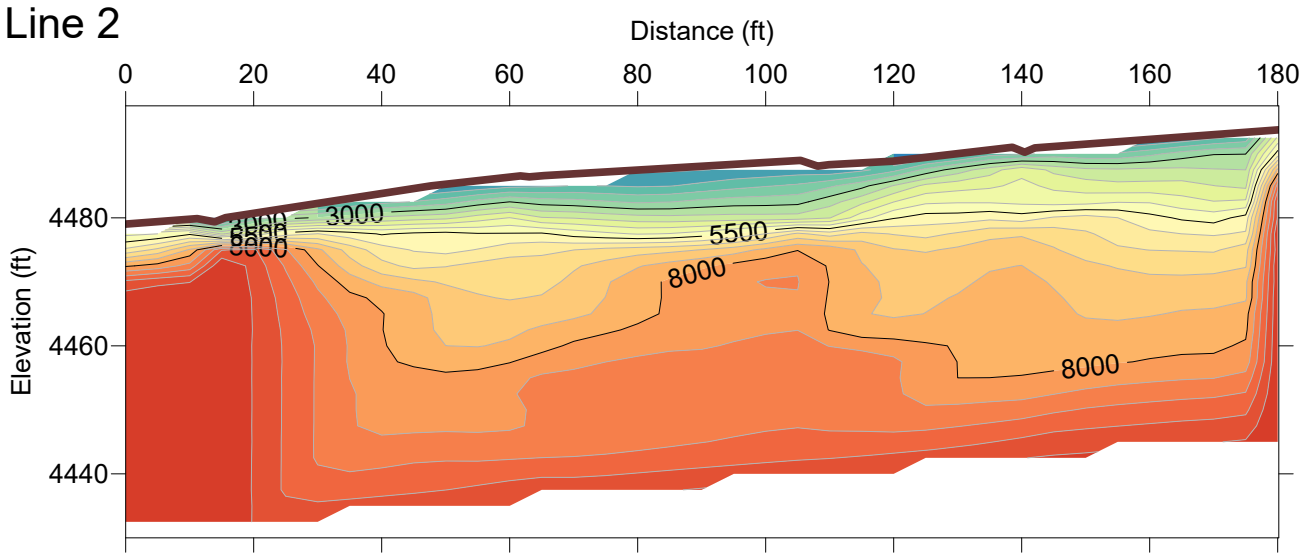
Global Geophysics
P.O. Box 2229
Redmond, WA 98073-2229
Tel: 425-890-4321

Project #: 109-0705.000			FILE No.
DESIGN	--		SCALE AS SHOWN REV.
CADD	EJ		
CHECK	JL		**FIGURE 1**
REVIEW	--		

Line 1



Line 2



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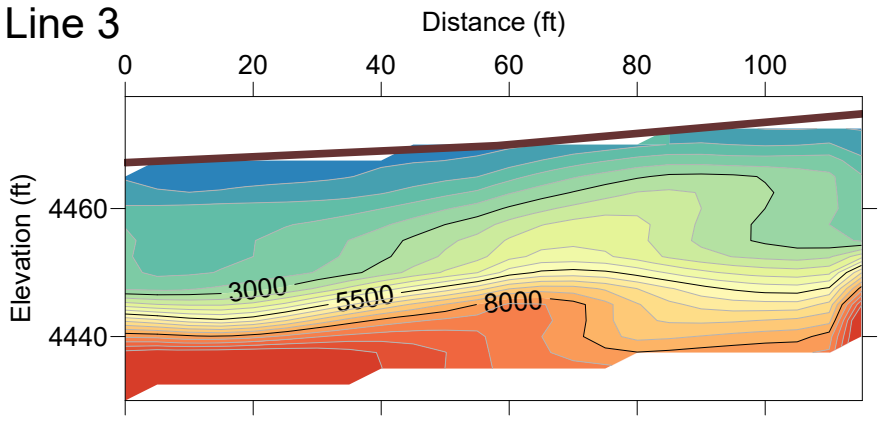

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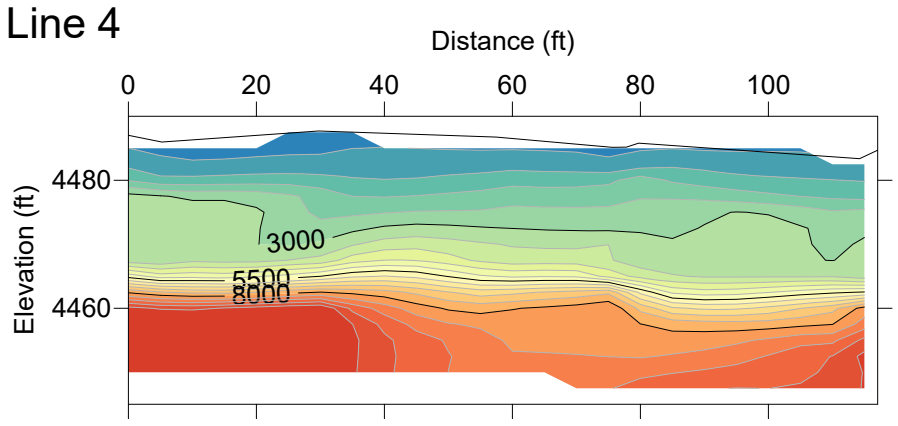
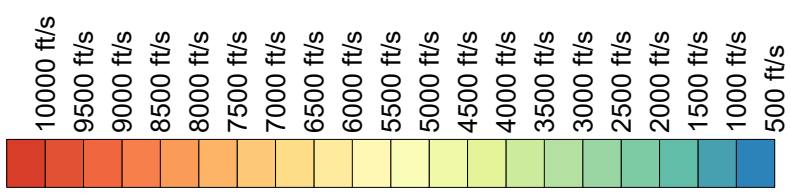
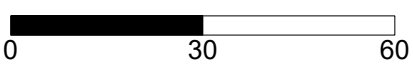




Legend:



PROJECT

Seismic Refraction Survey
Mission Ridge, Wenatchee, WA

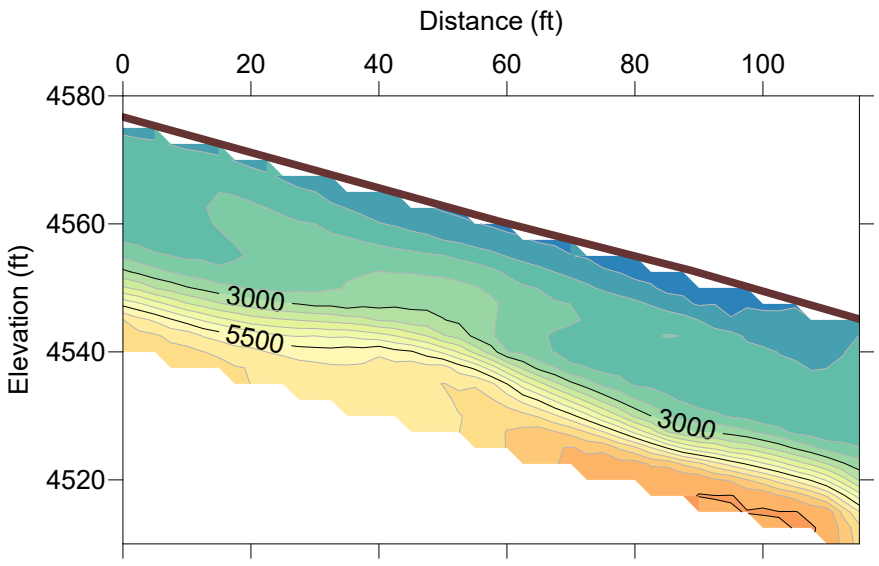
TITLE

P-wave velocity profiles
SL-1 - SL-4

Global Geophysics
P.O. Box 2229
Redmond, WA 98073-2229
Tel: 425-890-4321

Project #: 109-0705.000			FILE No.
DESIGN	--		SCALE AS SHOWN REV.
CADD	EJ		**FIGURE 2**
CHECK	JL		
REVIEW	--		

Line 5



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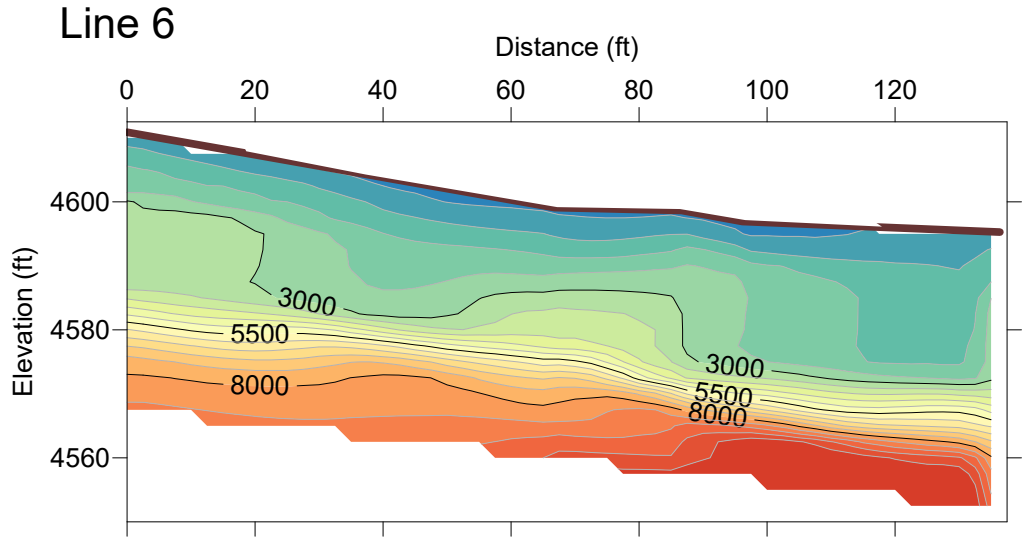

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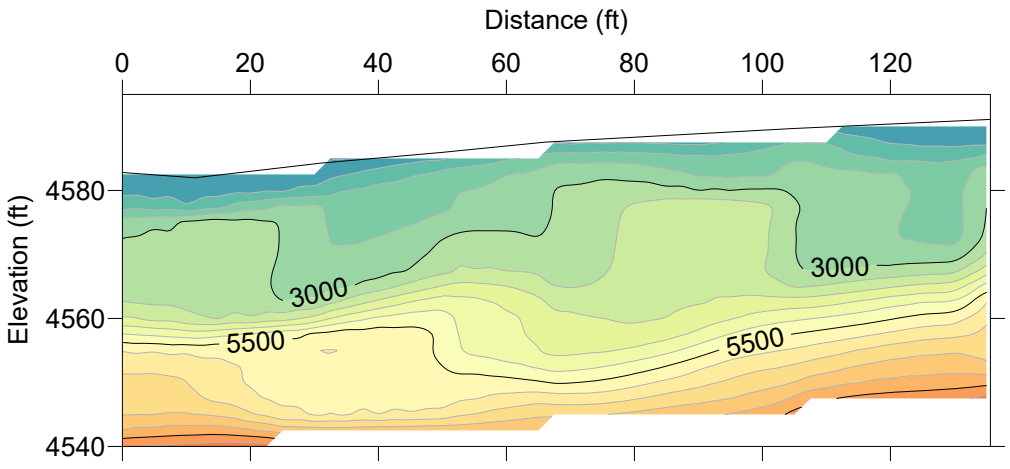
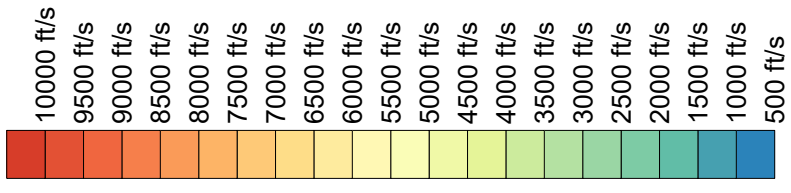




Legend:

Ground surface

0 ft 30 ft 60 ft

PROJECT

Seismic Refraction Survey
Mission Ridge, Wenatchee, WA

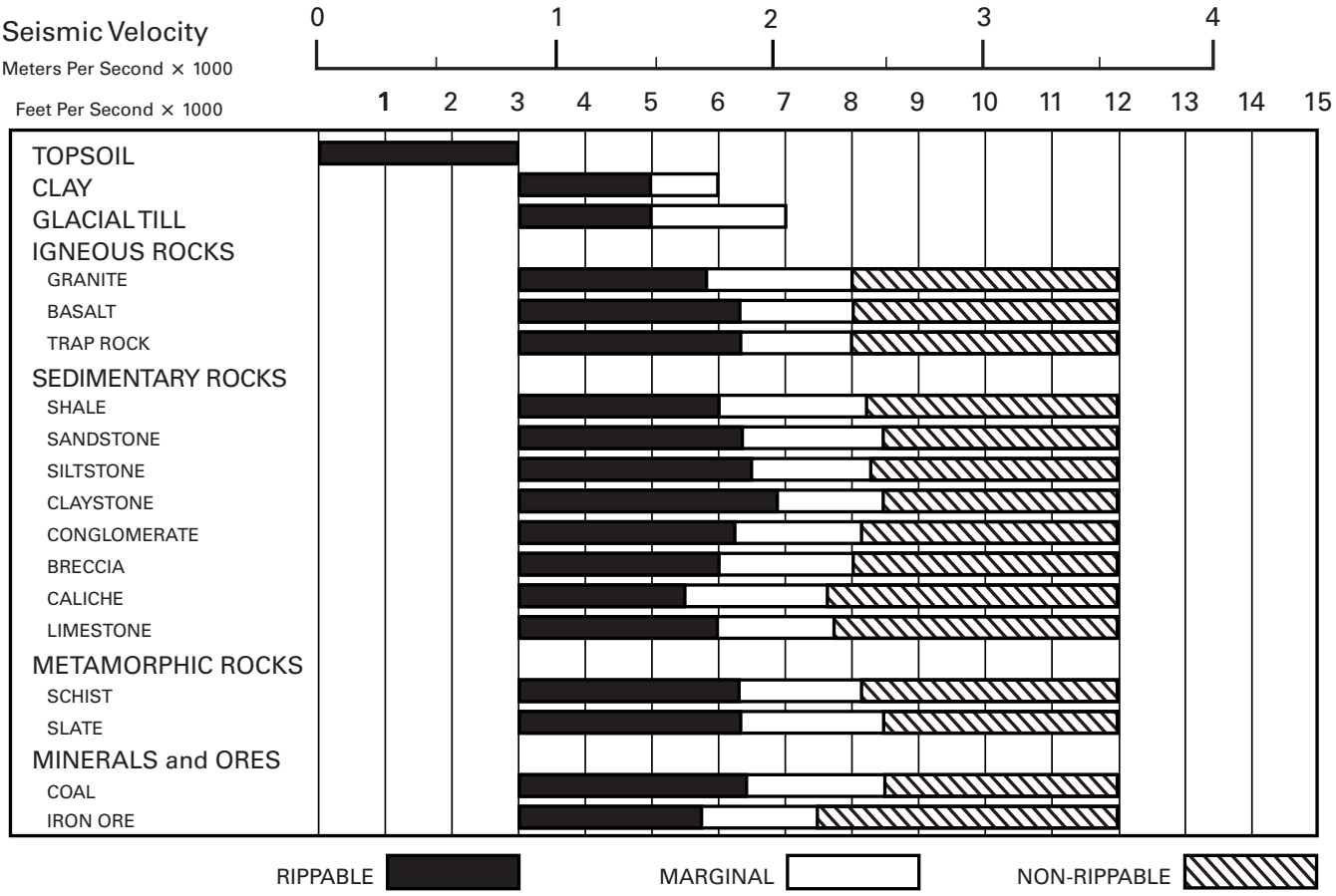
TITLE

P-wave velocity profiles
SL-5 - SL-7

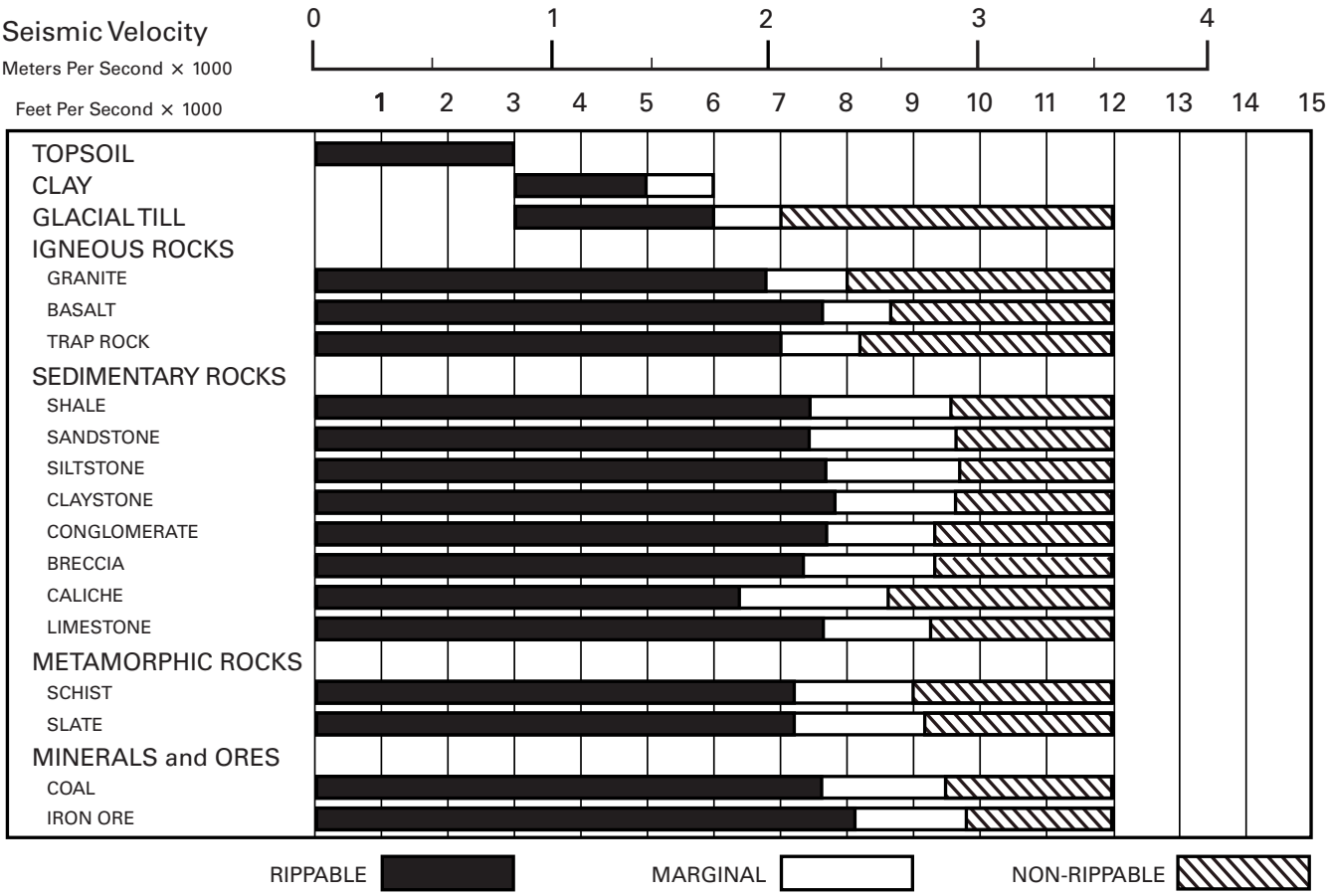
Global Geophysics
P.O. Box 2229
Redmond, WA 98073-2229
Tel: 425-890-4321

Project #: 109-0705.000			FILE No.
DESIGN	--		SCALE AS SHOWN REV.
CADD	EJ		
CHECK	JL		**FIGURE 3**
REVIEW	--		

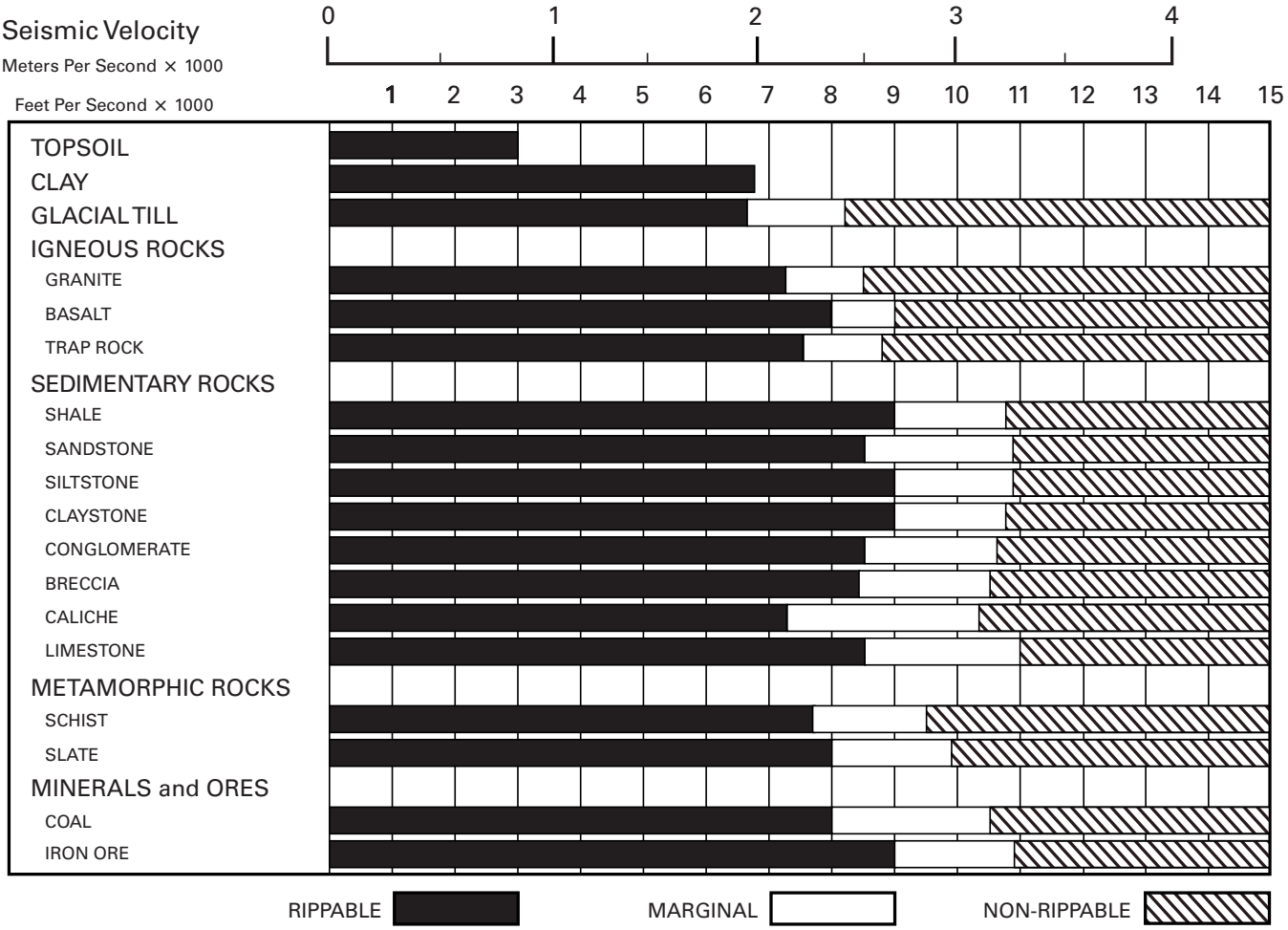
D8R/D8T
- **Multi- or Single Shank No. 8 Ripper**
- **Estimated by Seismic Wave Velocities**



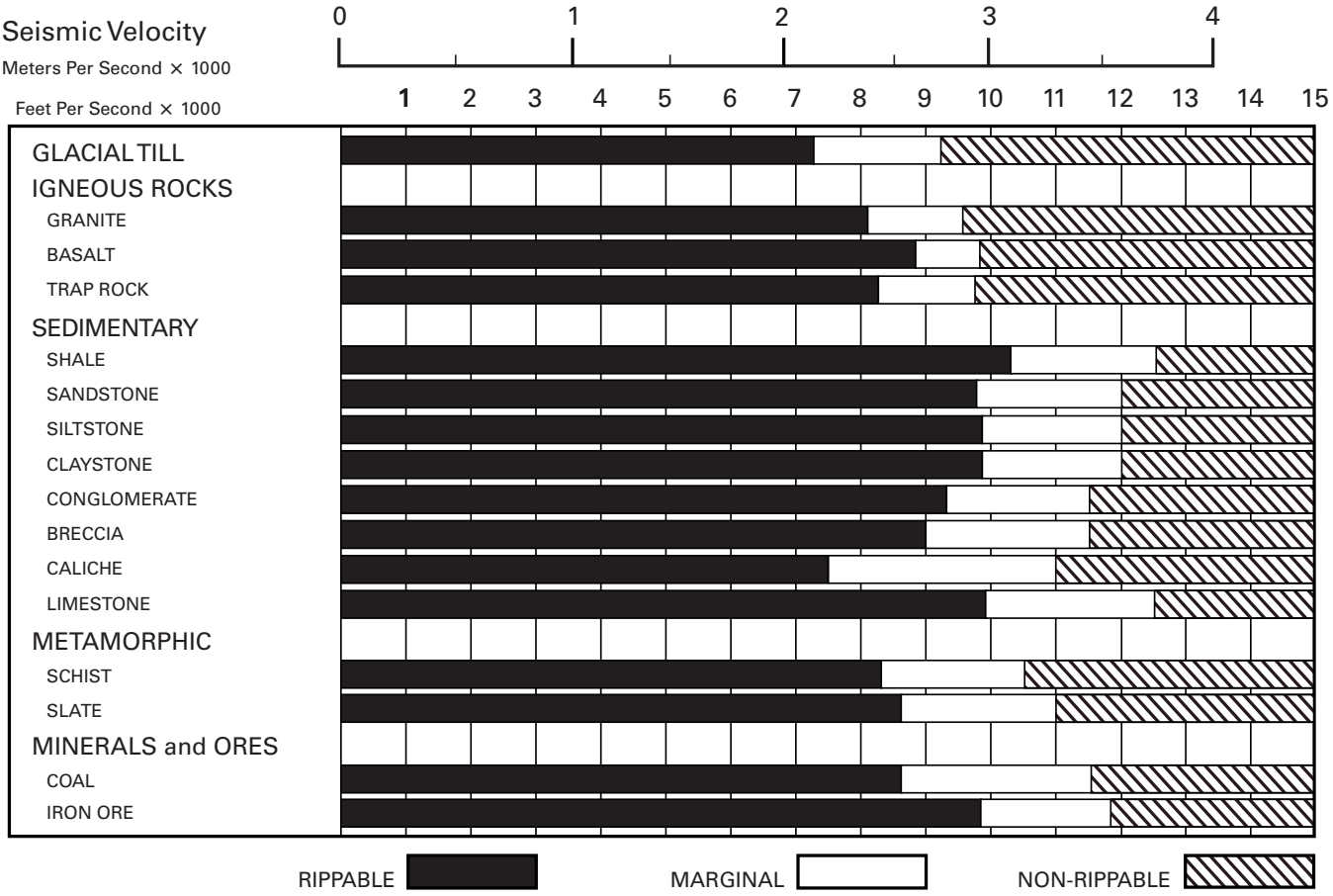
D9R/D9T
- **Multi- or Single Shank No. 9 Ripper**
- **Estimated by Seismic Wave Velocities**



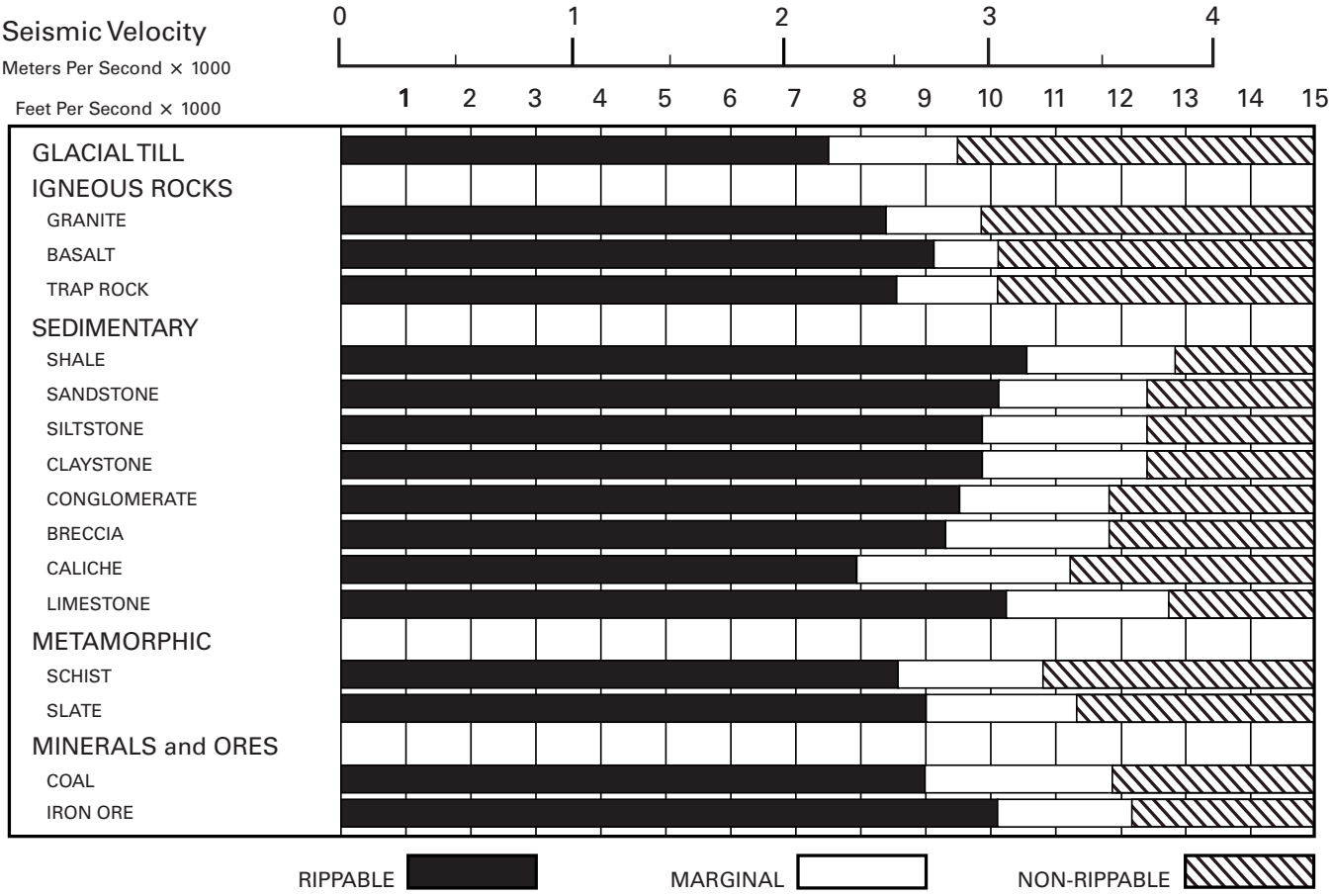
D10T2
- **Multi- or Single Shank No. 10 Ripper**
- **Estimated by Seismic Wave Velocities**



D11T
- **Multi- or Single Shank No. 11 Ripper**
- **Estimated by Seismic Wave Velocities**

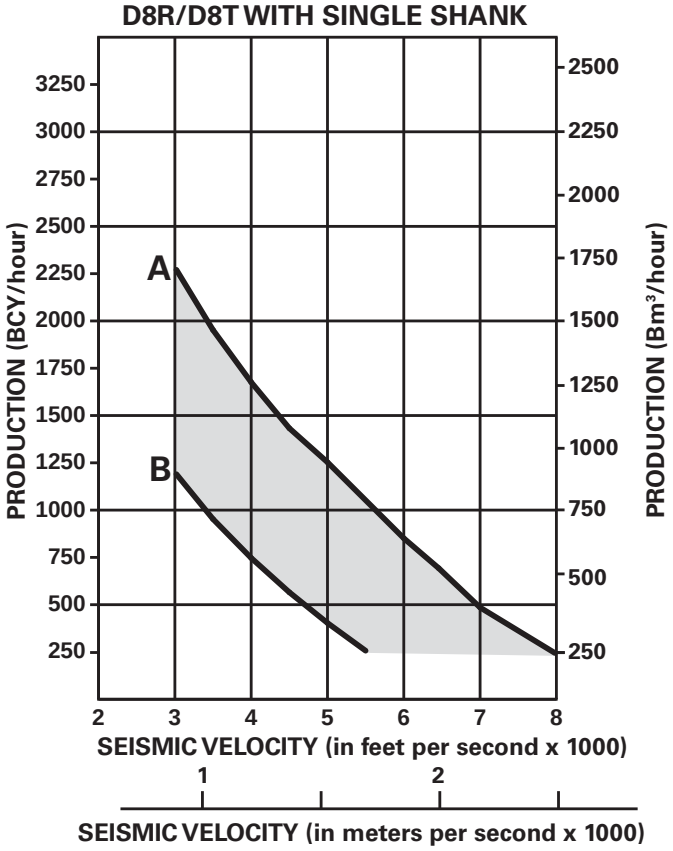


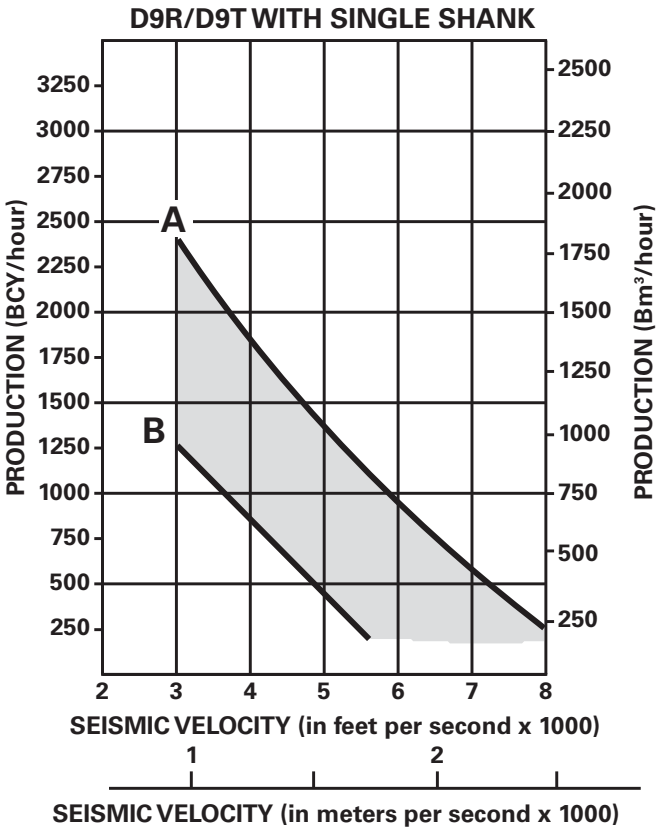
D11T CD
- **Single Shank No. 11 Ripper**
- **Estimated by Seismic Wave Velocities**



CONSIDERATIONS FOR USING PRODUCTION ESTIMATED GRAPHS:

- Machine rips full-time — no dozing.
- Power shift tractors with single shank rippers.
- 100% efficiency (60 min hour).
- Charts are for all classes of material.
- In igneous rock with seismic velocity of 8000 fps (2450 mps) or higher for the D11T, and 6000 fps (1830 mps) or higher for the D10T2, D9R/D9T and D8R/D8T, the production figures shown should be reduced by 25%.
- Upper limit of charts reflect ripping under ideal conditions only. If conditions such as thick lamination, vertical lamination or any factor which would adversely affect production are present, the lower limit should be used.

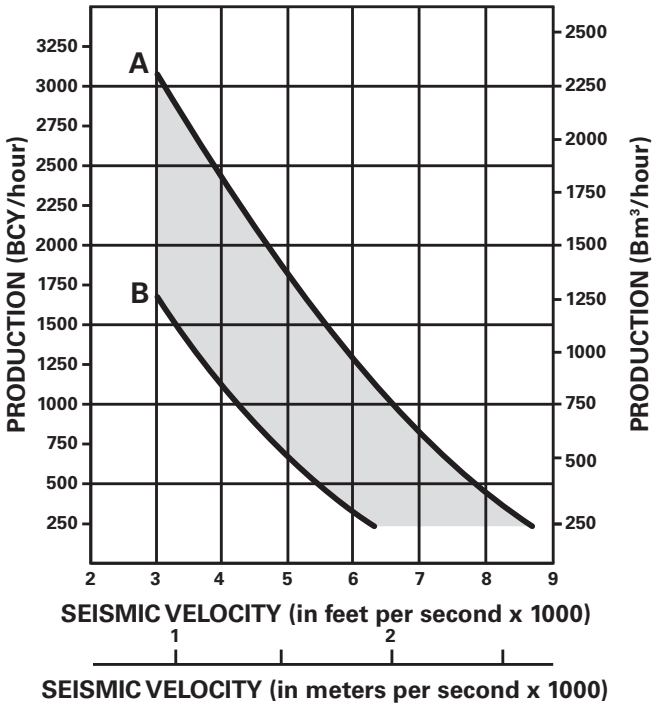




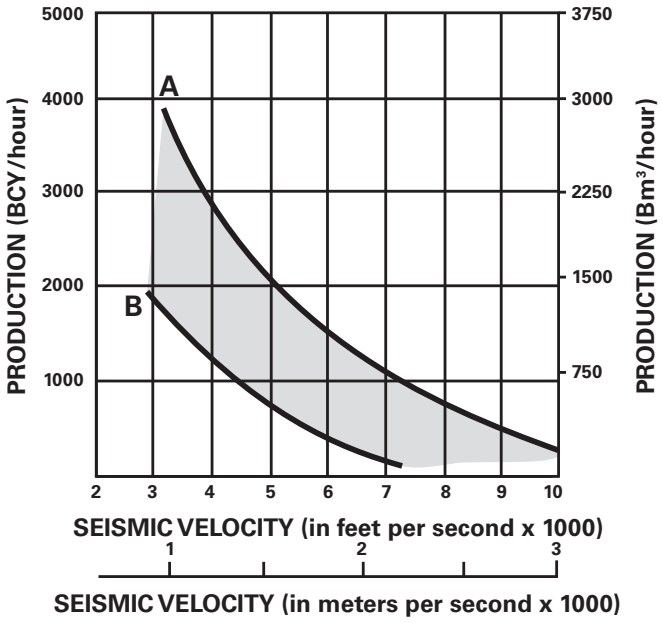
KEY
A — IDEAL
B — ADVERSE

Estimated Ripper Production Graphs
● D10T2 ● D11T ● D11T CD

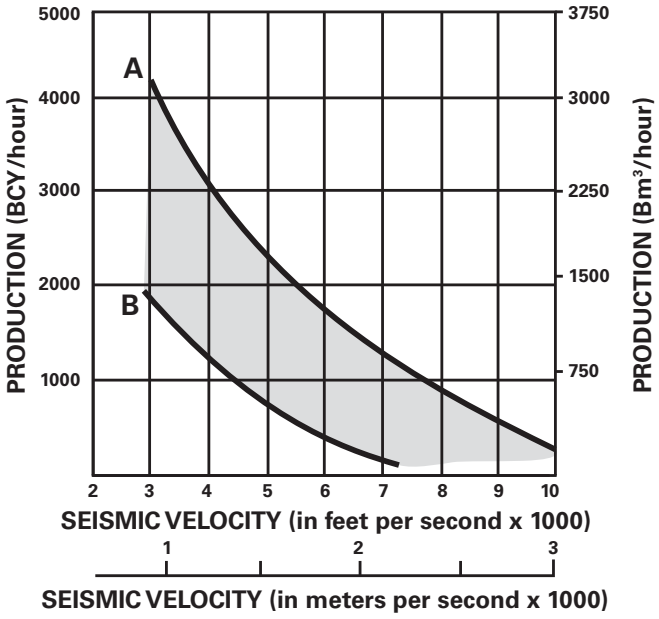
D10T2 WITH SINGLE SHANK



D11T WITH SINGLE SHANK



D11T CD WITH SINGLE SHANK



KEY
A — IDEAL
B — ADVERSE

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,

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

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

KARL A. HARMON STATE OF WASHINGTON 41534 REGISTERED PROFESSIONAL ENGINEER

State of Washington Engineering Geologist 2535 Licensed Geologist

Karl A. Harmon

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

722 N 16th Ave, Suite 31, Yakima WA 98902, 509-248-9798
C 4008 W Clearwater Ave, Kennewick WA 99336, 509-734-9320
11115 E Montgomery Suite D, Spokane Valley WA 99206, 509-893-9400
PO Box 1922, Hood River OR 97031, 541-387-3387
81006 HWY 395, Hermiston OR 97838, 541-564-0991

Visit our website at www.gnnorthern.com
Email: gnnorthern@gnnorthern.com

LIFT 6 / 4C

LIFT 7 /5C

LIFT 8 / 9 G

MID-STATION

MC

Platter Relay Lift

Pulse Cabriolet Gondola

10%

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

MISSION RIDGE
SKI & BOARD RESORT

ecosign
Mountain Resort Planners Ltd.

Box 63 Whistler, B.C. Canada V0N 1B0 (604)932-5976 Fax:(604)932-1897
www.ecosign.com info@ecosign.com

Contour Interval: 25 ft

Date: 12/19/2019

0ft 300 600 900 1200

Legend

Approximate Extent of Mass Wasting (Landslide) Deposits

Approximate Extent of Basalt Cobble / Boulder Rubble (Talus)

SITE FEATURES AND GEOLOGIC CONSTRAINTS A-3

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

GEOTECHNICAL SITE EVALUATION REPORT

PROPOSED ACCESS ROADWAY
MISSION RIDGE EXPANSION PROJECT
CHELAN COUNTY, WASHINGTON

GNN PROJECT NO. 217-854

FEBRUARY 2020

Prepared for

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

Prepared by

GN NORTHERN, INC.
CONSULTING GEOTECHNICAL ENGINEERS
YAKIMA, WASHINGTON
(509) 248-9798

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.

Northern, Inc.

February 26, 2020 **GNN Project No. 217-854**

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

Attn: Larry Scrivanich, President

CC: Josh Jorgensen, General Manager
Mike Milliken, Project Manager, Tamarack Saddle LLC
John Torrence, PE, Torrence Engineering, LLC

Subject: Geotechnical Site Evaluation Report
Proposed Access Roadway
Mission Ridge Expansion Project
Chelan County, Washington

Gentlemen,

As requested, GN Northern (GNN) has completed a design-level geotechnical site investigation for the proposed access roadway to be constructed between the existing Mission Ridge Ski & Board Resort base facilities and the proposed Mission Ridge Expansion Project site in Chelan County.

Based on the findings of our subsurface study, we conclude that the site of the proposed access roadway is suitable for the proposed construction provided that our geotechnical recommendations and parameters presented in this report are followed during the design and construction phases of the project.

This report describes in detail the results of our investigation, summarizes our findings and presents our recommendations for cut slope grading, roadway subgrade support, and placement of engineered fill, as well as preliminary creek crossing strucutre design considerations for the proposed project. It is important that GN Northern provide consultation during the design phase as well as field compaction testing and geotechnical monitoring services during construction to ensure implementation of the geotechnical recommendations.

If you have any questions regarding this report, please contact us at 509-893-9400.

Respectfully submitted,

GN Northern, Inc.

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

State of Washington
Engineering Geologist
2535
Licensed Geologist
Karl A. Harmon

M. Yousuf Memon, PE
Geotechnical Engineer

M. YOUSUF MEMON
STATE OF WASHINGTON
55606
REGISTERED
PROFESSIONAL ENGINEER

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APPENDICES

Appendix I – Vicinity Map (Figure 1), Site Exploration Plan (Figure 2)
Appendix II – Exploratory Boring Logs, Key Chart (for Soil Classification)
Appendix III – Laboratory Testing Results
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Appendix V – Slope Stability Analyses

1.0 PURPOSE AND SCOPE OF SERVICES

This report has been prepared for the proposed access roadway that will be constructed between the existing Mission Ridge Ski & Board Resort (Resort) base camp facilities and the proposed Mission Ridge Expansion Project site in Chelan County, Washington; site location is shown on the *Vicinity Map* (Figure 1, Appendix I). Our investigation was conducted to collect information regarding subsurface soil/rock conditions, assess geologic/geotechnical engineering properties of these materials and present recommendations for civil design of the proposed roadway including pavement subgrade support, permanent cut slopes, and preliminary creek crossing structure design considerations.

This report serves as a design-level supplement to the previous geotechnical investigations completed by GNN for this project. GNN has prepared this report for use by the client and their design consultants in the design of the proposed roadway. Do not use or rely upon this report for other locations or purposes without the written consent of GN Northern, Inc.

Our study was conducted in general accordance with our *Proposal for Design-Level Geotechnical Site Evaluation* dated September 18, 2019. Notice to proceed was provided on September 24, 2019.

A preliminary civil plan set prepared by Torrence Engineering (dated January 20, 2020), showing the currently proposed access roadway alignment with design grades, was provided for our use. Field exploration during this round consisted of ten (10) exploratory borings completed between November 19th and 22nd, 2019. Locations of the exploratory borings are shown on the *Site Exploration Plan* (Figure 2, Appendix I), and detailed boring logs are presented in Appendix II.

This report has been prepared to summarize the data obtained during this study and to present our recommendations based on the proposed construction and the subsurface conditions encountered at the site. Results of the field exploration were analyzed to develop recommendations for cut slope grading, roadway subgrade support, and placement of engineered fill, as well as preliminary creek crossing structure design considerations. Design parameters and a discussion of the geotechnical engineering considerations related to construction are included in this report. The scope this geotechnical evaluation specifically excludes engineering design for any proposed retaining structures.

2.0 PROPOSED CONSTRUCTION

Based on the preliminary civil plan set prepared by Torrence Engineering, we understand that the proposed new roadway will extend from near the eastern edge of the Resort's existing base area, traverse the northwest facing hillslope, and curve along the north and northeast facing slopes to terminate at the section line (Section 24) near the entrance for the future expansion project area. While not currently part of the scope of this investigation, the new roadway will also connect to the existing terminus of Mission Ridge Road.

The segment of the new roadway that is part of this scope, generally defined as the portion of the road from the base area to near the entrance for the future expansion, is approximately 3,000 feet (~0.57 mile) long. The new roadway will include two 16-feet wide paved drive-lanes, a 10-foot drainage ditch on the inside (cut side) and a 4-foot wide gravel shoulder on the outside. While we understand that a new permanent structure will ultimately be constructed across the creek crossing, a temporary bridge crossing will likely be employed during the early phases of construction for the roadway and expansion project. No details related to the planned design and construction of the creek crossing structure(s) were provided at the time of this report.

The new roadway will begin at an elevation of ±4,575' near the base area, ascend to elevation ±4,580' near the creek crossing, then descend down to a low elevation of ±4,530' to accommodate approximately 50 feet of elevation change across the main southwest-northeast aligned segment. The shorter northwest-southeast aligned segment around the curve will descend approximately 30 feet to elevation ±4,500' near the end of the currently planned roadway alignment. The road surface is generally planned at grades ranging from 2% to 7.5%, with a portion of the roadway around the curve planned at grades as steep as 10%.

The current civil model shows the new roadway to be primarily supported on a cut condition, resulting in relatively tall cut slopes on the uphill side and relatively short retaining walls on the fill side along selected segments of the roadway. Regarding the cut side of the new roadway, currently proposed grading will result in cuts ranging in height from less than 10 feet, to as great as ~55 feet (measured vertically down from the existing grades to the top of the finished ditch on the inside). Consequently, net heights of the finished cut slopes will be even taller. While not based on any analyses, the current plans show all cut slopes at a finished gradient of 0.5H:1V.

3.0 FIELD EXPLORATION & LABORATORY TESTING

GNN has conducted two previous rounds of preliminary field exploration activities at the project site. Following the initial pioneering of a trail extending generally along the vicinity of the proposed roadway alignment in October, 2018, GNN conducted a preliminary feasibility-level study that consisted of observations of the exposed back-cut slope faces along the trail cut and excavation of eight (8) test-pits to explore the shallow subsurface conditions at selected location. Based on the preliminary shallow subsurface information obtained from this first round of exploration, GNN selected seven (7) locations along the alignment and performed seismic refraction surveys to assess and interpret subsurface material properties and prepare profiles of the depth to, and topography of the density interface and p-wave velocity layering of the subsurface materials. The data obtained from our previous site exploration activities was used to select appropriate locations and depths for exploratory borings to assess the deeper strata.

This round of field exploration was completed on November 19th, 20th & 22nd, 2019. Ten (10) exploratory borings with rock coring were drilled to depths ranging from approximately 13 to 50 feet below the existing pioneered trail ground surface (BGS). Two of the borings (B-9 & B-10) were drilled on either side of the creek for design of a crossing structure. The borings were advanced using hollow-stem augers and HQ-3 cores barrels powered by a truck-mounted CME-850 drilling rig. The borings were typically advanced with hollow-stem augers until refusal on competent bedrock (where encountered), then converted to coring operations. Rock cores were obtained to the maximum depth of exploration.

Samples were obtained from the augured portions of test borings using a Standard Penetration (SPT) sampler (ASTM D1586). The SPT sampler has a 2-inch outside diameter and a 1.375-inch inside diameter. The samples were obtained by driving the sampler with a 140-pound auto-hammer, dropping 30 inches in general accordance with ASTM D 1586. Recovered soil samples were sealed in containers and returned to the laboratory. Bulk samples were also obtained from auger cuttings, representing a mixture of soils encountered at the depths noted.

The number of blows required to advance the samplers through each of three 6-inch increments is recorded in the field. The SPT resistance, or N-value, is defined as the number of blows required to drive the sampler from 6 inches to 18 inches below the auger, with the value reported as the

number of blows per one foot of penetration. The SPT N-value, adjusted for hammer efficiency and sampler size, provides an indication of the relative density or consistency of the soil and is indicated on the boring logs. The soils observed during our field exploration were classified according to the Unified Soil Classification System (USCS), utilizing the field classification procedures as outlined in ASTM D2488.

The final logs of the borings represent our interpretation of the data from the field logs and the results of laboratory testing performed on the samples retrieved. The locations of the strata boundaries were estimated in the field based on the exploratory methods used and obtained samples and may be transitional. Depths referred to in this report are relative to the existing ground surface elevation at the time of our field investigation. The surface and subsurface conditions described in this report are as observed at the site at the time of our field investigation. The subsurface conditions are known only at the exploration locations on the date explored and should be considered approximate. Actual subsurface conditions between exploratory locations may vary. The boring locations are shown on the *Site Exploration Plan*, Figure 2, in Appendix I. Logs of the exploratory borings are presented in Appendix II.

3.1 Rock Coring & Rock Quality Designation

Rock core drilling was performed in general accordance with ASTM D2113, *Standard Practice for Rock Core Drilling and Sampling of Rock for Site Investigation*. Cores of bedrock were obtained using a wireline coring system and HQ-3 coring equipment, yielding cores of approximately 2.4-inch. Cores were placed in cardboard partitioned boxes to ensure that the rock from each core run was kept separate. Rock cores were labeled and depths of the run were marked on the boxes. Depths at which the samples were taken and the penetration resistance values along with the percentage of Total Core Recovery and Rock Quality Designation (RQD) are shown on the boring logs in Appendix II. Core boxes were transported to our laboratory for examination and laboratory analysis. Rock core samples were measured and photographed. Photographic logs of the rock cores are included in Appendix III.

Rock core quality is determined based on the recovery ratio value or the RQD in general accordance with ASTM D6032-08. Based on the length of the rock core recovered from each run, the RQD is determined as follows:

$$RQD = \frac{\Sigma \text{ Length of recovered rock pieces equal to or larger than 4"}}{\text{Total length of rock cored in each run.}}$$

An RQD of 100 generally indicates the presence of extremely strong intact rock; for fractured rocks, the recovery ratio may be 50 or less. The general relationship between the RQD and the in-situ Rock Quality is as follows:

RQD%	Rock Quality
0-25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

Based on a review of the data obtained from our subsurface exploratory drilling and test-pit excavations along with the seismic refraction surveys and site reconnaissance with observations of exposed outcrops and roadway cuts we have estimated the average qualities of the rock mass along the project alignment and assign pertinent *rock mass classification* parameters. We have estimated and characterized the overall quality and strength properties of the rock mass in general accordance with the Geologic Strength Index (GSI) and Rock Mass Rating (RMR) system developed by Bieniawski (1989). The RMR system evaluates the rock mass quality by accounting for the strength of intact rock fragment, fracturing, discontinuity conditions (persistence, separation, roughness, infilling) and degree of weathering. Hoek and Brown (2002) developed failure strength criterion for the non-linear Mohr's failure envelope of the rock mass using the GSI.

3.2 Laboratory Testing

Representative samples of the subsurface soils/rock obtained from the field exploration were selected for testing to determine the index properties in general accordance with ASTM procedures. The following laboratory tests were performed:

Table 1: Laboratory Tests Performed

Test	To determine
Particle Size Distribution (ASTM D6913)	Soil classification based on proportion of sand, silt, and clay-sized particles
Natural Moisture Content (ASTM D2216)	Soil moisture content indicative of in-situ condition at the time samples were taken
Atterberg Limits (ASTM D4318)	Liquid limit, plastic limit and plasticity index of soils

Results of the laboratory test are included on the boring logs and are also presented in graphic form in Appendix III attached to the end of the report.

4.0 EXISTING SITE CONDITIONS

The proposed access roadway alignment will extend through the SE ¼ of Section 24, T21N, R19E between the existing Mission Ridge Ski Resort base area and the proposed expansion project site. Majority of the project alignment generally traverses along a northwest-facing hillside, with a shorter segment extending along a northeast-facing slope near the eastern end. The site location is shown on the *Vicinity Map*, Figure 1 in Appendix I.

Native slope gradients across the project alignment generally range from less than 30% to as steep as 85%. The hillslopes are densely forested and include a cover of native vegetation and trees, as well as selected areas of exposed cobble/boulder debris. An existing approximately 8 to 10 foot wide trail, constructed using typical upslope cut and downslope side-cast fill grading, has been pioneered across the general vicinity of the proposed roadway alignment. A temporary bridge was installed across the unnamed creek drainage near the western end of the trail.

Observations of the exposed backcut along the existing trail revealed a variety of soil/rock conditions ranging from relatively soft/wet clayey soils in the vicinity of the creek crossing, to cobbly/bouldery mass-wasting debris, to granitic bedrock that varied from completely weathered to fresh/competent pinnacles across a majority of the alignment. Localized failures of the backcut were also noted in areas of exposed mass-wasting and colluvium.

5.0 SUBSURFACE GEOLOGIC CONDITIONS

Our understanding of the subsurface geologic conditions is based on data obtained from our investigations completed along the existing trail, including exploratory borings drilled during this round of investigation, as well as test-pits and seismic refraction surveys conducted during prior rounds of exploration. To further aid in our understanding of the subsurface conditions, we reviewed published geologic information related to the mapped soil/rock units, along with LiDAR-derived topography to interpret the surface morphology of the project in better detail.

In general, the underlying geologic conditions along the project alignment can be subdivided into three distinct areas as shown on Figure 2, consisting of [Zone A] predominantly fine-grained clayey/sandy soils across a ~300 foot long segment near the base area, [Zone B] an intermediate zone of coarse-grained mass wasting landslide deposits, and [Zone C] granitic plutonic bedrock across the remaining larger portion towards the northeast extending to near the entrance for the future expansion area. The following sections summarize the various soil/rock units encountered during our investigation within these various zones:

Colluvium: These colluvial soils generally blankets a majority of Zone C and consist primarily of material derived from granitic rock, generally identified as fine- to coarse-grained sands with varying amounts of silt, gravel and cobbles. This unit was noted in the upper few feet across the southwest-northeast segment of Zone C, and to depths as great as approximately 6 to 8 feet BGS across the shorter northwest-southeast aligned segment. Localized zones of thicker colluvium may be anticipated, particularly adjacent to resistant rock outcrops.

Granitic Bedrock: As previously noted through visual observation of test-pit excavations, exploratory borings confirm presence of granitic bedrock across a majority of the roadway alignment. Granitic rock was confirmed to prevail across Zone C, and was also encountered in boring B-7 at ~26 feet BGS in the northeastern portion of Zone B. The rock exhibited varying degrees of weathering, ranging from completely weathered/residual soil to fresh hard rock including very competent exposed outcrops that are present as steep cliffs and pinnacles. This local granitic rock typically weathers to a brown-colored well graded fine- to coarse-grained sand with silt or silty sand. Based on SPT blow-counts, the residual soil exhibited ‘loose’ to ‘medium dense’ relative density, while the completely weathered granitic rock typically exhibited ‘dense’ to ‘very dense’ relative density. The highly to slightly weathered rock yielded ‘very poor’ to ‘fair’ RQD with varying degrees of fracturing. The intact rock fragments varied in hardness from moderately soft to very hard. The transition from completely weathered granitic rock to highly weathered granitic rock seems to closely correlate with a p-wave velocity (Vp) of approximately 5,500 feet/second. Unique to the northwest-southeast aligned segment, the completely weathered rock profile extends to relatively greater depths on the order of 30 to 40 feet BGS.

Coarse-Grained Mass Wasting: These soils were encountered to a depth of ~26 feet BGS in boring B-7 and the upper ~7.5 feet BGS in boring B-8 across the intermediate Zone B. These mass wasted deposits are primarily comprised of angular basaltic gravels, cobbles and boulders in a silty/sandy matrix. Typical to mass-wasting debris, zones of more soil and less rocks were also noted. SPT blow-counts suggest a range of 'loose' to 'very dense' relative density, with the higher blow-counts believed to be a result of the sampler encountering gravels/cobbles/boulders. In-situ moisture of these deposits ranged from moist to wet. At the surface, open-graded basaltic debris (talus) was also noted across the central portion of Zone B.

Fine-Grained Mass Wasting: Borings B-9 and B-10 completed on either side of the existing creek crossing encountered these fine-grained mass wasted deposits. This portion of the alignment predominantly includes clayey/sandy soils that were classified as Sandy Lean Clay (CL) and Clayey Sand (SC) with varying amounts of basaltic gravels. Based on SPT blow-counts, relative consistency of these soils varied from 'soft' to 'very stiff'. These soils were typically moist to wet with moisture contents in the range of 18% to 25%. Laboratory testing indicates a Plasticity Index (PI) range of 13 to 28. These conditions were noted to prevail to the full depth at boring B-9 to ~50 feet BGS and to ~35 feet BGS in boring B-10 where auger refusal was met on apparent cobbles, and are believed to be generally representative of subsurface conditions across Zone A. Furthermore, based on the subsurface soil conditions and the geomorphology of this area, we suspect that Zone A likely represents an earthflow (slope creep) that may potentially be active.

5.1 Hydrogeologic Conditions

Groundwater was encountered within only one of the exploratory borings (boring B-4) at a depth of 25 feet BGS at the time of our exploration in late November. While subsurface soils from borings B-9 & B-10 in the vicinity of the existing creek crossing were typically noted to be wet and presumed to be saturated at depth, due to fine-grained nature of these clayey soils at this location, static groundwater levels were not obtained at the time of our exploration. We believe that groundwater across this area (Zone A) may be relatively shallow.

The U.S. Fish & Wildlife Service National Wetlands Inventory maps of surface waters and wetlands at the site vicinity depicts two riverine streams that cross the proposed access roadway alignment and flow down the slope into Squilchuck Creek. While the noted stream near the southwest end of the roadway includes active flowing water, no indications of flowing surface

water were observed in the vicinity of the other mapped riverine during our field exploration activities in late November. It is noteworthy however that the location of boring B-4, where groundwater was encountered at depth, is generally coincidental with noted northeastern mapped riverine. Springs and/or seeps could exist at various other locations throughout the project area and may be encountered within deeper cuts during construction/grading of the roadway.

6.0 SLOPE STABILITY ANALYSIS

GNN performed slope stability analyses at four locations along the proposed roadway alignment under both static and seismic (pseudostatic) conditions for the native existing conditions and currently proposed regraded slope conditions representing critical geometries. Through an iterative process, we conducted stability analyses for roadway cut slopes with various gradients controlled by strength parameters of the various earth materials that will be exposed. The analyses were conducted using generalized geologic cross section models developed from the existing site topography shown at 5-foot contours, currently proposed roadway alignment, and data obtained from all of our explorations at the site.

Our slope stability analyses used a two-dimensional limit-equilibrium stability analysis of selected trial failure surfaces using the computer program *SLIDE* (*Version 7*). Potential circular-arc failure surfaces are evaluated using the simplified Spencer method. The program searches for critical potential failure surfaces with low computed factors of safety (FS). The computed factor of safety against slope failure is simply the ratio of total resisting forces or moments (strength of the slope) to the total driving forces or moments for planar or circular failure surfaces, respectively. Therefore, a slope with a factor of safety of 1.0 is in equilibrium, indicating that the disturbing forces driving the slope down are equal to its strength to resist failure.

Our analysis used the pseudostatic method which modifies the limit equilibrium method by incorporating a horizontal seismic force to simulate the potential inertial forces generated from earthquake ground accelerations. For slope stability analyses under seismic loading, a pseudostatic seismic coefficient, k_h (horizontal component), expressed in terms of acceleration (units of *g*), is typically estimated as a percentage of the horizontal peak ground acceleration (PGA). For our analyses, we have selected a conservative value of 0.07g, approximately 50% of the site PGA of 0.14g associated with a return interval (RI) of 975-years.

The selection of presumptive unit weight and shear strength parameters for the various onsite earth materials encountered were based on judgment and data obtained during our investigation(s), laboratory testing, review of previous studies, and research and prior experience with similar materials in comparable geotechnical and geologic settings. Engineering and geologic judgment was be applied relative to the estimated shear strength of the onsite earth materials in order to consider lateral and vertical variations in the subsurface conditions, such as degree of weathering, fracturing, planes of weakness, and gradational characteristics. The following estimated geotechnical strength parameters were used in our stability calculations:

Table 2a: Estimated Mohr-Coulomb Soil/Rock Strength Parameters

Earth Material	Unit Weight, γ (pcf)	Friction Angle, ϕ (degrees)	Cohesion, c (psf)
Colluvium	120	32	0
Residual Soil	115	31.5	150
Mass Wasting (Coarse)	130	35	35
Completely Weathered Granitic Bedrock	125	36	275
Highly to Mod. Weathered Granitic Bedrock	135	40	500
Engineered Fill	130	34	0

Table 2b: Generalized Hoek-Brown Rock Mass Strength Parameters

Rock Material		Slight Weathered to Fresh Granitic Bedrock
Unit Weight, γ		145 pcf
Geologic Strength Index (GSI)		70
Unconfined Compressive Strength (UCS) of Intact Rock		3,500 ksf
Intact Rock Constant, m_i		29
Disturbance Factor, D		0.7
Reduced Rock Constant, m_b		5.779
Rock Mass Constants	**a**	0.0129
	s	0.5014

Based on the *WSDOT Geotechnical Design Manual* (M 46-03.08), minimum factors of safety of 1.25 and 1.1 against failure are recommended for slope stability analyses under static and seismic conditions, respectively. The results of our stability analyses indicate, that in their current condition, the stability of the existing native slopes typically falls below recommended minimum factors of safety for both the static and seismic conditions (see Table 3). Our analyses further indicate that these noted slope failures are relatively shallow and occur primarily within the upper overburden materials consisting of colluvium, mass wasting, and residual soils.

Table 3: Calculated Factors of Safety

Section	Slope Condition	Mode of Failure	Safety Factor	
			Static	Seismic
A-A'	Existing Native Slope	Shallow Surficial Slope Face	0.99	0.9
	Proposed Cut Slope	Shallow Surficial Slope Face	1.27	1.1
		Upper Zone of Cut Face	1.41	1.2
		Full Cut Face	1.40	1.3
B-B'	Existing Native Slope	Slope Face (Residual Soil)	1.12	1.0
	Proposed Cut Slope	Slope Face (Residual Soil)	1.17	1.0
		Deeper Slope Face	1.25	1.1
		Upper Zone of Cut Face	1.42	1.2
C-C'	Existing Native Slope	Slope Face (Residual Soil)	1.12	1.0
	Proposed Cut Slope	Slope Face (Residual Soil)	1.14	1.0
		Deeper Slope Face	1.28	1.1
		Upper Zone of Cut Face	1.83	1.6
D-D'	Existing Native Slope	Slope Face (Mass Wasting)	1.10	1.0
	Proposed Cut Slope	Slope Face (Mass Wasting)	1.10	1.0
		Global Stability of Fill/Retaining Wall	0.76	0.7

Stability analyses conducted for proposed cut slope conditions suggest that regraded cut slopes will require grading at material-dependent specified gradients ranging from near-vertical to 2H:1V in order to meet or exceed minimum recommended safety factors, as shown in Table 4. While existing topography across some portions of the project alignment allows for slopes to be regraded to shallower gradients (as shown by cross-section A-A'), the majority of the native northwest-facing hillside includes relatively steep terrain that does not allow for laying-back of the overburden material to sufficiently shallow gradients to enhance stability (as shown by cross-sections B-B' and C-C'). However, allowable regrading (lay-back) within the geometric constraints results in sufficient removal of the overburden material from near the roadway backcut, driving the slope failures farther up-slope. Furthermore, where the new roadway will be supported on a fill embankment and retaining wall (as shown by cross-section D-D'), our analysis indicates that global stability of the fill/retaining wall system will control the design and therefore engineered reinforcement such as geogrids and/or tiebacks will be required.

Table 4: Material-Dependent Specified Slope Gradients

Earth Material	Maximum Recommended Cut-Slope Gradient
Colluvium & Mass Wasting	2H:1V
Residual Soil	1.5H:1V
Completely Weathered Granitic Bedrock	1H:1V
Highly to Mod. Weathered Granitic Bedrock	Vertical
Slight Weathered to Fresh Granitic Bedrock	Vertical

7.0 GEOTECHNICAL RECOMMENDATIONS

The following geotechnical recommendations are based on our current understanding of the proposed project as described in Section 2.0 of this report. Please note that Soil Design Parameters and Recommendations presented in this report are predicated upon appropriate geotechnical monitoring and testing during construction by a representative of GNN's Geotechnical-Engineer-of-Record (GER). Any deviation and nonconformity from this requirement may invalidate, partially or in whole, the following recommendations. We recommend that we be engaged to review the final project plans in order to provide revised, augmented, and/or additional geotechnical recommendations as required.

7.1 Clearing and Grubbing

At the start of site grading, any vegetation, large roots, and existing side-cast fill shall be removed from the areas of proposed grading. Depth of stripping can be minimized with real-time onsite observation of sufficient removals. Areas disturbed during clearing shall be properly backfilled and compacted as described below. Removal of existing trees and vegetation should be carefully controlled and limited to only those areas of proposed improvements and associated grading. Site vegetation and surface conditions should be maintained in their native condition to the greatest extent possible during construction. Areas disturbed during grading and construction should employ appropriate BMPs and be immediately protected and/or re-vegetated to control runoff and erosion.

7.2 Excavation

Due to the noted variability of the rock mass conditions, we anticipate exposed areas of soft weathered conditions as well as hard resistant bedrock. Specialized excavation equipment such as a hoe-ram or rippers will be required for hard/resistant bedrock conditions. Blasting will be required in areas of exposed fresh competent granitic rock.

7.3 Slope Grading

Permanent cut slopes along the new roadway shall be constructed at slope gradients no steeper than those recommended in Table 4 of this report based upon the specific earth materials exposed. Portions of the final slope surface exposing soil conditions should be recompacted to improve the slope's resistance to erosion. The GER, or their representatives, should monitor cut slopes during construction, to check for adverse geologic features exposed within the cut face.

Proper slope protection and maintenance will help minimize slope erosion and improve the stability of the project slopes. Positive drainage should be provided at the tops of all slopes to divert runoff away from the face. Erosion protection should be provided, especially where concentrated runoff is anticipated. As the exposed site soils are susceptible to erosion, it is required that erosion control measures, such as planting, erosion control blankets or fabrics, sprayed tackifiers, or some combination of these, be utilized on all slopes within the project. Landscaping should take into consideration the engineering characteristics of the slopes, especially with regards to the surficial stability.

The need for and design of 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 concerns.

Unprotected cut slope faces will be prone to the risk of ongoing spalling of gravel sized rock fragments due to the effects from frost wedging. Options to address the long-term effects of ongoing surface spalling may include installation of erosion control measures such as vegetation, geotextiles, erosion control blankets, netting, etc. Ongoing maintenance efforts to remove any buildup of raveled materials from the toe of the slope adjacent to the edge of the roadway will be required.

7.4 Slope Drainage

The presence of water is a critical factor contributing to the instability of cut slopes. To improve slope stability, the installation of horizontal drains to lower the water table and reduce pore pressures will be required in selected areas. Reduction of water pressures generally increases the shear strength of soil resulting in improved slope stability. Careful inspection of the exposed roadway cut slopes should be performed by the GER during construction to identify and characterize possible areas of seeps or springs. Where deemed necessary, design of an appropriate remedial drainage system shall follow the guidance provided in *Design Guidelines for Horizontal Drains used for Slope Stabilization* (Pohll et. al, 2013).

7.5 Embankment Fill and Roadway Subgrade Preparation

After full removal of all topsoil, organics, and existing fills, the exposed native sloping surface shall be keyed and benched into with benching dimensions limited to maximum 3-feet vertical and minimum 5-feet horizontal. Once a competent native subgrade is confirmed by a representative of the GER across the subgrade, the exposed subgrade at the bottom of the excavation and across the benches shall be scarified a minimum 12 inches, moisture-conditioned to near-optimum, and re-compacted to minimum 95% of ASTM D1557, or to a dense and non-yielding condition. Once the native subgrade has been re-compacted, placement of engineered fill may commence using suitable onsite soils as described in the following section.

Unique to Zone A, subgrade soils are anticipated to consist of relatively soft wet clayey soils that will require stabilization. We recommend minimum 24 inches of quarry spalls punched into the soft subgrade, or chemical stabilization using lime or cement to a minimum depth of 3 feet below the pavement section. GNN is available to provide design-level recommendations for chemical stabilization once final civil design plans are available.

7.6 Reuse of Onsite Materials as Engineered Fill

The onsite excavated granitic rock is anticipated to generate a well-graded fine to coarse grained sandy material that is considered acceptable for reuse as engineered fill for this project. The mass wasting and colluvial soils potentially include significant oversize rocks (cobbles and boulders), and will therefore require screening and processing to remove rocks larger than 4 inches in nominal diameter. While not currently anticipated to be excavated, the onsite clayey soils near the roadway entrance area are not suitable for reuse as engineered fill.

Engineered fill shall be approved by a representative of the GER, moisture-conditioned to near-optimum, placed in uniform lifts, and compacted to a minimum 95% of the maximum dry density as determined by ASTM D1557. The compaction effort must be verified by a representative of the GER in the field using a nuclear density gauge in accordance with ASTM D6938. The thickness of the loose, non-compacted, lift of structural fill shall not exceed 8 inches for heavy-duty compactors.

7.7 Roadway Pavement Section

Minimum structural surfacing and pavement depths for the new roadway shall comply with Chelan County Code 15.30.250.

8.0 PRELIMINARY CREEK CROSSING STRUCTURE DESIGN CONSIDERATIONS

Geologic conditions identified in the vicinity of the creek crossing indicate that this area is underlain by fine-grained mass wasted deposits. Subsurface soil conditions along this portion of the alignment predominantly include 'soft' to 'very stiff' and moist to wet Sandy Lean Clay (CL) and Clayey Sand (SC) with varying amounts of basaltic gravels extending to depths of at least 50 feet BGS. Based on the subsurface soil conditions encountered and the noted surficial expression (geomorphology) of the area, we believe this portion of the project alignment may be characterized as a potentially active earthflow (slope creep).

Options for design of the creek crossing structure have not been prepared as of the date of this report. We understand that a temporary bridge crossing may be considered for use during the initial construction phases of the proposed access roadway and expansion area development. The borings completed at this location (B-9 & B-10) did not reveal a competent bearing stratum within a depth of 50 feet BGS. Design of a permanent creek crossing structure at this location that will ultimately be used for public access to the expansion area will require additional geotechnical exploration and evaluation/analysis to assess potential slope creep concerns and develop appropriate recommendation for remediation and structure design support.

Based on the subsurface conditions encountered in borings B-9 & B-10, a National Earthquake Hazard Reduction Program (NEHRP) seismic site class of 'E' is applicable for the new creek crossing structure. The following table provides mapped spectral accelerations, site response factors and modified design spectra based on the 2009 AASHTO/USGS seismic hazard maps for a 1,000-yr return period (7% probability of exceedance in 75 years):

Table 5: AASHTO Design Response Spectra Parameters

Mapped Spectra	Site Response Factors	Design Spectra
PGA = 0.151g	F_{pga} = 2.093	A_s = 0.316g
S_s = 0.347g	F_a = 2.191	SD_s = 0.759g
S_1 = 0.123g	F_v = 3.430	SD_1 = 0.423g

It shall be noted that determination of an appropriate site class requires shear wave velocity, soil undrained shear strength, or standard penetration resistance (N-value) data in the upper 100 feet of the subsurface profile, which was beyond the scope of this investigation. In lieu of performing a 100-foot boring, a refraction microtremor (ReMi) survey is considered an appropriate method for determination of a site-specific site class.

9.0 RECOMMENDED ADDITIONAL GEOTECHNICAL EXPLORATION

Based on the findings and results of this geotechnical investigation, we have identified the need for additional geotechnical exploration and monitoring. The following are preliminary recommendations for the additional exploration related to design and construction of the proposed access roadway project:

- Assessment of long-term slope creep across Zone A by means of installation and monitoring of survey monuments uphill and downhill of the proposed roadway alignment for a period of at least one full year. GNN is available to work with your surveyor to select locations of the survey monuments. We recommend that this survey commence as soon as possible.
- Three exploratory borings in Zone A (including a re-drill at B-10) to depths greater than 50 feet BGS to confirm prevailing soft clayey conditions or encounter competent sub-stratum.
- Selected exploration near the eastern end of the proposed alignment beyond the end of the currently pioneered trail.
- Exploration across the currently un-investigated segment of proposed roadway to connect with the existing Mission Ridge Road by means of borings, test-pits and/or seismic refraction.

10.0 REFERENCES

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11.0 CONTINUING GEOTECHNICAL SERVICES

GNN recommends that the Client should maintain an adequate program of geotechnical consultation, construction monitoring, and soils testing during the final design and construction phases to monitor compliance with GNN's geotechnical recommendations. Maintaining GNN as the geotechnical consultant from beginning to end of the project will provide continuity of services. If GN Northern, Inc. is not retained by the owner/developer and/or the contractor to provide the recommended geotechnical inspections/observations and testing services, the geotechnical engineering firm or testing/inspection firm providing tests and observations shall assume the role and responsibilities of Geotechnical Engineer-of-Record.

GNN can provide construction monitoring and testing as additional services. The costs of these services are not included in our present fee arrangement, but can be obtained from our office. The recommended construction monitoring and testing includes, but is not necessarily limited to, the following:

- Consultation during the design stages of the project.
- Review of the grading and drainage plans to monitor compliance and proper implementation of the recommendations in GNN's Report.
- Observation and quality control testing during site preparation, grading, and placement of engineered fill as required by the local building ordinances.
- Geotechnical engineering consultation as needed during construction

12.0 LIMITATIONS OF THE GEOTECHNICAL SITE EVALUATION REPORT

This GEOTECHNICAL SITE EVALUATION REPORT ("Report") was prepared for the exclusive use of the Client. GN Northern, Inc.'s (GNN) findings, conclusions and recommendations in this Report are based on selected points of field exploration, and GNN's understanding of the proposed project at the time the Report is prepared. Furthermore, GNN's findings and recommendations are based on the assumption that soil, rock and/or groundwater conditions do not vary significantly from those found at specific exploratory locations at the project site. Variations in soil, bedrock and/or groundwater conditions could exist between and beyond the exploration points. 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.

In many cases the scope of geotechnical exploration and the test locations are selected by others without consultation from the geotechnical engineer/consultant. GNN assumes no responsibility and, by preparing this Report, does not impliedly or expressly validate the scope of exploration and the test locations selected by others.

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, conclusions, and recommendations 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 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. The owner or the owner's representative also has the responsibility to verify that the general contractor and all subcontractors follow such recommendations during construction. 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 services in accordance with generally accepted geotechnical engineering practices in this locality at this time. GNN expressly disclaims all warranties and guarantees, express or implied.

Client shall provide GNN an opportunity to review the final design and specifications so that earthwork, drainage and foundation recommendations may be properly interpreted and implemented in the design and specifications. If GNN is not accorded the review opportunity, GNN shall have no responsibility for misinterpretation of GNN's recommendations.

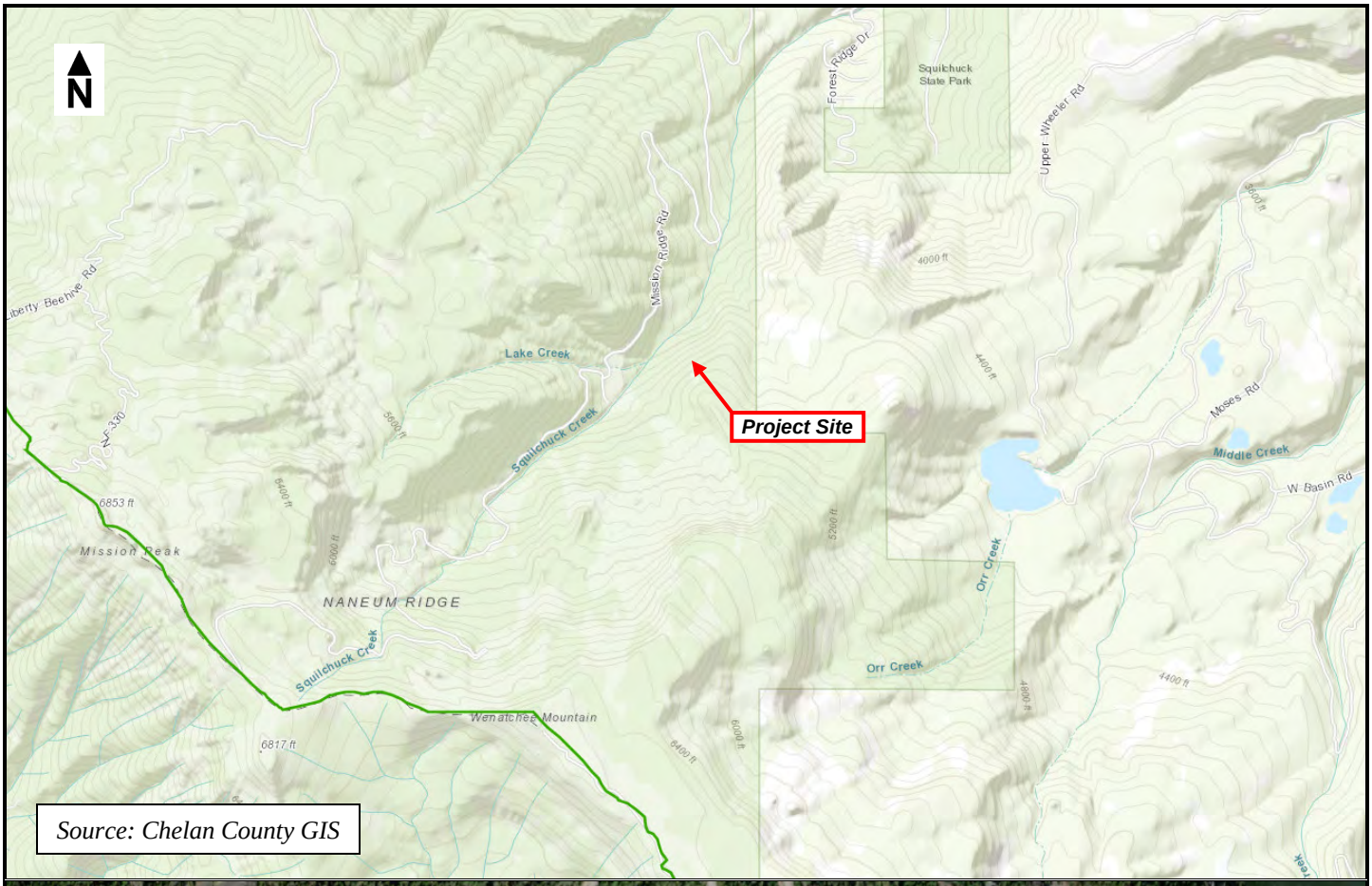
Although GNN can provide environmental assessment and investigation services for an additional cost, the current scope of GNN's services does not include an environmental assessment or an investigation for the presence or absence of wetlands, hazardous or toxic materials in the soil, surface water, groundwater,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

APPENDICES

Appendix I

Vicinity Map (Figure 1)

Site Exploration Plan (Figure 2)



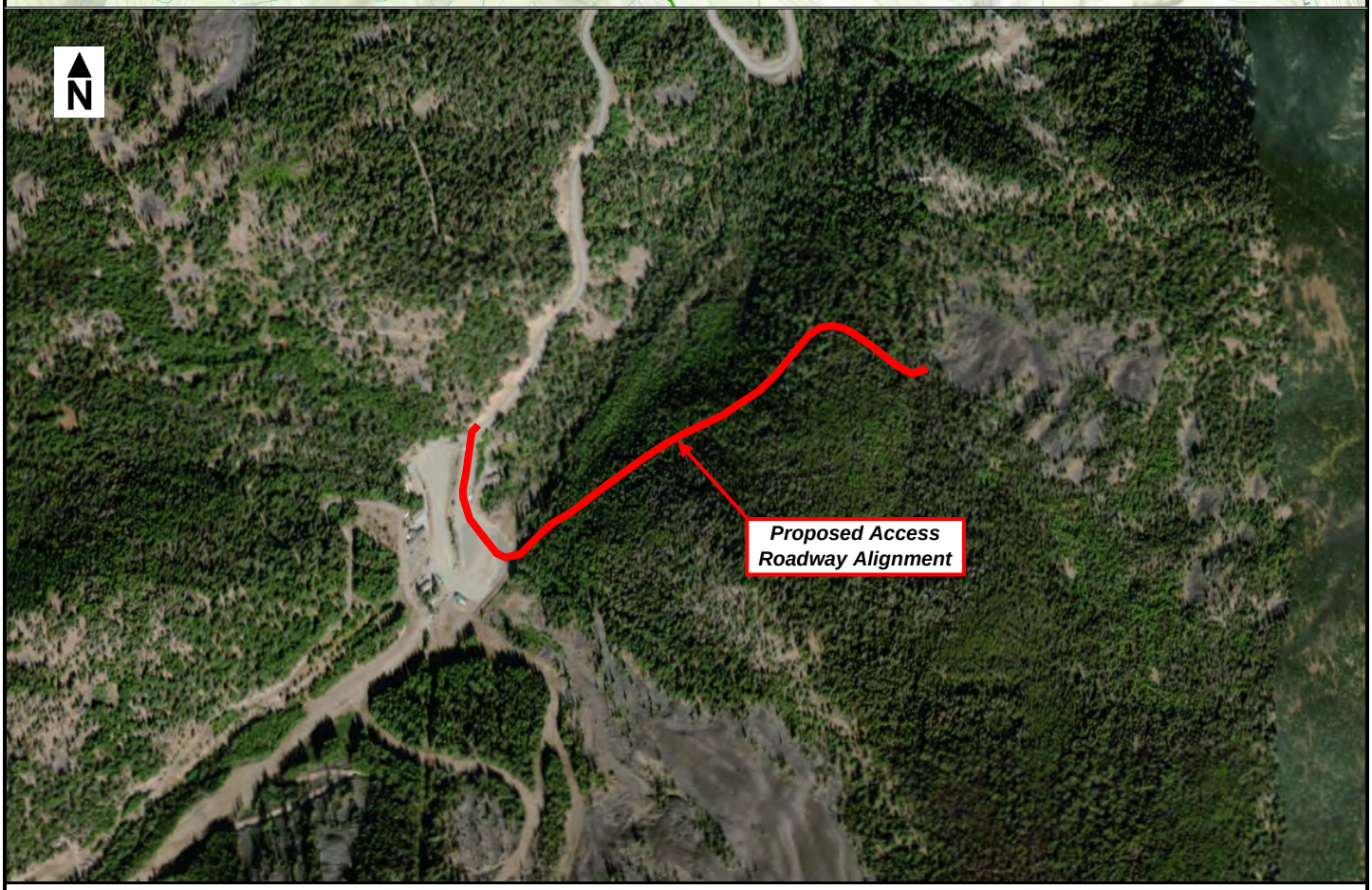


FIGURE 1: VICINITY MAP **PROJECT NO. 217-854**

PROJECT NO. 217-854

DATE: 1/28/2020

FIGURE NO. 2

SITE EXPLORATION PLAN
Proposed Access Roadway
Mission Ridge Expansion Project
Chelan County, Washington

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

Appendix II
Exploratory Boring Logs
Key Chart (for Soil Classification)

GN Northern, Inc.
722 N. 16th Avenue Suite 31
Yakima, Washington
Telephone: (509) 248-9798
Fax: (509) 248-4220

BORING NUMBER B-1

CLIENT Mission Ridge Ski and Board Resort
PROJECT NAME Mission Ridge Expansion Project - Proposed Access Road
PROJECT NUMBER 217-854
PROJECT LOCATION Mission Ridge Ski and Board Resort, Chelan Co., WA
DATE STARTED 11/19/19 **COMPLETED** 11/19/19
GROUND ELEVATION 4474.1 ft **HOLE SIZE** 6 inches
DRILLING CONTRACTOR Haz-Tech Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD CME 850 w/ HSA & Autohammer
AT TIME OF DRILLING ---
LOGGED BY KAH **CHECKED BY** MYM
AT END OF DRILLING ---
NOTES Northing: 108334.871, Easting: 1750515.829
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SPT	4-5-3 (8)		GP-GM		POORLY GRADED GRAVEL WITH SILT AND SAND, (GP-GM) brown, damp, loose, [COLLUVIUM]
	SPT	10-13-19 (32)				- becomes medium dense to dense, with apparent cobbles
						8.0 4466.1
10	SPT	42-50/5"	MC = 9% Fines = 30%			COMPLETELY WEATHERED GRANITIC BEDROCK, friable to fine to coarse grained silty sand with gravel (SM), brown, damp to moist
	SPT	35-48-29 (77)				- becomes light brown, damp
20	SPT	50/6"				- becomes light gray brown
	SPT	32-49-50/3"	MC = 5% Fines = 16%			
30	SPT	50/3"				- becomes dry to damp
	SPT	50/4"				- becomes dry
						- becomes highly weathered
40	SPT	10-15-50/5"				
	SPT	19-34-25 (59)				- becomes damp
50	SPT	18-50/3"				50.6 4423.5

- Groundwater not encountered at time of drilling
- Surveyed location and elevation data provided by Northwest Geodimensions

Bottom of borehole at 50.6 feet.

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GN Northern, Inc.
722 N. 16th Avenue Suite 31
Yakima, Washington
Telephone: (509) 248-9798
Fax: (509) 248-4220

BORING NUMBER B-2

CLIENT Mission Ridge Ski and Board Resort
PROJECT NAME Mission Ridge Expansion Project - Proposed Access Road
PROJECT NUMBER 217-854
PROJECT LOCATION Mission Ridge Ski and Board Resort, Chelan Co., WA
DATE STARTED 11/19/19 **COMPLETED** 11/19/19
GROUND ELEVATION 4486.8 ft **HOLE SIZE** 6 inches
DRILLING CONTRACTOR Haz-Tech Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD CME 850 w/ HSA & Autohammer & HQ Coring
AT TIME OF DRILLING ---
LOGGED BY KAH **CHECKED BY** MYM
AT END OF DRILLING ---
NOTES Northing: 108181.255, Easting: 1750273.984
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0							1.0 COLLUVIUM 4485.8
	SPT		5-2-8 (10)	MC = 6% Fines = 10%	SW-SM		WELL GRADED SAND WITH SILT AND GRAVEL, (SW-SM) brown, fine to coarse grained, damp to moist, loose to medium dense, [RESIDUAL SOIL]
	SPT		5-24-16 (40)	MC = 4% Fines = 10%			5.5 4481.3 COMPLETELY WEATHERED GRANITIC BEDROCK, friable to fine to coarse grained well graded sand with silt (SW-SM), light brown, dry to damp
10	SPT		50/2"				- becomes highly weathered, damp
	SPT		50/2"				- becomes highly to moderately weathered, dry to damp
20	SPT		50/1"				- becomes white and black, slightly weathered, moderately fractured, very hard rock
	RC	100 (37)					
	RC	100 (60)					- becomes moderately to slightly fractured
30							30.0 4456.8

- Auger refusal at 20' BGS, switched to rock coring
- Groundwater not encountered at time of drilling
- Surveyed location and elevation data provided by Northwest Geodimensions

Bottom of borehole at 30.0 feet.

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BORING NUMBER B-3

CLIENT Mission Ridge Ski and Board Resort
PROJECT NAME Mission Ridge Expansion Project - Proposed Access Road
PROJECT NUMBER 217-854
PROJECT LOCATION Mission Ridge Ski and Board Resort, Chelan Co., WA
DATE STARTED 11/19/19 **COMPLETED** 11/19/19
GROUND ELEVATION 4468.2 ft **HOLE SIZE** 6 inches
DRILLING CONTRACTOR Haz-Tech Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD CME 850 w/ HSA & Autohammer & HQ Coring
AT TIME OF DRILLING ---
LOGGED BY KAH **CHECKED BY** MYM
AT END OF DRILLING ---
NOTES Northing: 107938.555, Easting: 1750018.715
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0					SM		SILTY SAND WITH GRAVEL, (SM) [COLLUVIUM]	4467.2
1.0							SILTY SAND, (SM) brown, fine to coarse grained, moist, loose to medium dense, some clay [RESIDUAL SOIL]	
	SPT		3-4-9 (13)	MC = 15% Fines = 30%	SM			
10	SPT		4-4-4 (8)	MC = 11% Fines = 23%			- becomes loose, damp to moist, less clay	
13.0								4455.2
	SPT		9-15-21 (36)				COMPLETELY WEATHERED GRANITIC BEDROCK, friable to fine to coarse grained silty sand (SM), brown, damp to moist	
20	SPT		7-14-19 (33)	MC = 11% Fines = 27%			- becomes olive green	
	SPT		19-28-38 (66)				- becomes highly weathered	
30	RC	100 (0)					- becomes highly to moderately weathered, moderately fractured, moderately hard rock, moderately healed	
	RC	100 (0)					- becomes hard rock	
40	RC	100 (33)					- becomes orange-brown - becomes moderately weathered, moderately soft rock, with purple clay infilling - becomes slightly weathered, slightly to moderately fractured, hard rock	
45.0								4423.2

- Auger refusal at 30' BGS, switched to rock coring
- Groundwater not encountered at time of drilling
- Surveyed location and elevation data provided by Northwest Geodimensions

Bottom of borehole at 45.0 feet.

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BORING NUMBER B-4

CLIENT Mission Ridge Ski and Board Resort
PROJECT NAME Mission Ridge Expansion Project - Proposed Access Road
PROJECT NUMBER 217-854
PROJECT LOCATION Mission Ridge Ski and Board Resort, Chelan Co., WA
DATE STARTED 11/19/19 **COMPLETED** 11/20/19
GROUND ELEVATION 4487.1 ft **HOLE SIZE** 6 inches
DRILLING CONTRACTOR Haz-Tech Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD CME 850 w/ HSA & Autohammer & HQ Coring
▽ **AT TIME OF DRILLING** 25.00 ft / Elev 4462.10 ft
LOGGED BY KAH **CHECKED BY** MYM
AT END OF DRILLING ---
NOTES Northing: 107784.339, Easting: 1749743.663
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0					SM		1.0 SILTY SAND WITH GRAVEL, (SM) [COLLUVIUM]	4486.1
					SM		SILTY SAND, (SM) orange brown, fine to coarse grained, moist, very loose, some clay [RESIDUAL SOIL]	
	SPT		2-1-1 (2)	MC = 16% Fines = 28%				
							7.5	4479.6
10							COMPLETELY WEATHERED GRANITIC BEDROCK, friable to fine to coarse grained silty sand (SM), orange brown, damp to moist	
	SPT		11-28-28 (56)					
	SPT		21-48-43 (91)				- becomes damp	
20								
	SPT		18-23-25 (48)	MC = 11% Fines = 20%			- becomes moist	
	SPT		22-30-49 (79)				▽ - becomes completely to highly weathered	
30								
	RC	100 (70)					- becomes olive green, slightly weathered, slightly to moderately fractured, very hard rock	
							35.0	4452.1

- Auger refusal at 30' BGS, switched to rock coring
- Groundwater encountered at ~25' BGS at time of drilling
- Surveyed location and elevation data provided by Northwest Geodimensions

Bottom of borehole at 35.0 feet.

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BORING NUMBER B-5

CLIENT Mission Ridge Ski and Board Resort
PROJECT NAME Mission Ridge Expansion Project - Proposed Access Road
PROJECT NUMBER 217-854
PROJECT LOCATION Mission Ridge Ski and Board Resort, Chelan Co., WA
DATE STARTED 11/20/19 **COMPLETED** 11/20/19
GROUND ELEVATION 4537.7 ft **HOLE SIZE** 6 inches
DRILLING CONTRACTOR Haz-Tech Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD CME 850 w/ HSA & Autohammer
AT TIME OF DRILLING ---
LOGGED BY KAH **CHECKED BY** MYM
AT END OF DRILLING ---
NOTES Northing: 107633.793, Easting: 1749555.851
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0					1.0 COLLUVIUM 4536.7
	SPT	23-17-8 (25)			COMPLETELY WEATHERED GRANITIC BEDROCK, friable to fine to coarse grained silty sand (SM), brown, dry to damp
10	SPT	28-48-45 (93)			- becomes friable to fine to coarse grained well graded sand with silt (SP-SM)
	SPT	24-32-38 (70)	MC = 5% Fines = 12%		
20	SPT	15-19-22 (41)			
	SPT	50/5"			- becomes completely to highly weathered, friable to silty gravel with sand (GM), dry
30	SPT	8-41-54 (95)			- becomes highly to moderately weathered, friable to fine to coarse grained silty sand (SM)
	SPT	26-50/6"			- becomes friable to fine to coarse grained well graded sand with silt (SP-SM), dry to damp
					- becomes moderately weathered
40	SPT	50/2"			40.1 4497.6

- Groundwater not encountered at time of drilling
- Surveyed location and elevation data provided by Northwest Geodimensions

Bottom of borehole at 40.1 feet.

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BORING NUMBER B-6

CLIENT Mission Ridge Ski and Board Resort
PROJECT NAME Mission Ridge Expansion Project - Proposed Access Road
PROJECT NUMBER 217-854
PROJECT LOCATION Mission Ridge Ski and Board Resort, Chelan Co., WA
DATE STARTED 11/20/19 **COMPLETED** 11/20/19
GROUND ELEVATION 4599.5 ft **HOLE SIZE** 6 inches
DRILLING CONTRACTOR Haz-Tech Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD CME 850 w/ HSA & Autohammer & HQ Coring
AT TIME OF DRILLING ---
LOGGED BY KAH **CHECKED BY** MYM
AT END OF DRILLING ---
NOTES Northing: 107390.246, Easting: 1749384.610
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0								
							COLLUVIUM	4598.5
							WELL GRADED SAND WITH SILT AND GRAVEL, (GP-GM) brown, moist, loose, [RESIDUAL SOIL]	
	SPT		2-2-4 (6)	MC = 10% Fines = 12%	GP-GM			
10								4589.5
	SPT		5-8-8 (16)		SP-SM		POORLY GRADED SAND WITH SILT, (SP-SM) brown, fine to medium grained, damp, medium dense, trace coarse grained sand [RESIDUAL SOIL]	4586.5
	SPT		50/3"				COMPLETELY WEATHERED GRANITIC BEDROCK, black and white, moderately to highly fractured, moderately hard rock	
	RC	100 (8)					- becomes moderately weathered	
20	RC	100 (0)						
	RC	100 (0)						4575.5

- Auger refusal at 15' BGS, switched to rock coring
- Groundwater not encountered at time of drilling
- Surveyed location and elevation data provided by Northwest Geodimensions

Bottom of borehole at 24.0 feet.

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BORING NUMBER B-7

CLIENT Mission Ridge Ski and Board Resort
PROJECT NAME Mission Ridge Expansion Project - Proposed Access Road
PROJECT NUMBER 217-854
PROJECT LOCATION Mission Ridge Ski and Board Resort, Chelan Co., WA
DATE STARTED 11/20/19 **COMPLETED** 11/20/19
GROUND ELEVATION 4587.2 ft **HOLE SIZE** 6 inches
DRILLING CONTRACTOR Haz-Tech Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD CME 850 w/ HSA & Autohammer
AT TIME OF DRILLING ---
LOGGED BY KAH **CHECKED BY** MYM
AT END OF DRILLING ---
NOTES Northing: 107140.418, Easting: 1749055.041
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0					COBBLES & BOULDERS, with silty/sandy matrix [MASS WASTING]	
10	SPT	5-29-50 (79)			SILTY GRAVEL WITH SAND (GM), brown, moist, very dense, basaltic rocks	
					12.5	4574.7
	SPT	1-5-4 (9)	SM		SILTY SAND, (SM) brown, fine grained, moist to wet, loose, [MASS WASTING]	
					19.0	4568.2
20	SPT	3-7-8 (15)	GM		SILTY GRAVEL, (GM) brown, wet, medium dense, [MASS WASTING]	
	SPT	5-36-50/5"			26.0	4561.2
					HIGHLY WEATHERED GRANITIC BEDROCK, friable to fine to coarse grained well graded sand with silt (SW-SM), gray, dry	
30	SPT	50/5"			- becomes highly to moderately weathered	
	SPT	50/4"			35.2	4552.0
					- Groundwater not encountered at time of drilling - Surveyed location and elevation data provided by Northwest Geodimensions Bottom of borehole at 35.2 feet.	

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Fax: (509) 248-4220

BORING NUMBER B-8

CLIENT Mission Ridge Ski and Board Resort
PROJECT NAME Mission Ridge Expansion Project - Proposed Access Road
PROJECT NUMBER 217-854
PROJECT LOCATION Mission Ridge Ski and Board Resort, Chelan Co., WA
DATE STARTED 11/20/19 **COMPLETED** 11/20/19
GROUND ELEVATION 4577.1 ft **HOLE SIZE** 6 inches
DRILLING CONTRACTOR Haz-Tech Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD CME 850 w/ HSA & Autohammer
AT TIME OF DRILLING ---
LOGGED BY KAH **CHECKED BY** MYM
AT END OF DRILLING ---
NOTES Northing: 107058.262, Easting: 1748906.841
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0				GM		SILTY GRAVEL WITH SAND, (GM) brown, moist, medium dense to dense, basaltic rocks [MASS WASTING]
	SPT	6-20-9 (29)				
7.5						4569.6
10				CH		SANDY FAT CLAY WITH GRAVEL, (CH) brown and yellowish brown, moist to wet, soft to medium stiff, [MASS WASTING]
	SPT	2-2-4 (6)	MC = 22% LL = 51 PL = 23 Fines = 53%			
13.0						4564.1

- Auger refusal at ~13' BGS on apparent boulder
- Groundwater not encountered at time of drilling
- Surveyed location and elevation data provided by Northwest Geodimensions

Bottom of borehole at 13.0 feet.

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BORING NUMBER B-9

CLIENT Mission Ridge Ski and Board Resort
PROJECT NAME Mission Ridge Expansion Project - Proposed Access Road
PROJECT NUMBER 217-854
PROJECT LOCATION Mission Ridge Ski and Board Resort, Chelan Co., WA
DATE STARTED 11/22/19 **COMPLETED** 11/22/19
GROUND ELEVATION 4575.7 ft **HOLE SIZE** 6 inches
DRILLING CONTRACTOR Haz-Tech Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD CME 850 w/ HSA & Autohammer
AT TIME OF DRILLING ---
LOGGED BY KAH **CHECKED BY** MYM
AT END OF DRILLING ---
NOTES Northing: 107027.222, Easting: 1748793.720
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						SANDY LEAN CLAY, (CL) brown, moist, stiff, [MASS WASTING]
	SPT	4-7-6 (13)	MC = 24% Fines = 60%	CL		
4.5						4571.2
	SPT	1-2-4 (6)	MC = 19% LL = 38 PL = 10 Fines = 36%			CLAYEY SAND, (SC) brown, fine to coarse grained, wet, soft to medium stiff, [MASS WASTING]
	SPT	1-3-3 (6)				- becomes moist, with ~6" layer of SILTY SAND (SM)
10						- becomes brown/olive/variegated, medium stiff
	SPT	2-3-4 (7)	MC = 18% LL = 36 PL = 23 Fines = 37%	SC		- becomes moist to wet
	SPT	1-3-10 (13)				- becomes medium stiff to stiff
	SPT	1-3-5 (8)				
18.0						4557.7
20						SANDY LEAN CLAY WITH GRAVEL, (CL) light olive brown, moist to wet, stiff to very stiff, with SILTY SAND (SM) and basalt fragments [MASS WASTING]
	SPT	10-7-15 (22)				
	SPT	2-4-6 (10)	LL = 31 PL = 16			- becomes blue green, medium stiff to stiff
						- trace gravel
30						
	SPT	13-25-20 (45)				- becomes hard
	SPT	2-4-9 (13)	MC = 24% LL = 48 PL = 26 Fines = 48%	CL		- becomes olive brown, stiff, trace basalt gravel
40						
	SPT	2-7-13 (20)				- becomes stiff to very stiff
	SPT	3-9-24 (33)	LL = 41 PL = 25			- becomes reddish brown, very stiff to hard, some basalt gravel
50						
	SPT	10-1-19 (20)				- becomes soft to very stiff
51.5						4524.2

- Groundwater not encountered at time of drilling
- Surveyed location and elevation data provided by Northwest Geodimensions

Bottom of borehole at 51.5 feet.

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BORING NUMBER B-10

CLIENT Mission Ridge Ski and Board Resort
PROJECT NAME Mission Ridge Expansion Project - Proposed Access Road
PROJECT NUMBER 217-854
PROJECT LOCATION Mission Ridge Ski and Board Resort, Chelan Co., WA
DATE STARTED 11/22/19 **COMPLETED** 11/22/19
GROUND ELEVATION 4575.9 ft **HOLE SIZE** 6 inches
DRILLING CONTRACTOR Haz-Tech Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD CME 850 w/ HSA & Autohammer
AT TIME OF DRILLING ---
LOGGED BY KAH **CHECKED BY** MYM
AT END OF DRILLING ---
NOTES Northing: 107011.918, Easting: 1748757.073
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0				SM		SILTY SAND, (SM) light yellow brown, fine grained, moist to wet, loose, [MASS WASTING]
	SPT	1-2-3 (5)	MC = 18% Fines = 28%			
8.0						4567.9
10				SC		CLAYEY SAND WITH GRAVEL, (SC) brown, moist to wet, soft to medium stiff, [MASS WASTING]
	SPT	2-2-2 (4)	MC = 21% Fines = 32%			
13.5						4562.4
	SPT	1-2-5 (7)	MC = 21% LL = 41 PL = 20 Fines = 49%			SANDY LEAN CLAY, (CL) olive, moist to wet, soft to medium stiff, [MASS WASTING]
20						
				CL		
	SPT	7-8-8 (16)	MC = 25% LL = 39 PL = 22 Fines = 61%			- becomes blue green, very stiff, trace basalt gravel
30						
	SPT	50/5"				- with rock fragments (cobbles (?))
35.5						4540.4

- Auger refusal at ~35' BGS on possible cobbles
- Groundwater not encountered at time of drilling
- Surveyed location and elevation data provided by Northwest Geodimensions

Bottom of borehole at 35.5 feet.

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Northern, Inc.
Kennewick, Yakima, Spokane, Hermiston (OR)

KEY CHART

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N-VALUE

COARSE-GRAINED SOILS			FINE-GRAINED SOILS		
DENSITY	**N (BLOWS/FT)**	**FIELD TEST**	**CONSISTENCY**	**N (BLOWS/FT)**	**FIELD TEST**
Very Loose	0 – 4	Easily penetrated with ½-inch reinforcing rod pushed by hand	Very Soft	0 – 2	Easily penetrated several inches by thumb
Loose	4 – 10	Difficult to penetrate with ½-inch reinforcing rod pushed by hand	Soft	2 – 4	Easily penetrated one inch by thumb
Medium -Dense	10 – 30	Easily penetrated with ½-inch rod driven with a 5-lb hammer	Medium-Stiff	4 – 8	Penetrated over ½-inch by thumb with moderate effort
Dense	30 – 50	Difficult to penetrate with ½-inch rod driven with a 5-lb hammer	Stiff	8 – 15	Indented about ½-inch by thumb but penetrated with great effort
Very Dense	> 50	penetrated only a few inches with ½-inch rod driven with a 5-lb hammer	Very Stiff	15 – 30	Readily indented by thumb
			Hard	> 30	Indented with difficulty by thumbnail

USCS SOIL CLASSIFICATION

MAJOR DIVISIONS				GROUP DESCRIPTION
Coarse-Grained Soils <50% passes #200 sieve	**Gravel** and **Gravelly Soils** <50% coarse fraction passes #4 sieve	**Gravel** (with little or no fines)	GW	Well-graded **Gravel**
			GP	Poorly Graded **Gravel**
		Gravel (with >12% fines)	GM	Silty **Gravel**
			GC	Clayey **Gravel**
	Sand and **Sandy Soils** >50% coarse fraction passes #4 sieve	**Sand** (with little or no fines)	SW	Well-graded **Sand**
			SP	Poorly graded **Sand**
		Sand (with >12% fines)	SM	Silty **Sand**
			SC	Clayey **Sand**
Fine-Grained Soils >50% passes #200 sieve	**Silt** and **Clay** Liquid Limit < 50		ML	**Silt**
			CL	Lean **Clay**
			OL	Organic **Silt** and **Clay** (low plasticity)
	Silt and **Clay** Liquid Limit > 50		MH	Inorganic **Silt**
			CH	Inorganic **Clay**
			OH	Organic **Clay** and **Silt** (med. to high plasticity)
Highly Organic Soils			PT	**Peat**

Top Soil

LOG SYMBOLS

	2S	2" OD Split Spoon (SPT)
	3S	3" OD Split Spoon
	NS	Non-Standard Split Spoon
	ST	Shelby Tube
	CR	Core Run
	BG	Bag Sample
	TV	Torvane Reading
	PP	Penetrometer Reading
	NR	No Recovery
	GW	Groundwater Table

MODIFIERS

DESCRIPTION	RANGE
Trace	<5%
Little	5% – 12%
Some	>12%

MOISTURE CONTENT

DESCRIPTION	FIELD OBSERVATION
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but not visible water
Wet	Visible free water

SOIL CLASSIFICATION INCLUDES

1. Group Name
2. Group Symbol
3. Color
4. Moisture content
5. Density / consistency
6. Cementation
7. Particle size (if applicable)
8. Odor (if present)
9. Comments

MAJOR DIVISIONS WITH GRAIN SIZE

SIEVE SIZE						
12"	3"	3/4"	4	10	40	200
GRAIN SIZE (INCHES)						
12	3	0.75	0.19	0.079	0.0171	0.0029

Boulders	Cobbles	Gravel		Sand			Silt and Clay
		Coarse	Fine	Coarse	Medium	Fine	

Conditions shown on boring and testpit logs represent our observations at the time and location of the fieldwork, modifications based on lab test, analysis, and geological and engineering judgment. These conditions may not exist at other times and locations, even in close proximity thereof. This information was gathered as part of our investigation, and we are not responsible for any use or interpretation of the information by others.

Appendix III
Laboratory Testing Results

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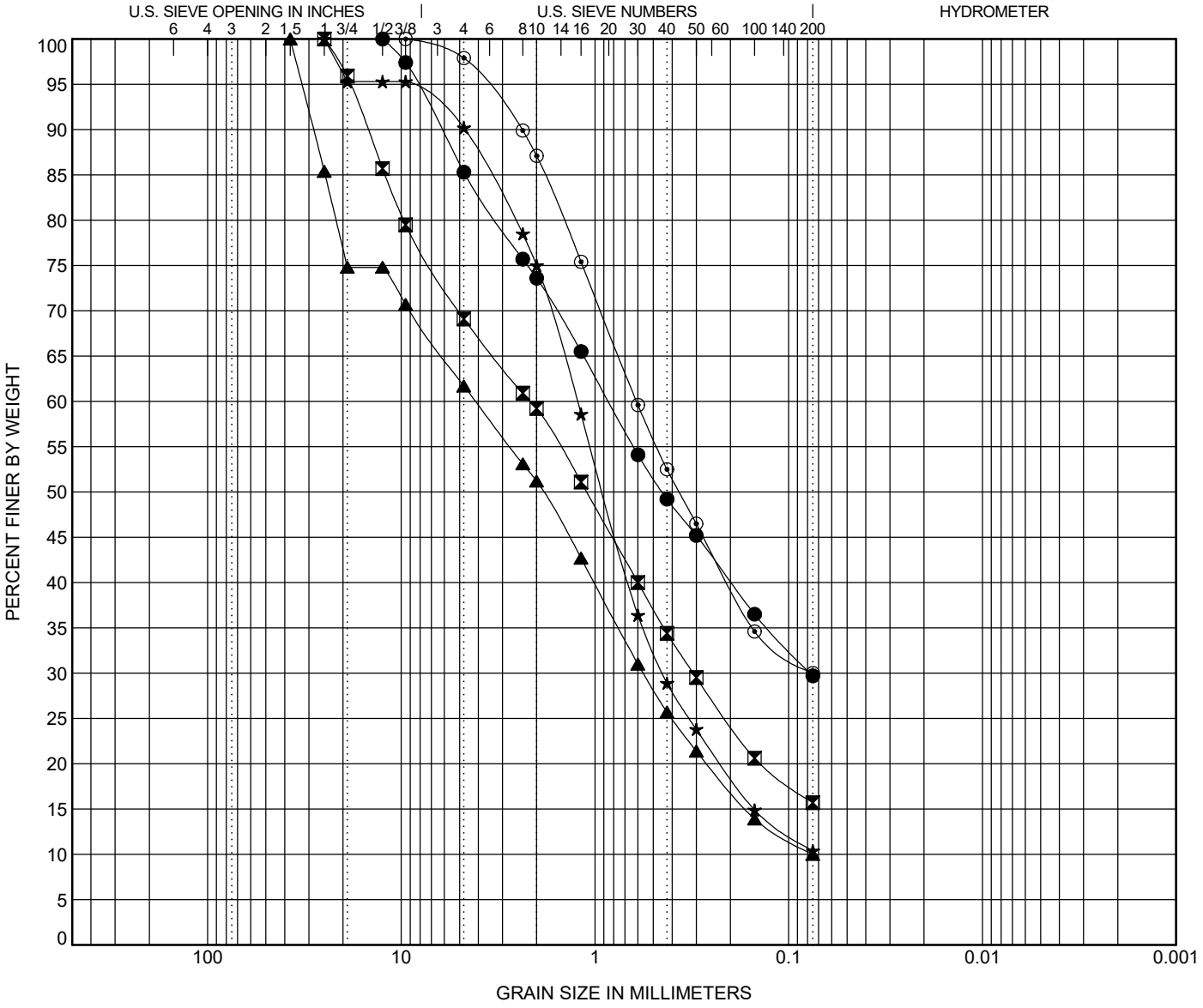
GRAIN SIZE DISTRIBUTION

CLIENT Mission Ridge Ski and Board Resort

PROJECT NAME Mission Ridge Expansion Project - Proposed Access Road

PROJECT NUMBER 217-854

PROJECT LOCATION Mission Ridge Ski and Board Resort, Chelan Co., WA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	B-1	10.0	SILTY SAND (SM)					
⊠	B-1	25.0	SILTY SAND WITH GRAVEL (SM)					
▲	B-2	2.5	WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)				1.02	55.15
★	B-2	5.0	WELL GRADED SAND WITH SILT (SW-SM)				2.30	17.50
⊙	B-3	5.0	SILTY SAND (SM)					

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-1	10.0	12.5	0.851	0.077		14.7	55.6	29.7	
⊠	B-1	25.0	25	2.162	0.311		30.9	53.4	15.7	
▲	B-2	2.5	37.5	4.137	0.562	0.075	38.3	51.7	10.0	
★	B-2	5.0	25	1.234	0.447		9.8	79.8	10.4	
⊙	B-3	5.0	9.5	0.61	0.075		2.1	67.9	30.0	

GRAIN SIZE - TEMPLATE_JESSE.GDT - 1/17/20 12:32 - C:\USERS\GN NORTHERN\ONEDRIVE\PUBLIC\MISSION RIDGE EXPANSION FILES\ACCESS ROAD FILES\ACCESS ROAD LOGS.GPJ

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722 N. 16th Avenue Suite 31
Yakima, Washington
Telephone: (509) 248-9798
Fax: (509) 248-4220

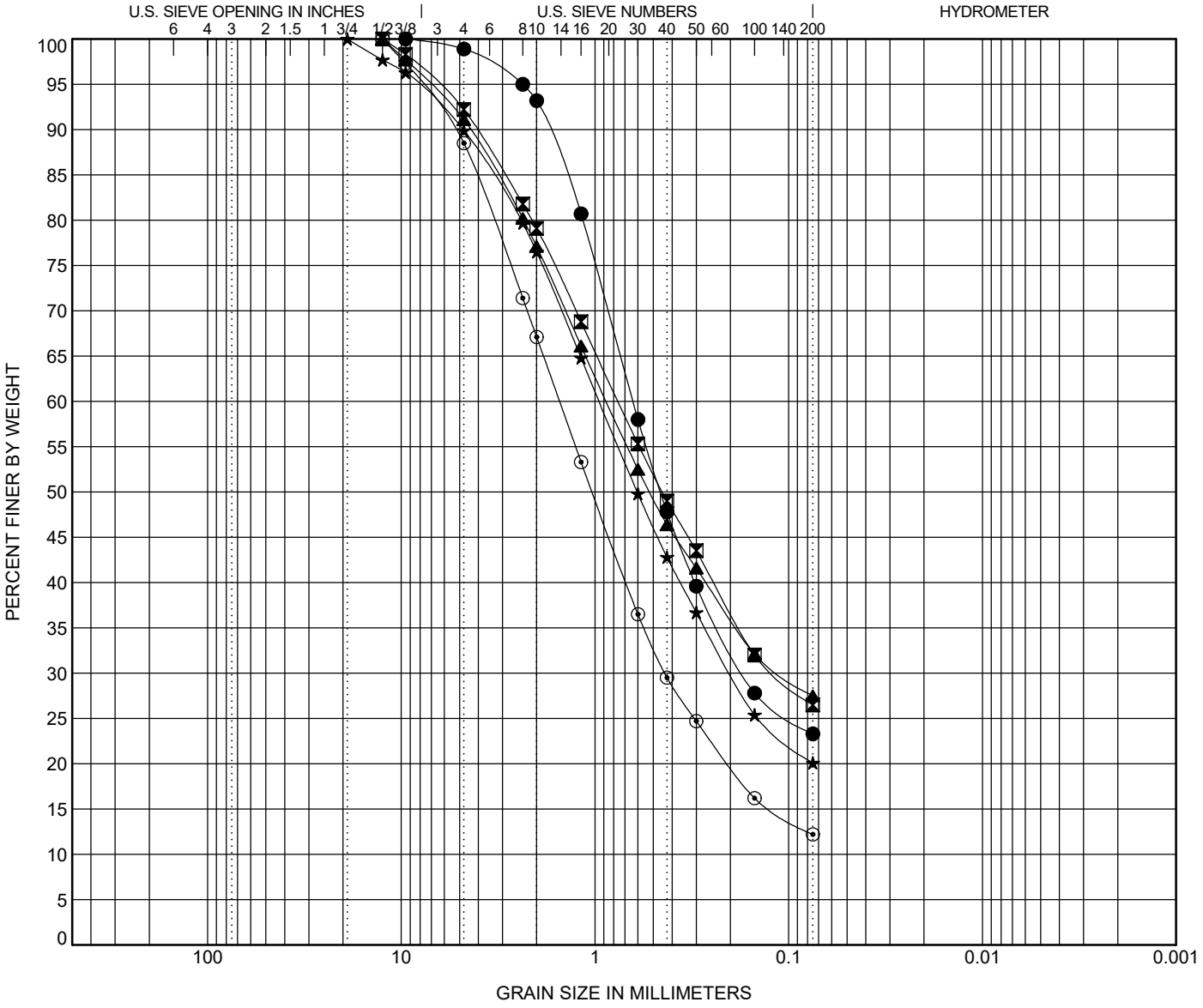
GRAIN SIZE DISTRIBUTION

CLIENT Mission Ridge Ski and Board Resort

PROJECT NAME Mission Ridge Expansion Project - Proposed Access Road

PROJECT NUMBER 217-854

PROJECT LOCATION Mission Ridge Ski and Board Resort, Chelan Co., WA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE		DEPTH	Classification	LL	PL	PI	Cc	Cu
●	B-3	10.0	SILTY SAND (SM)					
⊠	B-3	20.0	SILTY SAND (SM)					
▲	B-4	5.0	SILTY SAND (SM)					
★	B-4	20.0	SILTY SAND (SM)					
⊙	B-5	13.5	SILTY SAND (SM)				2.43	29.76

BOREHOLE		DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-3	10.0	9.5	0.637	0.171		1.1	75.6	23.3	
⊠	B-3	20.0	12.5	0.759	0.117		7.8	65.7	26.5	
▲	B-4	5.0	12.5	0.871	0.109		8.9	63.6	27.5	
★	B-4	20.0	19	0.95	0.199		10.1	69.8	20.1	
⊙	B-5	13.5	12.5	1.525	0.436		11.5	76.3	12.2	

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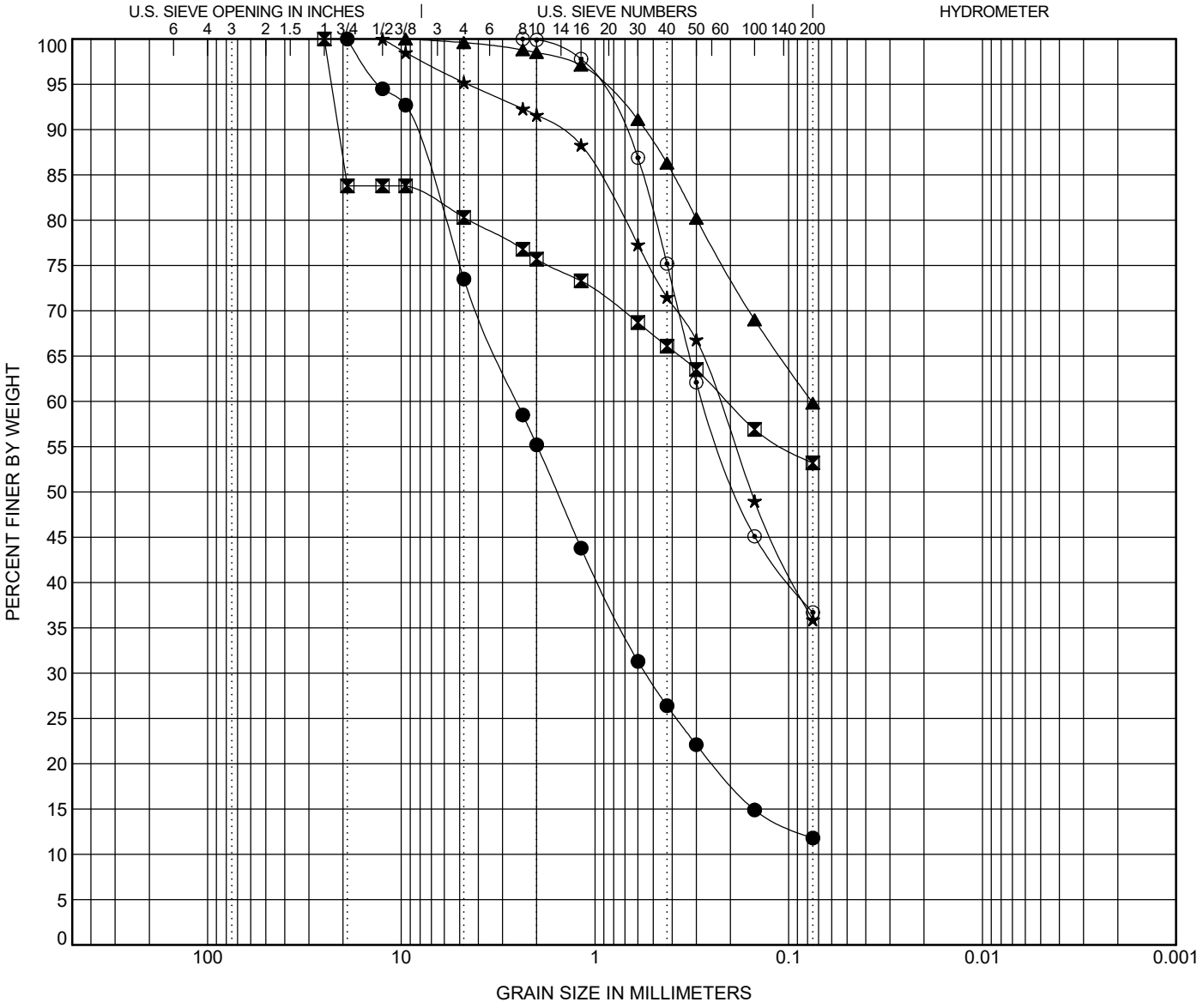
GRAIN SIZE DISTRIBUTION

CLIENT Mission Ridge Ski and Board Resort

PROJECT NAME Mission Ridge Expansion Project - Proposed Access Road

PROJECT NUMBER 217-854

PROJECT LOCATION Mission Ridge Ski and Board Resort, Chelan Co., WA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	B-6	5.0	WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)				2.36	50.47
⊠	B-8	10.0	SANDY FAT CLAY with GRAVEL(CH)	51	23	28		
▲	B-9	2.5	SANDY LEAN CLAY (CL)					
★	B-9	5.0	CLAYEY SAND(SC)	38	10	28		
⊙	B-9	10.0	CLAYEY SAND(SC)	36	23	13		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-6	5.0	19	2.531	0.548		26.5	61.7	11.8	
⊠	B-8	10.0	25	0.208			19.7	27.1	53.2	
▲	B-9	2.5	9.5	0.076			0.4	39.8	59.8	
★	B-9	5.0	12.5	0.23			4.8	59.3	35.9	
⊙	B-9	10.0	2.36	0.275			0.0	63.3	36.7	

GRAIN SIZE - TEMPLATE_JESSE.GDT - 1/17/20 12:32 - C:\USERS\GN NORTHERN\ONEDRIVE\PUBLIC\MISSION RIDGE EXPANSION FILES\ACCESS ROAD FILES\ACCESS ROAD LOGS.GPJ

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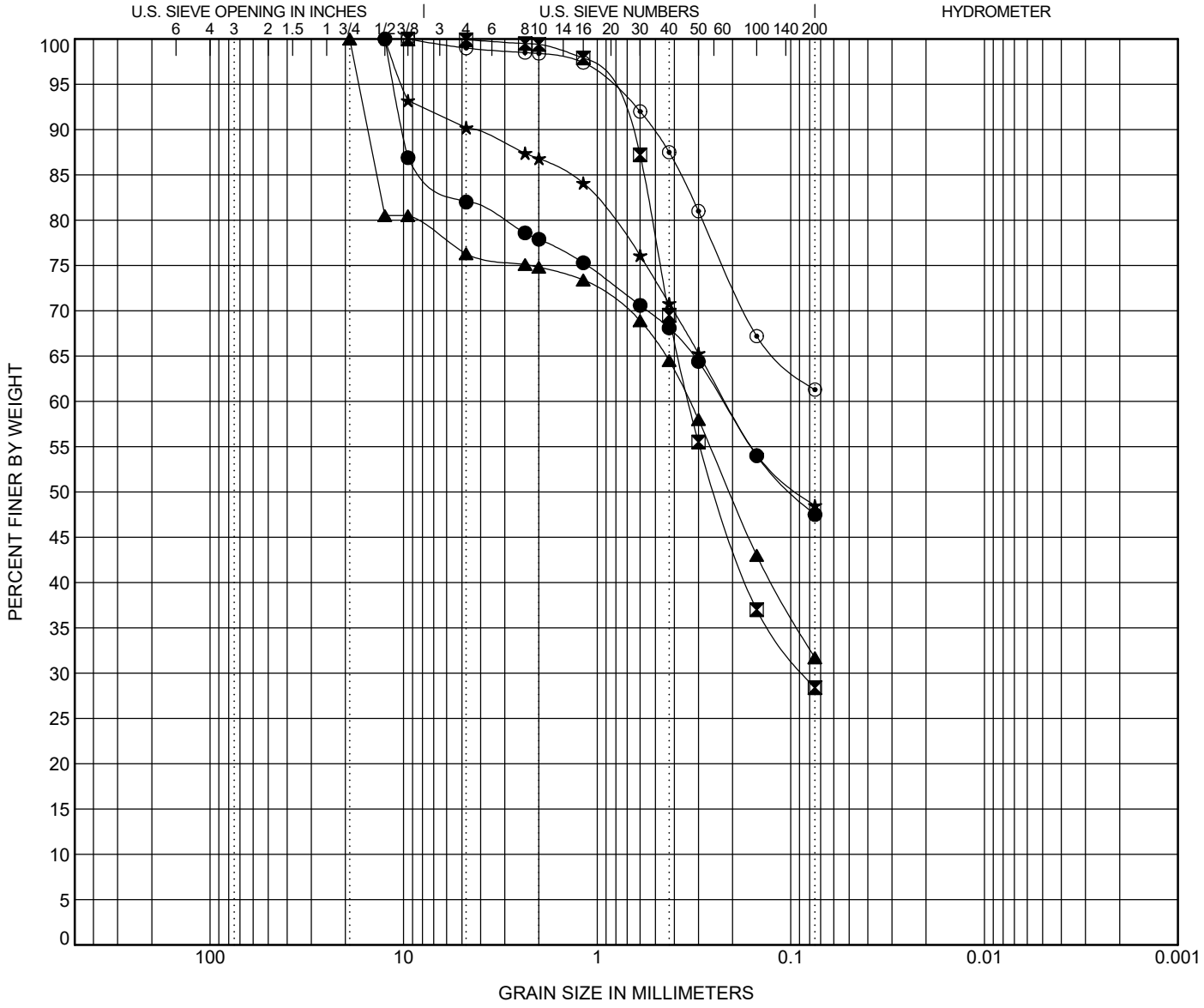
GRAIN SIZE DISTRIBUTION

CLIENT Mission Ridge Ski and Board Resort

PROJECT NAME Mission Ridge Expansion Project - Proposed Access Road

PROJECT NUMBER 217-854

PROJECT LOCATION Mission Ridge Ski and Board Resort, Chelan Co., WA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	B-9	35.0	CLAYEY SAND with GRAVEL(SC)	48	26	22		
⊠	B-10	5.0	SILTY SAND (SM)					
▲	B-10	10.0	SILTY SAND WITH GRAVEL (SM)					
★	B-10	15.0	SANDY LEAN CLAY (CL)	41	20	21		
⊙	B-10	25.0	SANDY LEAN CLAY (CL)	39	22	17		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-9	35.0	12.5	0.224			18.0	34.5	47.5	
⊠	B-10	5.0	9.5	0.336	0.085		0.1	71.5	28.4	
▲	B-10	10.0	19	0.334			23.7	44.6	31.7	
★	B-10	15.0	12.5	0.216			9.8	41.7	48.5	
⊙	B-10	25.0	9.5				1.0	37.7	61.3	

GRAIN SIZE - TEMPLATE_JESSE.GDT - 1/17/20 12:32 - C:\USERS\GN NORTHERN\ONEDRIVE\PUBLIC\MISSION RIDGE EXPANSION FILES\ACCESS ROAD FILES\ACCESS ROAD LOGS.GPJ

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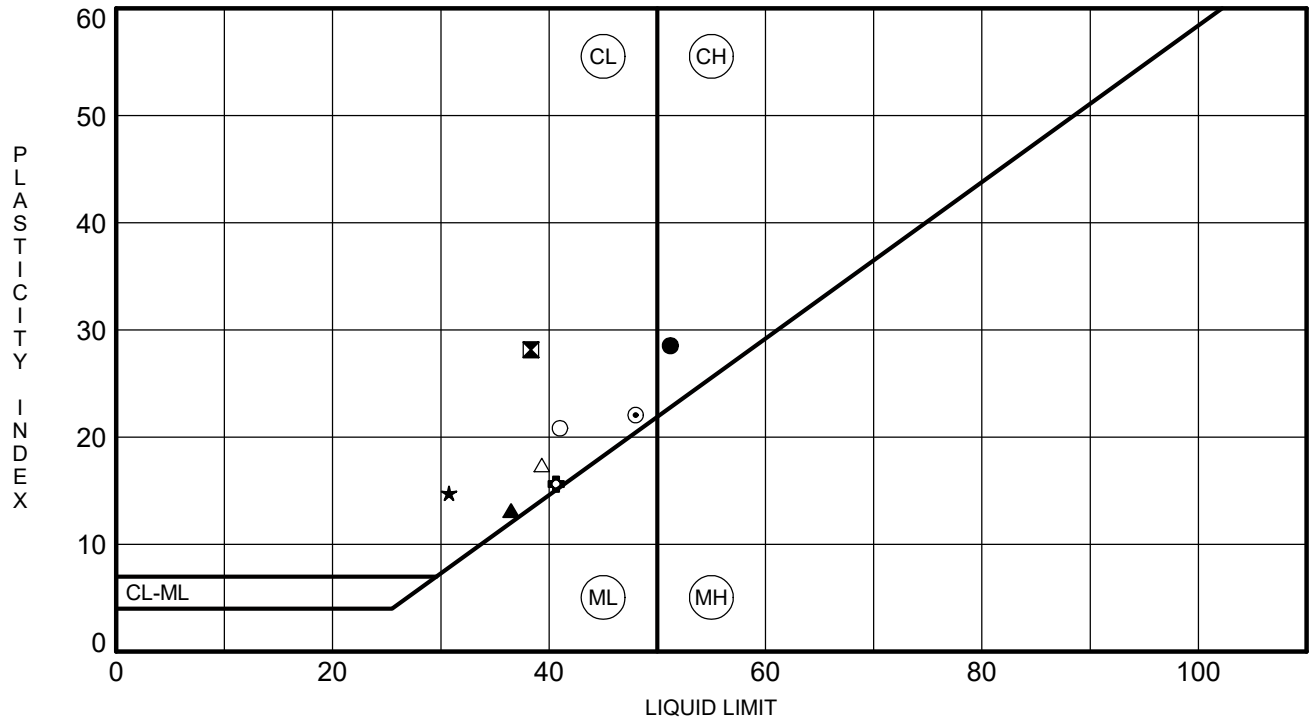
ATTERBERG LIMITS' RESULTS

CLIENT Mission Ridge Ski and Board Resort

PROJECT NAME Mission Ridge Expansion Project - Proposed Access Road

PROJECT NUMBER 217-854

PROJECT LOCATION Mission Ridge Ski and Board Resort, Chelan Co., WA



	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification
●	**B-8**	**10.0**	**51**	**23**	**28**	**53**	**SANDY FAT CLAY with GRAVEL(CH)**
⊠	**B-9**	**5.0**	**38**	**10**	**28**	**36**	**CLAYEY SAND(SC)**
▲	**B-9**	**10.0**	**36**	**23**	**13**	**37**	**CLAYEY SAND(SC)**
★	**B-9**	**25.0**	**31**	**16**	**15**		**SANDY LEAN CLAY with GRAVEL (CL)**
⊙	**B-9**	**35.0**	**48**	**26**	**22**	**48**	**CLAYEY SAND with GRAVEL(SC)**
✿	**B-9**	**45.0**	**41**	**25**	**16**		**LEAN CLAY (CL)**
○	**B-10**	**15.0**	**41**	**20**	**21**	**49**	**CLAYEY SAND(SC)**
△	**B-10**	**25.0**	**39**	**22**	**17**	**61**	**SANDY LEAN CLAY(CL)**

ATTERBERG LIMITS - TEMPLATE_JESSE.GDT - 1/17/20 12:24 - C:\USERS\GN NORTHERN\ONEDRIVE\PUBLIC\MISSION RIDGE EXPANSION FILES\ACCESS ROAD FILES\ACCESS ROAD LOGS.GPJ

Appendix IV

Site & Exploration Photographs

Rock Core Photographs

Drilling at borehole B-1

Split-spoon sample obtained within borehole B-1 @ 15' BGS

Drilling at borehole B-2

Core sample run obtained within borehole B-2 from 25' to 30' BGS

Drilling at borehole B-3

Core sample run obtained within borehole B-3 from 40' to 45' BGS

PLATE 1: SITE & EXPLORATION PHOTOGRAPHS **PROJECT NO. 217-854**

Drilling at borehole B-4

Split-spoon sample obtained within borehole B-4 @ 25' BGS

Drilling at borehole B-5

Split-spoon sample obtained within borehole B-5 @ 13.5' BGS

Drilling at borehole B-6

Core sample run obtained within borehole B-6 from 20.5' to 25' BGS

PLATE 2: SITE & EXPLORATION PHOTOGRAPHS **PROJECT NO. 217-854**

Drilling at borehole B-7

Split-spoon sample obtained within borehole B-7 @ 25' BGS

Drilling at borehole B-8

Drilling at borehole B-9

Auger cuttings from borehole B-9

Split-spoon sample obtained within borehole B-9 @ 45' BGS

PLATE 3: SITE & EXPLORATION PHOTOGRAPHS **PROJECT NO. 217-854**

Rock core sample obtained from borehole B-2 from 20' to 30' BGS

PLATE 1: ROCK CORE PHOTOGRAPHS **PROJECT NO. 217-854**

Rock core sample obtained from borehole B-3 from 32.5' to 40' BGS

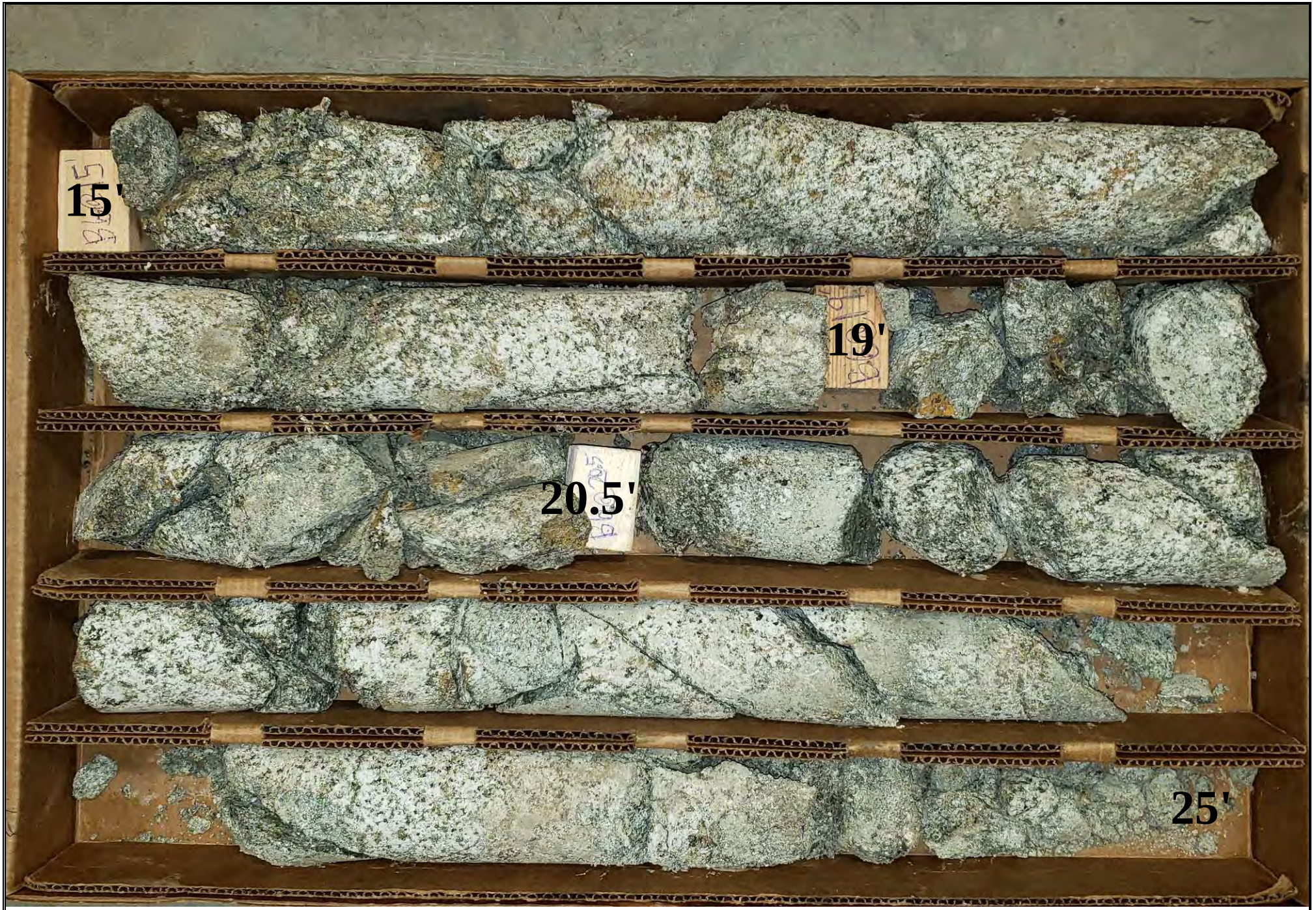
PLATE 2: ROCK CORE PHOTOGRAPHS **PROJECT NO. 217-854**

Rock core sample obtained from borehole B-3 from 40' to 45' BGS

PLATE 3: ROCK CORE PHOTOGRAPHS **PROJECT NO. 217-854**

Rock core sample obtained from borehole B-4 from 30' to 35' BGS

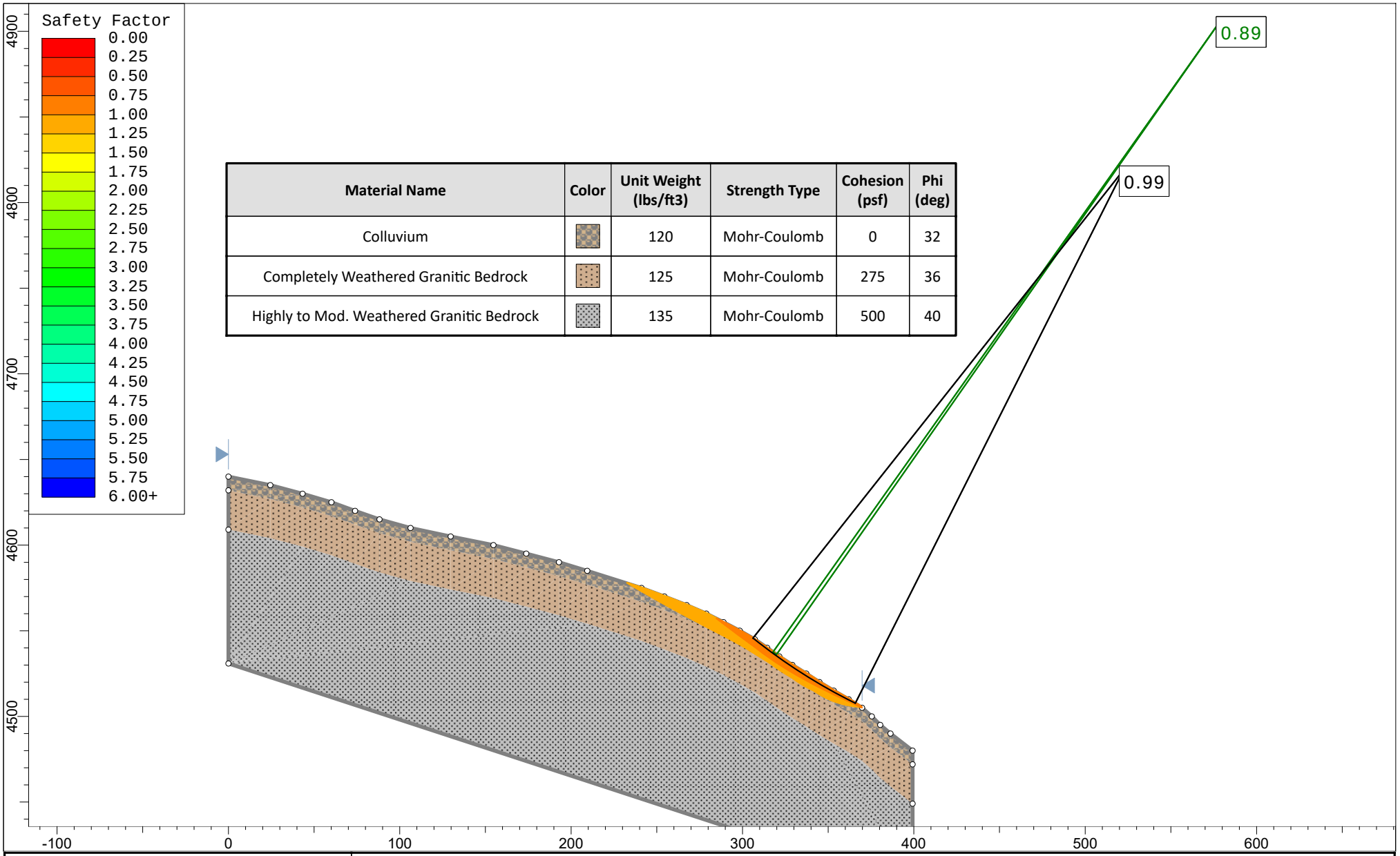
PLATE 4: ROCK CORE PHOTOGRAPHS **PROJECT NO. 217-854**



Rock core sample obtained from borehole B-6 from 15' to 25' BGS

PLATE 5: ROCK CORE PHOTOGRAPHS **PROJECT NO. 217-854**

Appendix V
Slope Stability Analyses



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Colluvium		120	Mohr-Coulomb	0	32
Completely Weathered Granitic Bedrock		125	Mohr-Coulomb	275	36
Highly to Mod. Weathered Granitic Bedrock		135	Mohr-Coulomb	500	40

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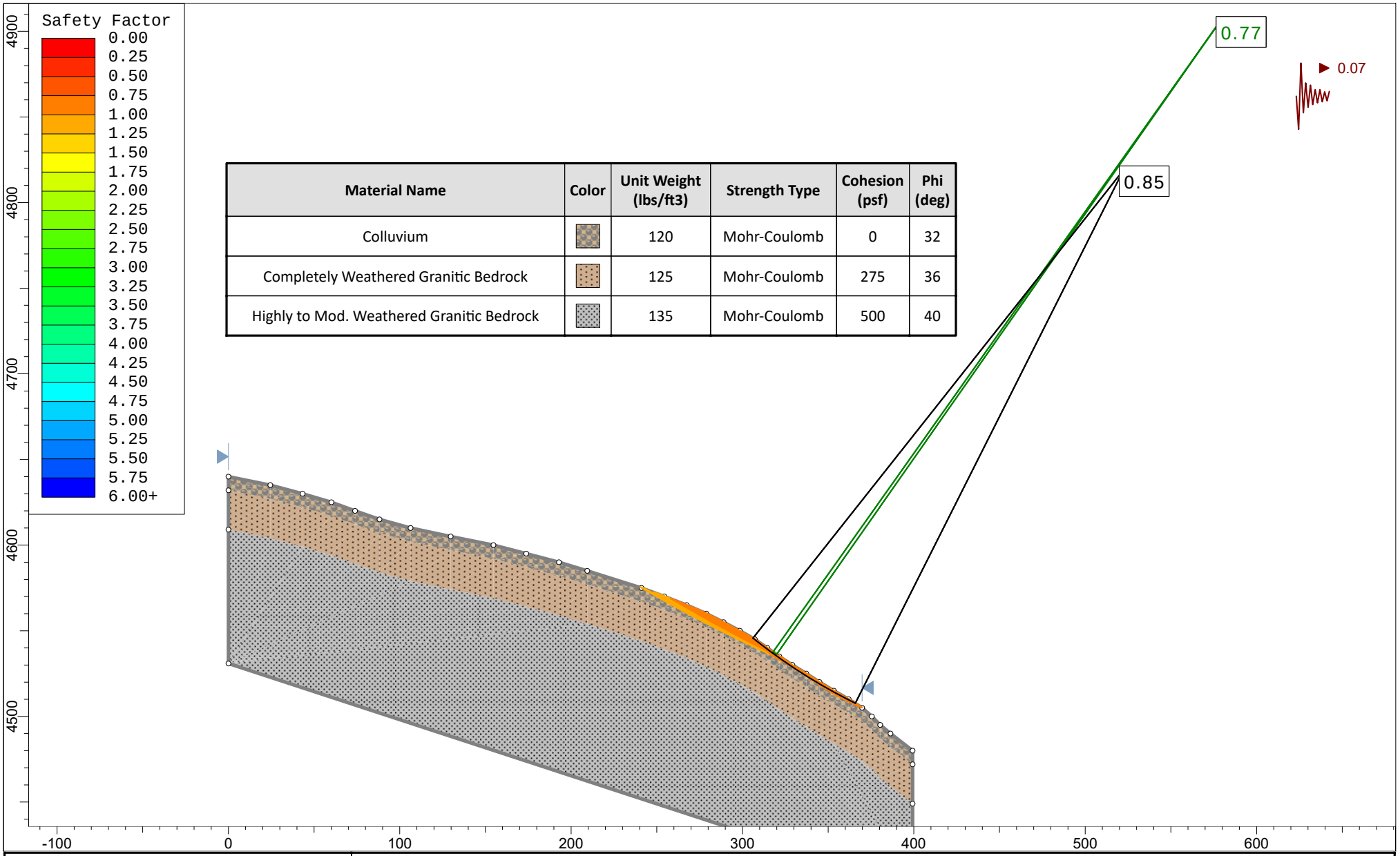
Construction Materials Testing Geophysical Services

SLIDEINTERPRET 7.037

Project	Proposed Access Roadway - Mission Ridge Expansion Project		
Analysis Description	Section A-A' - Existing Condition - Spencer Method - Static		
Drawn By	MYM	*Scale* 1:929	*Company* GN Northern, Inc.
Date			*File Name* SecAA_existing_static.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Colluvium		120	Mohr-Coulomb	0	32
Completely Weathered Granitic Bedrock		125	Mohr-Coulomb	275	36
Highly to Mod. Weathered Granitic Bedrock		135	Mohr-Coulomb	500	40

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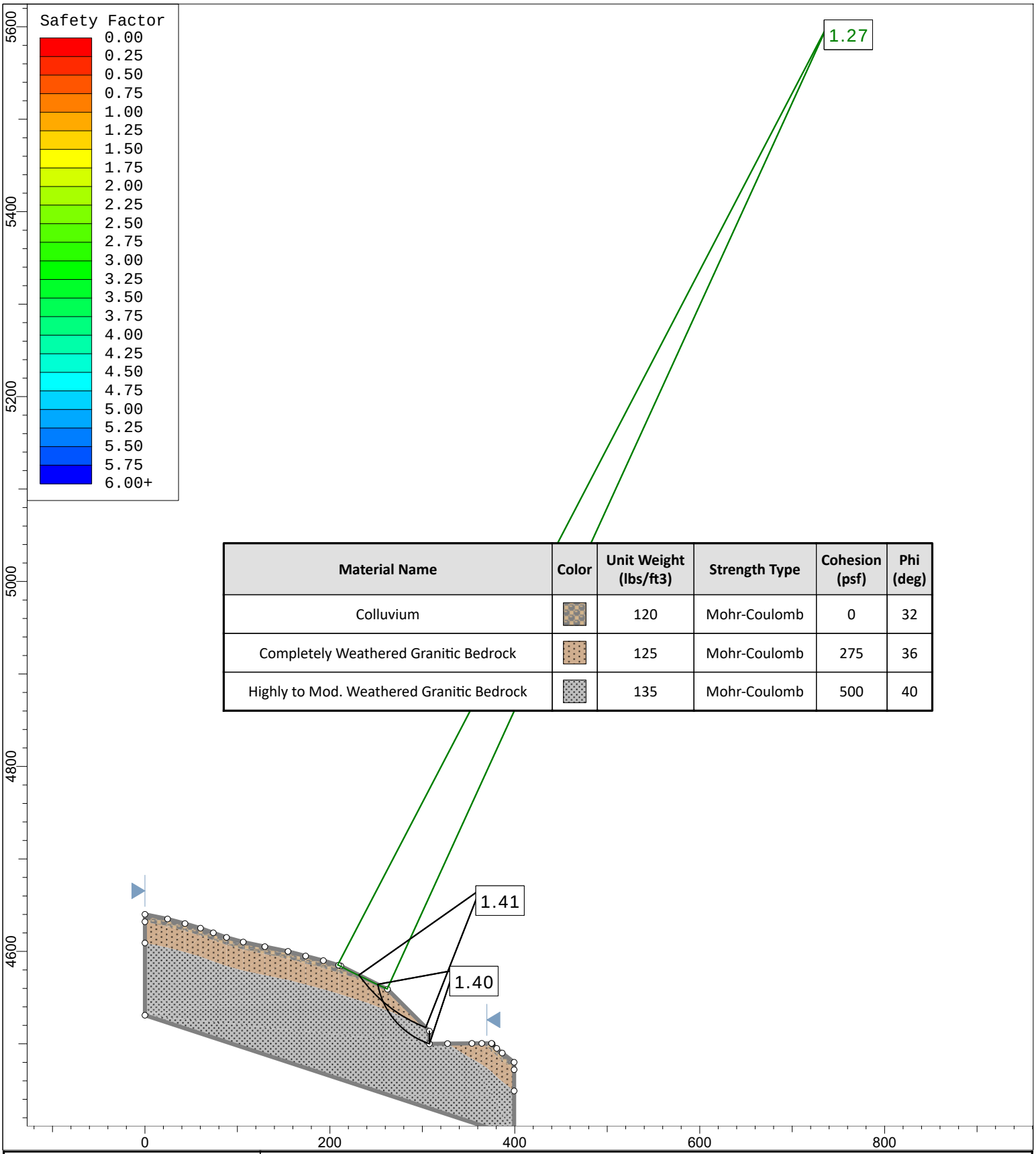
Project	Proposed Access Roadway - Mission Ridge Expansion Project		
Analysis Description	Section A-A' - Existing Condition - Spencer Method - Pseudostatic		
Drawn By	MYM	*Scale* 1:929	*Company* GN Northern, Inc.
Date		*File Name*	SecAA_existing_seismic.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Colluvium		120	Mohr-Coulomb	0	32
Completely Weathered Granitic Bedrock		125	Mohr-Coulomb	275	36
Highly to Mod. Weathered Granitic Bedrock		135	Mohr-Coulomb	500	40

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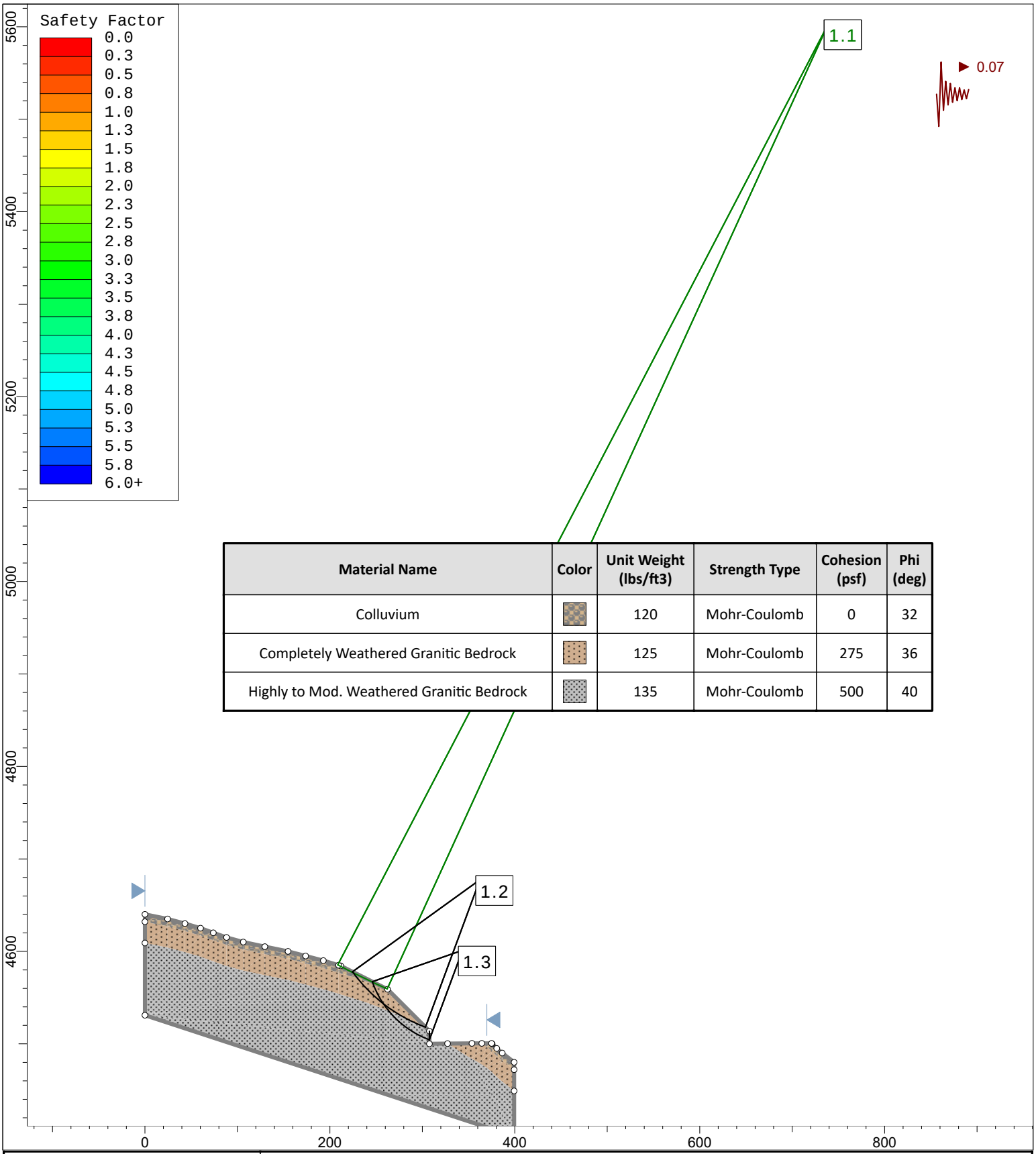
Project	Proposed Access Roadway - Mission Ridge Expansion Project		
Analysis Description	Section A-A' - Cut Slope - Spencer Method - Static		
Drawn By MYM	*Scale* 1:1672	*Company* GN Northern, Inc.	
Date		*File Name* SecAA_cut_static.slim	



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Colluvium		120	Mohr-Coulomb	0	32
Completely Weathered Granitic Bedrock		125	Mohr-Coulomb	275	36
Highly to Mod. Weathered Granitic Bedrock		135	Mohr-Coulomb	500	40

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Project	Proposed Access Roadway - Mission Ridge Expansion Project		
Analysis Description	Section A-A' - Cut Slope - Spencer Method - Pseudostatic		
Drawn By MYM	*Scale* 1:1672	*Company* GN Northern, Inc.	
Date		*File Name* SecAA_cut_seismic.slim	

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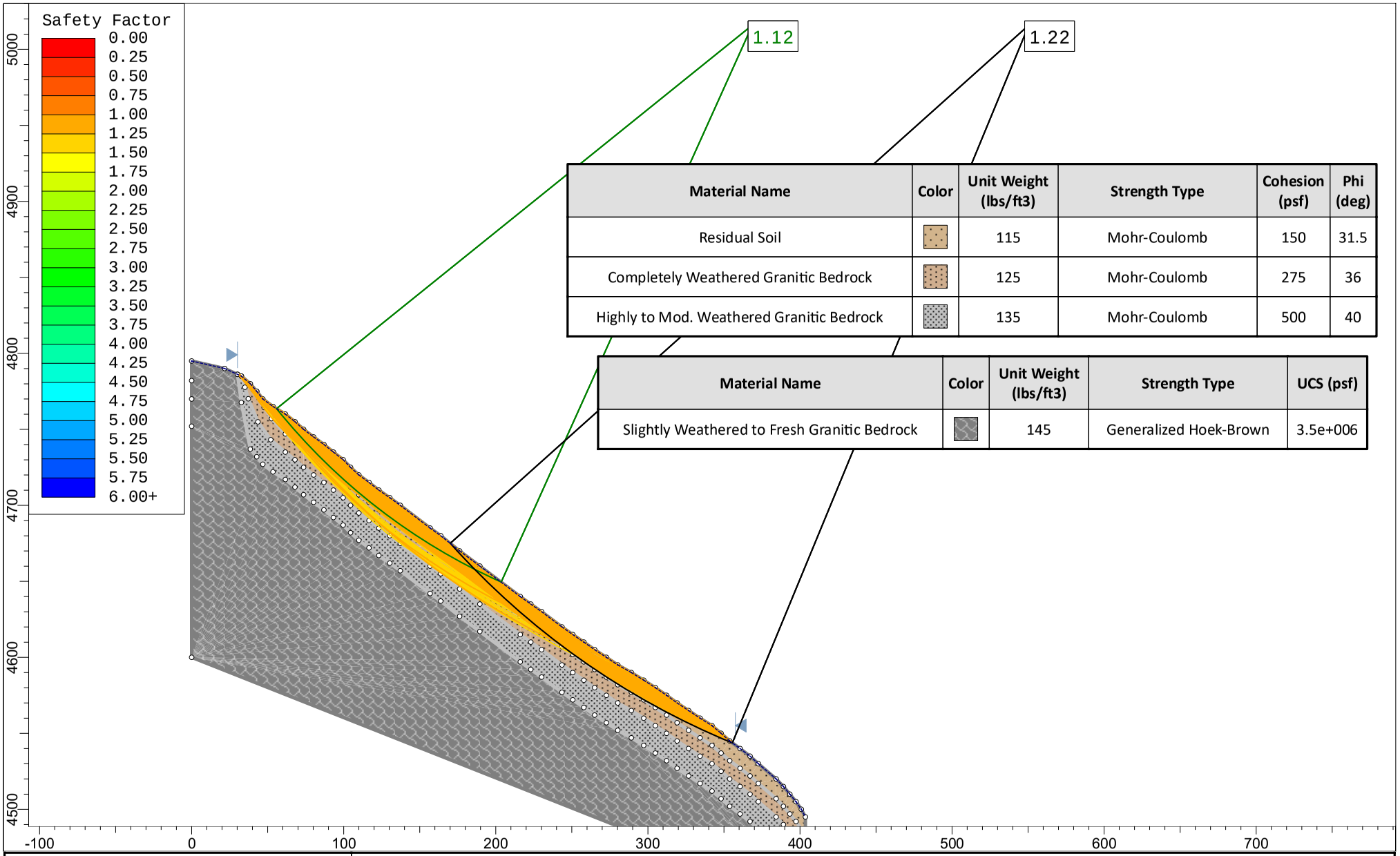

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Residual Soil		115	Mohr-Coulomb	150	31.5
Completely Weathered Granitic Bedrock		125	Mohr-Coulomb	275	36
Highly to Mod. Weathered Granitic Bedrock		135	Mohr-Coulomb	500	40

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (psf)
Slightly Weathered to Fresh Granitic Bedrock		145	Generalized Hoek-Brown	3.5e+006

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Project	Proposed Access Roadway - Mission Ridge Expansion Project		
Analysis Description	Section B-B' - Existing Conditions - Spencer Method - Pseudostatic		
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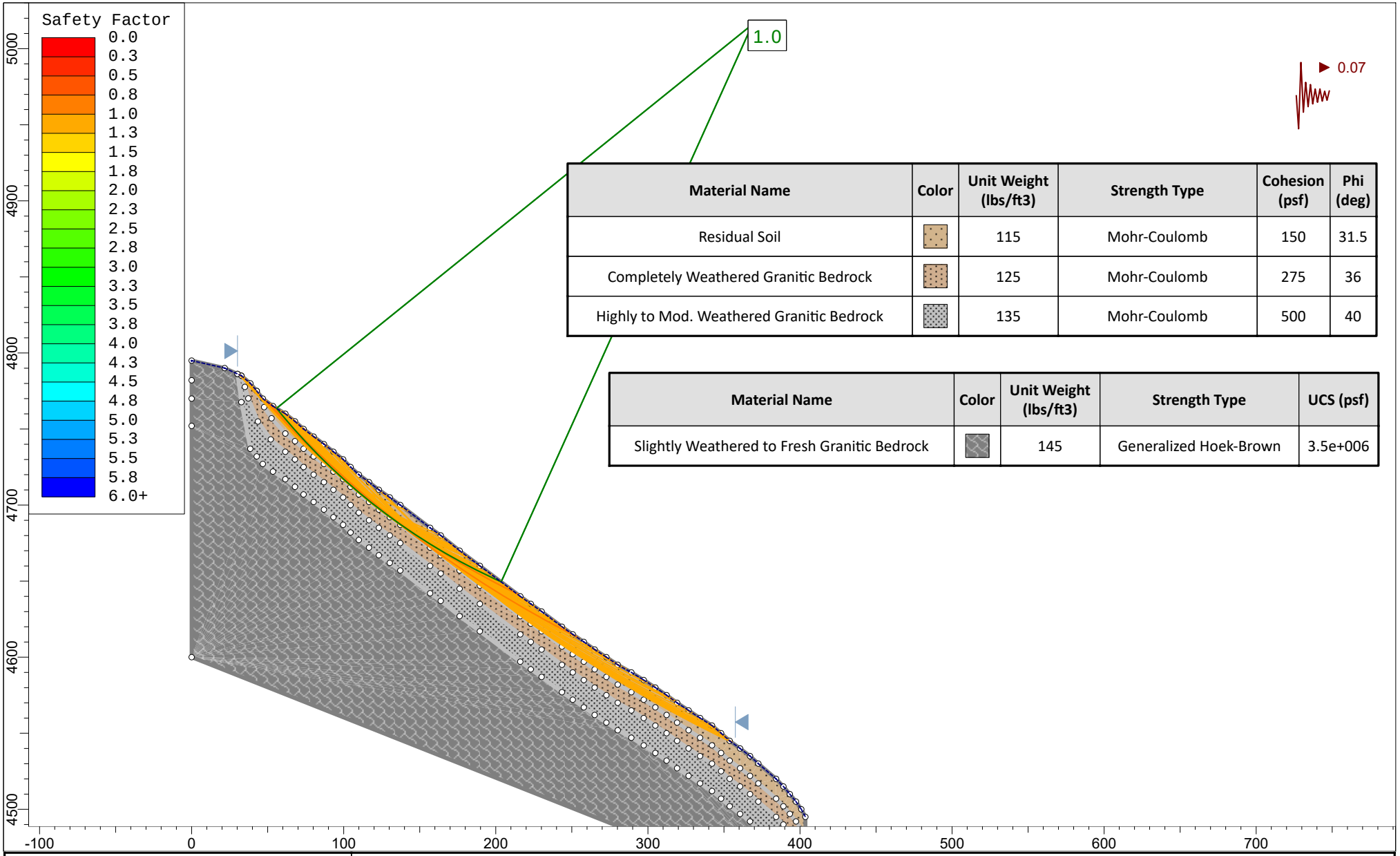
Date			File Name SecBB_existing_static.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Residual Soil		115	Mohr-Coulomb	150	31.5
Completely Weathered Granitic Bedrock		125	Mohr-Coulomb	275	36
Highly to Mod. Weathered Granitic Bedrock		135	Mohr-Coulomb	500	40

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (psf)
Slightly Weathered to Fresh Granitic Bedrock		145	Generalized Hoek-Brown	3.5e+006

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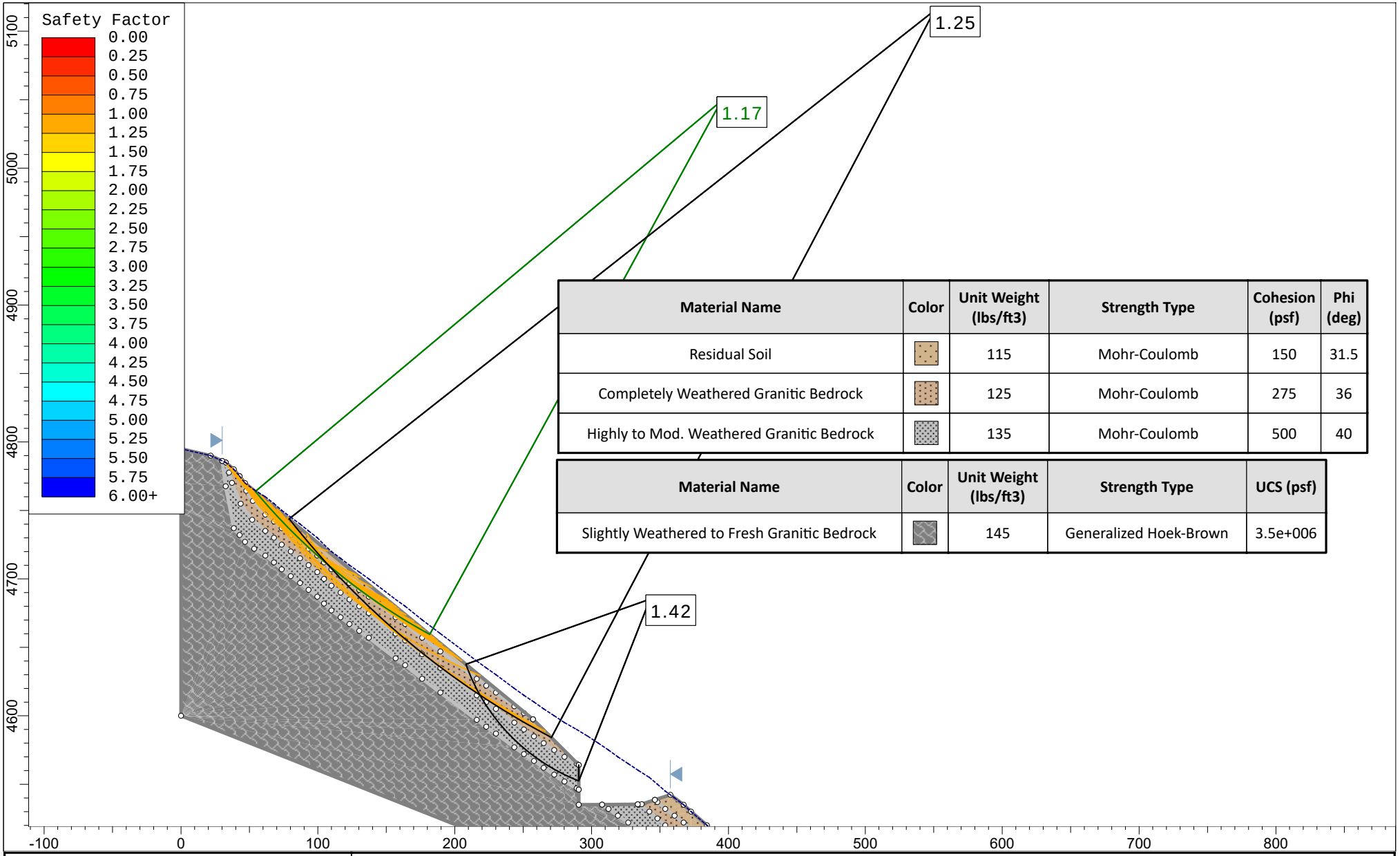
Project	Proposed Access Roadway - Mission Ridge Expansion Project		
Analysis Description	Section B-B' - Existing Conditions - Spencer Method - Pseudostatic		
Drawn By	MYM	Scale 1:1046	Company GN Northern, Inc.
Date			File Name SecBB_existing_seismic.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Residual Soil		115	Mohr-Coulomb	150	31.5
Completely Weathered Granitic Bedrock		125	Mohr-Coulomb	275	36
Highly to Mod. Weathered Granitic Bedrock		135	Mohr-Coulomb	500	40

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (psf)
Slightly Weathered to Fresh Granitic Bedrock		145	Generalized Hoek-Brown	3.5e+006

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Project	Proposed Access Roadway - Mission Ridge Expansion Project		
Analysis Description	Section B-B' - Cut Slope - Spencer Method - Static		
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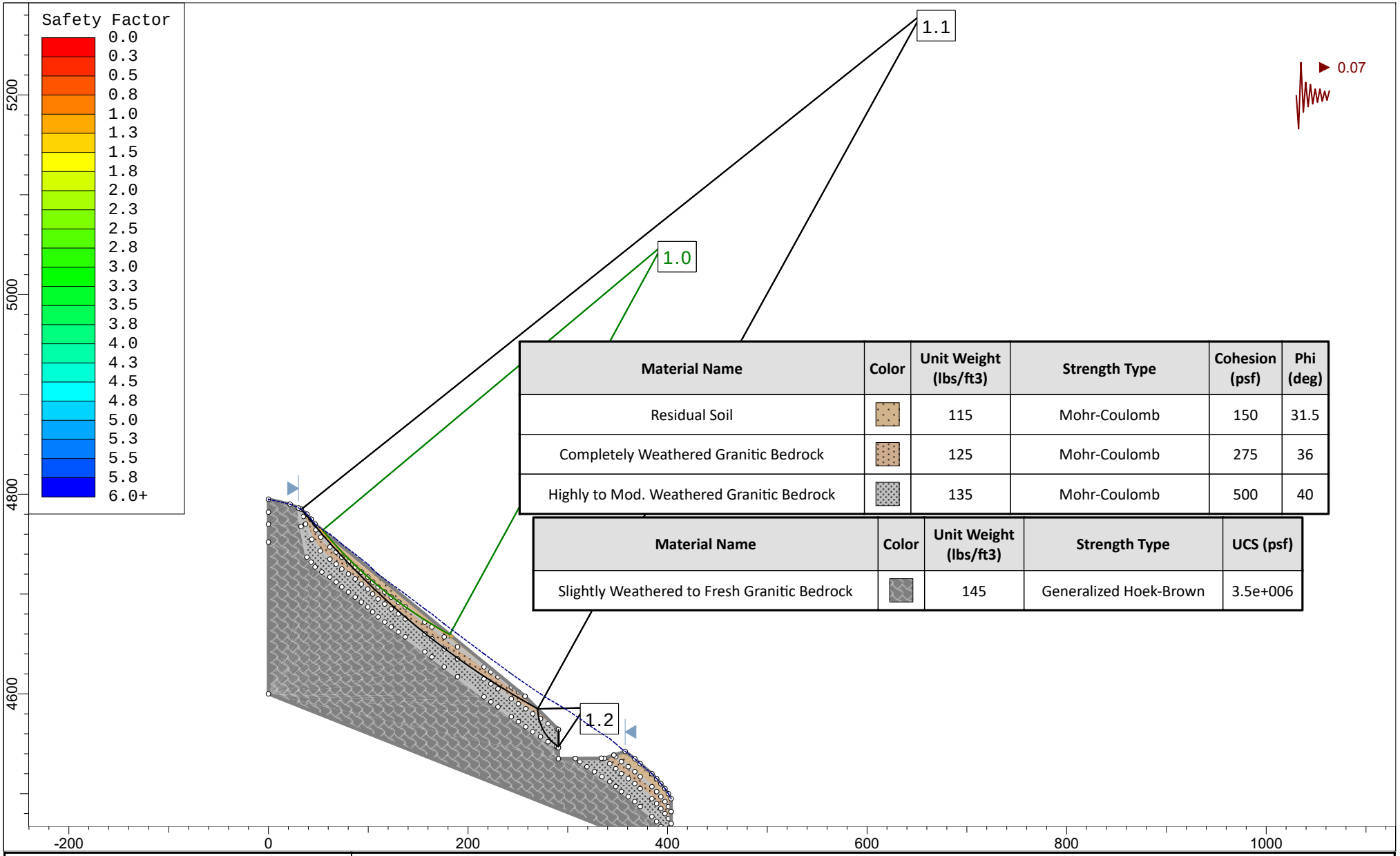
Date			File Name SecBB_cut_static.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Residual Soil		115	Mohr-Coulomb	150	31.5
Completely Weathered Granitic Bedrock		125	Mohr-Coulomb	275	36
Highly to Mod. Weathered Granitic Bedrock		135	Mohr-Coulomb	500	40

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (psf)
Slightly Weathered to Fresh Granitic Bedrock		145	Generalized Hoek-Brown	3.5e+006

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Project	Proposed Access Roadway - Mission Ridge Expansion Project		
Analysis Description	Section B-B' - Cut Slope - Spencer Method - Pseudostatic		
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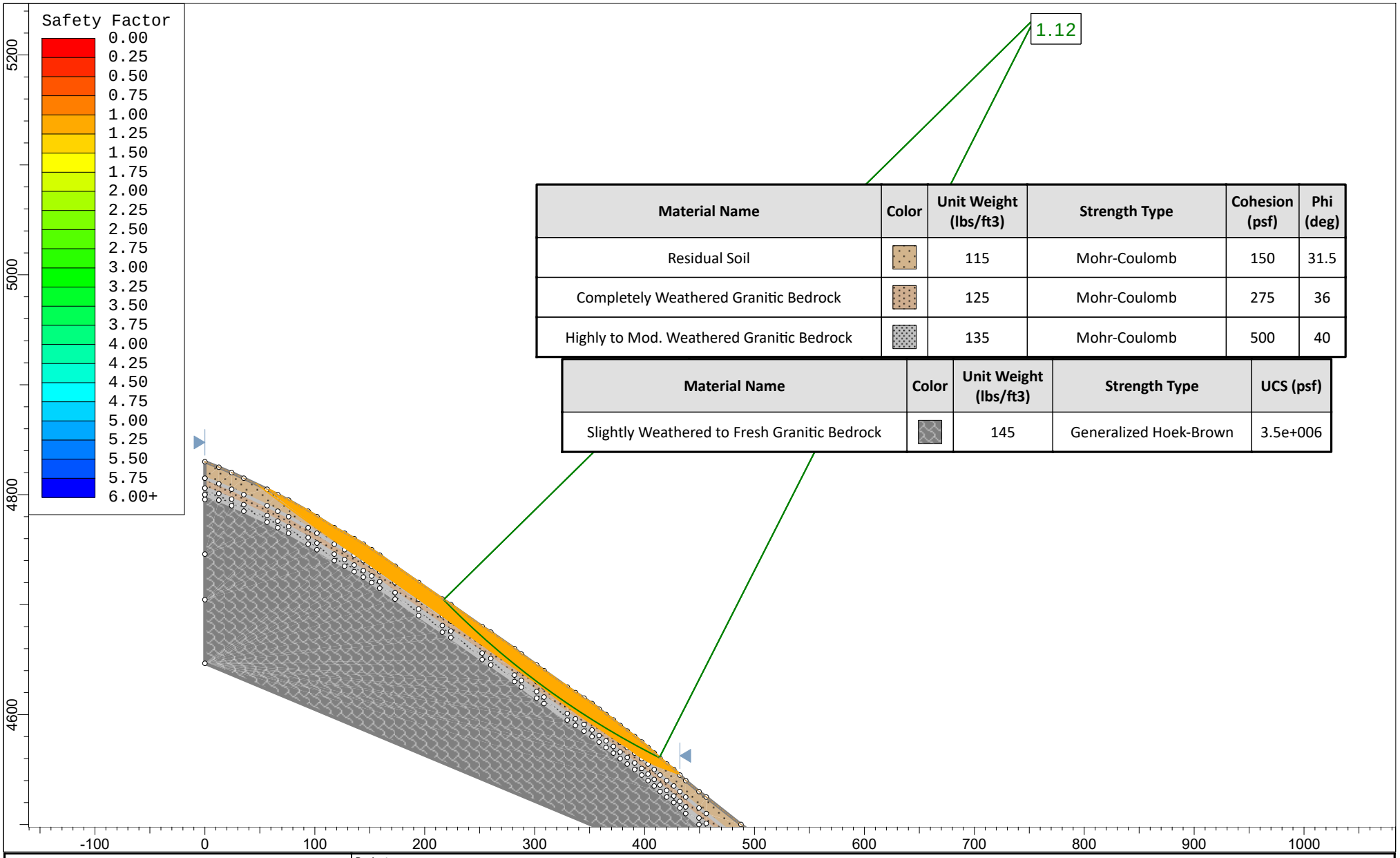
Date		*File Name* SecBB_cut_seismic.slim	



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Residual Soil		115	Mohr-Coulomb	150	31.5
Completely Weathered Granitic Bedrock		125	Mohr-Coulomb	275	36
Highly to Mod. Weathered Granitic Bedrock		135	Mohr-Coulomb	500	40

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (psf)
Slightly Weathered to Fresh Granitic Bedrock		145	Generalized Hoek-Brown	3.5e+006

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Project	Proposed Access Roadway - Mission Ridge Expansion Project		
Analysis Description	Section C-C' - Existing Condition - Spencer Method - Static		
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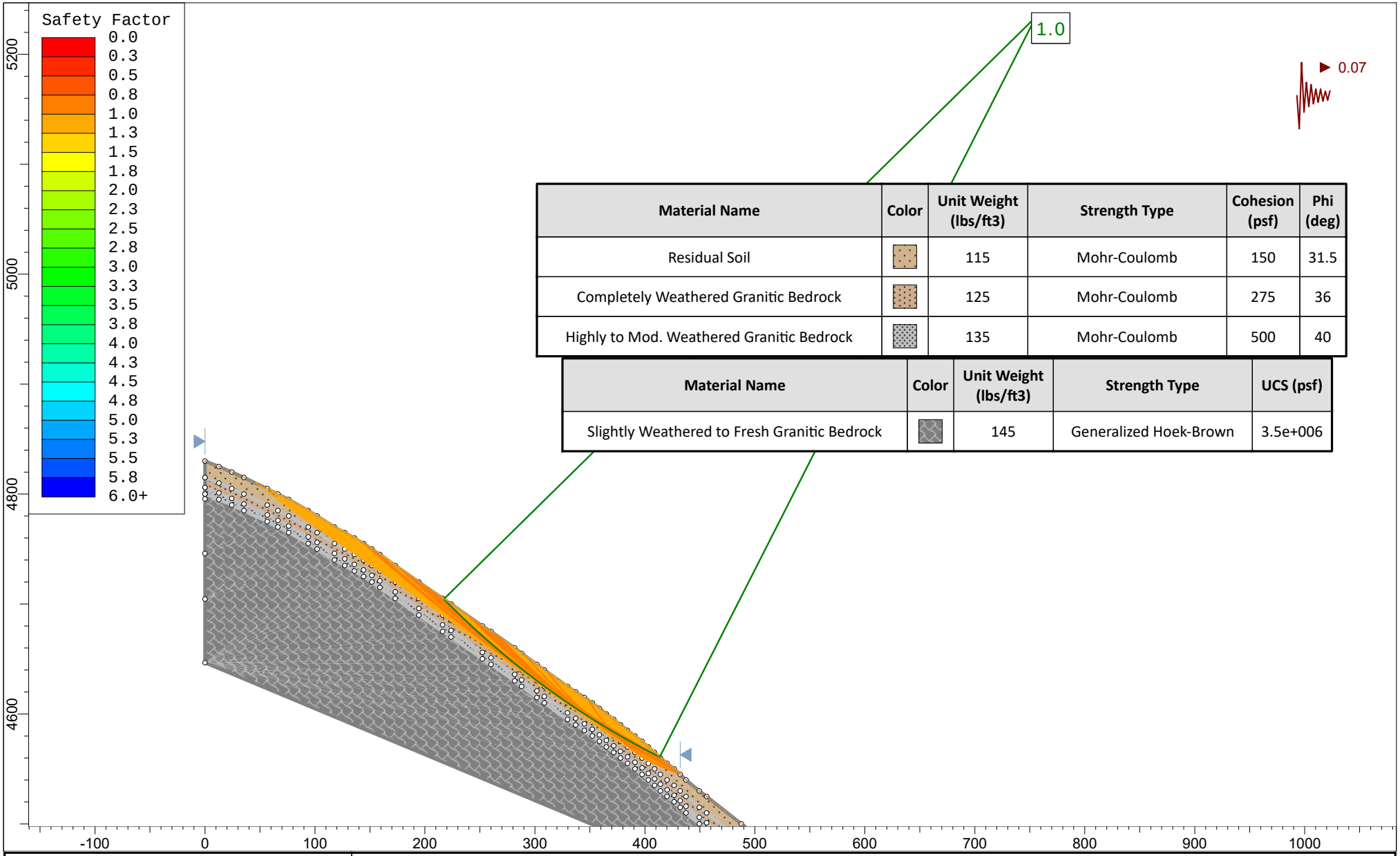
Date			*File Name* SecCC_existing_static.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Residual Soil		115	Mohr-Coulomb	150	31.5
Completely Weathered Granitic Bedrock		125	Mohr-Coulomb	275	36
Highly to Mod. Weathered Granitic Bedrock		135	Mohr-Coulomb	500	40

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (psf)
Slightly Weathered to Fresh Granitic Bedrock		145	Generalized Hoek-Brown	3.5e+006

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SLIDEINTERPRET 7.037

Project	Proposed Access Roadway - Mission Ridge Expansion Project		
Analysis Description	Section C-C' - Existing Condition - Spencer Method - Pseudostatic		
Drawn By	MYM	*Scale* 1:1448	*Company* GN Northern, Inc.
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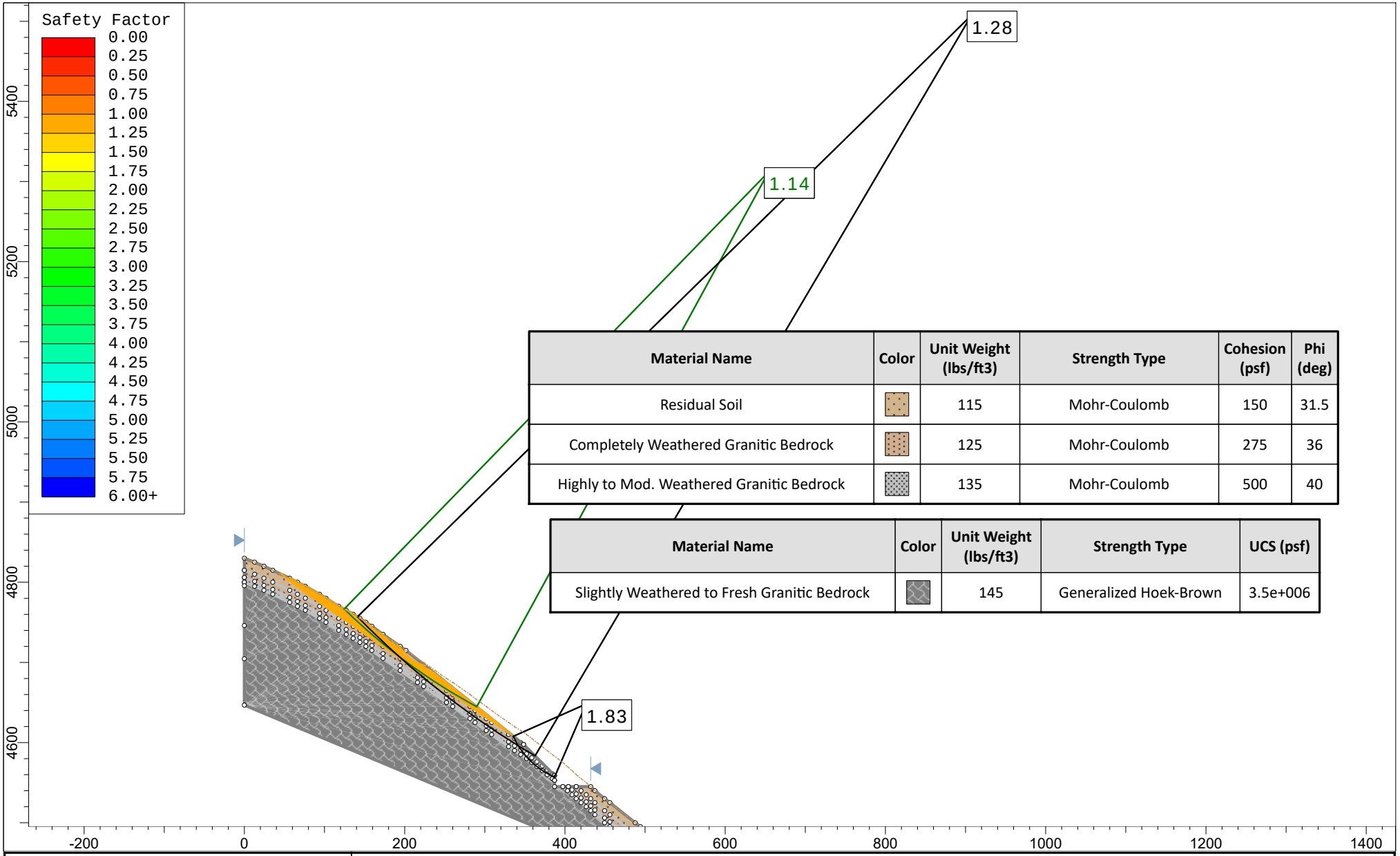


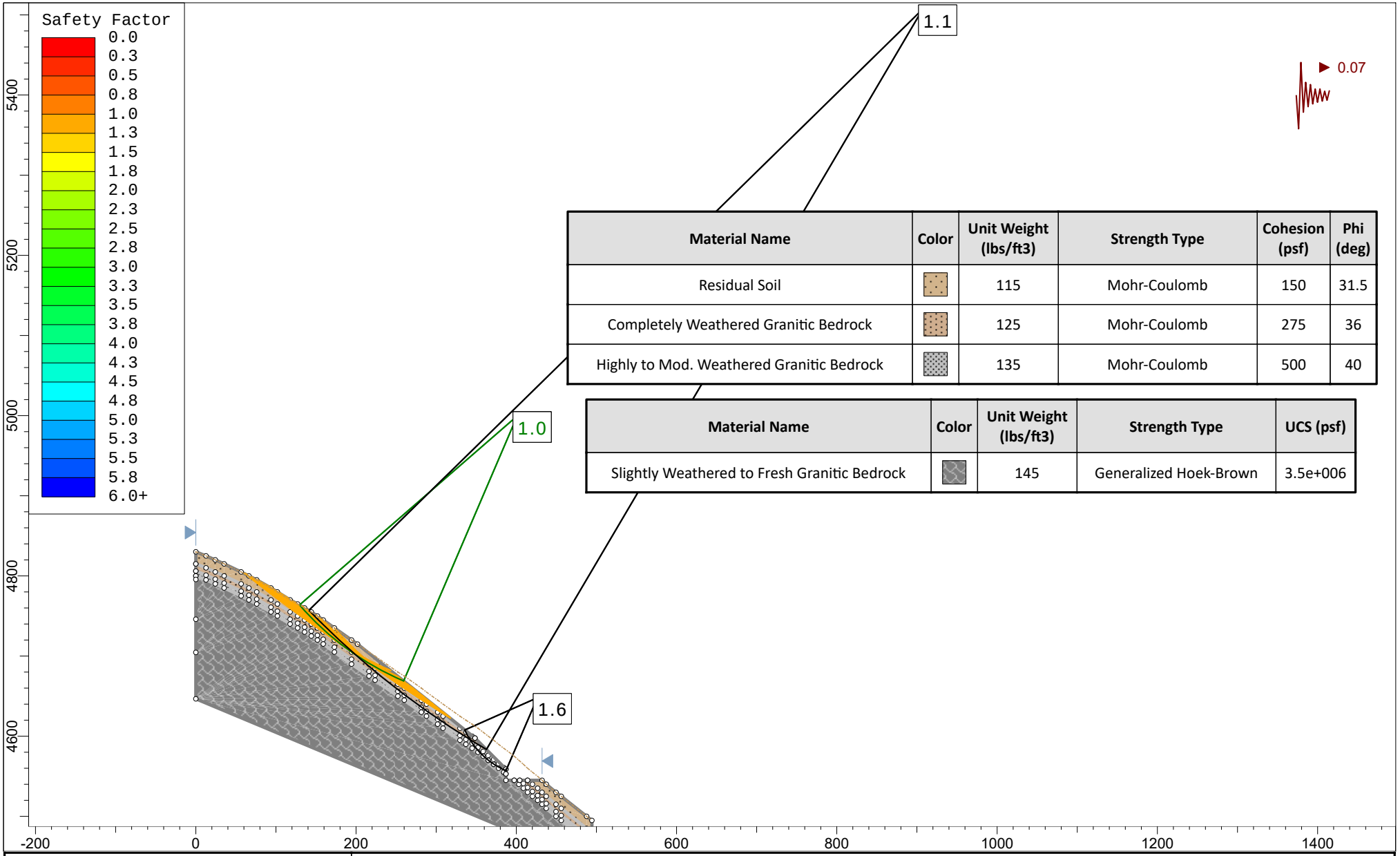
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Residual Soil		115	Mohr-Coulomb	150	31.5
Completely Weathered Granitic Bedrock		125	Mohr-Coulomb	275	36
Highly to Mod. Weathered Granitic Bedrock		135	Mohr-Coulomb	500	40

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (psf)
Slightly Weathered to Fresh Granitic Bedrock		145	Generalized Hoek-Brown	3.5e+006

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

SLIDEINTERPRET 7.037

Project	Proposed Access Roadway - Mission Ridge Expansion Project		
Analysis Description	Section C-C' - Cut Slope - Spencer Method - Static		
Drawn By	MYM	*Scale* 1:1986	*Company* GN Northern, Inc.
Date		*File Name*	SecCC_cut_static.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Residual Soil		115	Mohr-Coulomb	150	31.5
Completely Weathered Granitic Bedrock		125	Mohr-Coulomb	275	36
Highly to Mod. Weathered Granitic Bedrock		135	Mohr-Coulomb	500	40

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (psf)
Slightly Weathered to Fresh Granitic Bedrock		145	Generalized Hoek-Brown	3.5e+006

Northern, Inc.
Consulting Engineers Environmental Scientists Geologists
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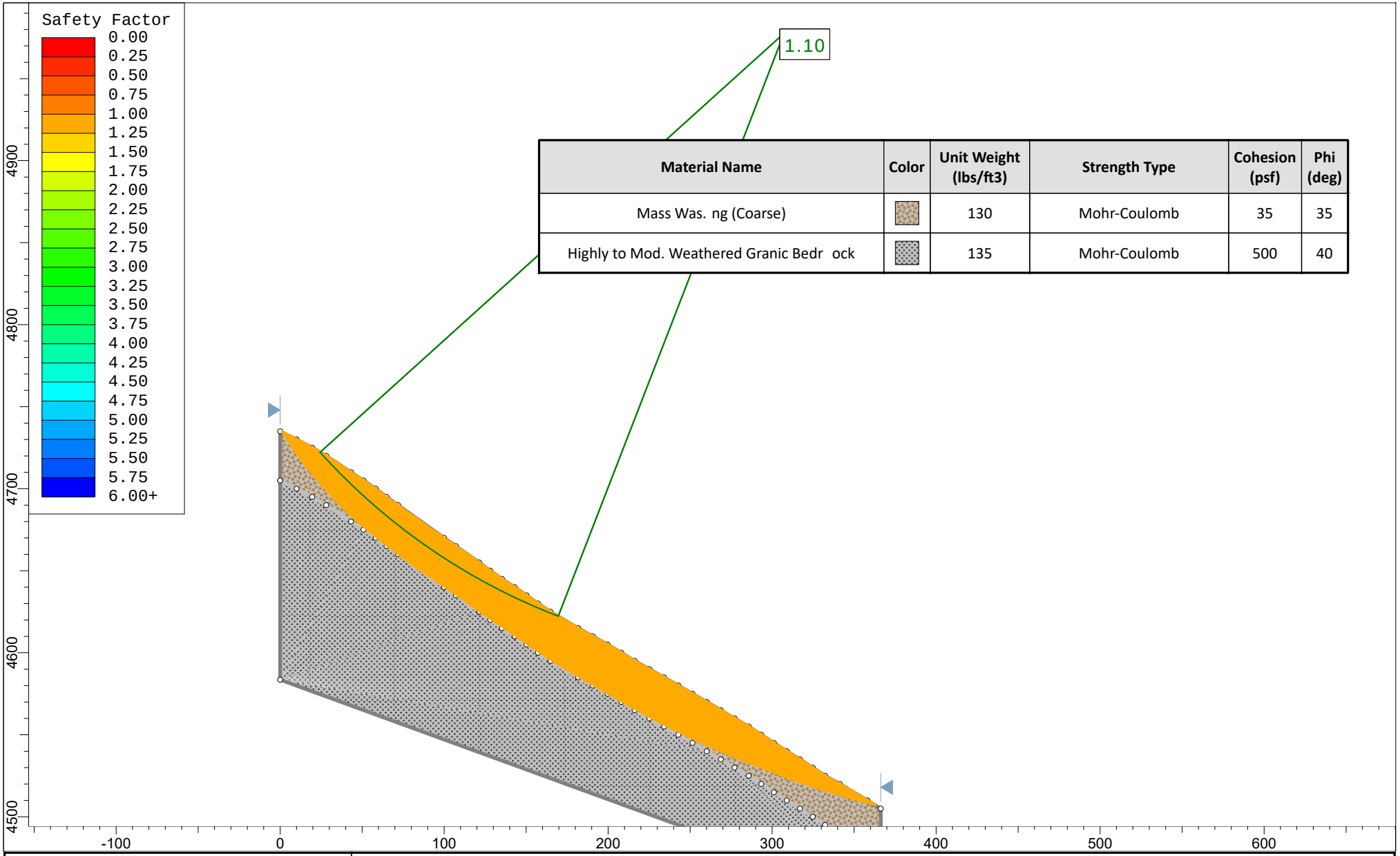
SLIDEINTERPRET 7.037

Project	Proposed Access Roadway - Mission Ridge Expansion Project		
Analysis Description	Section C-C' - Cut Slope - Spencer Method - Pseudostatic		
Drawn By	MYM	*Scale* 1:1986	*Company* GN Northern, Inc.
Date			*File Name* SecCC_cut_seismic.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Mass Was. ng (Coarse)		130	Mohr-Coulomb	35	35
Highly to Mod. Weathered Granic Bedr ock		135	Mohr-Coulomb	500	40

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

SLIDEINTERPRET 7.037

Project	Proposed Access Roadway - Mission Ridge Expansion Project		
Analysis Description	Section D-D' - Existing Condition - Spencer Method - Static		
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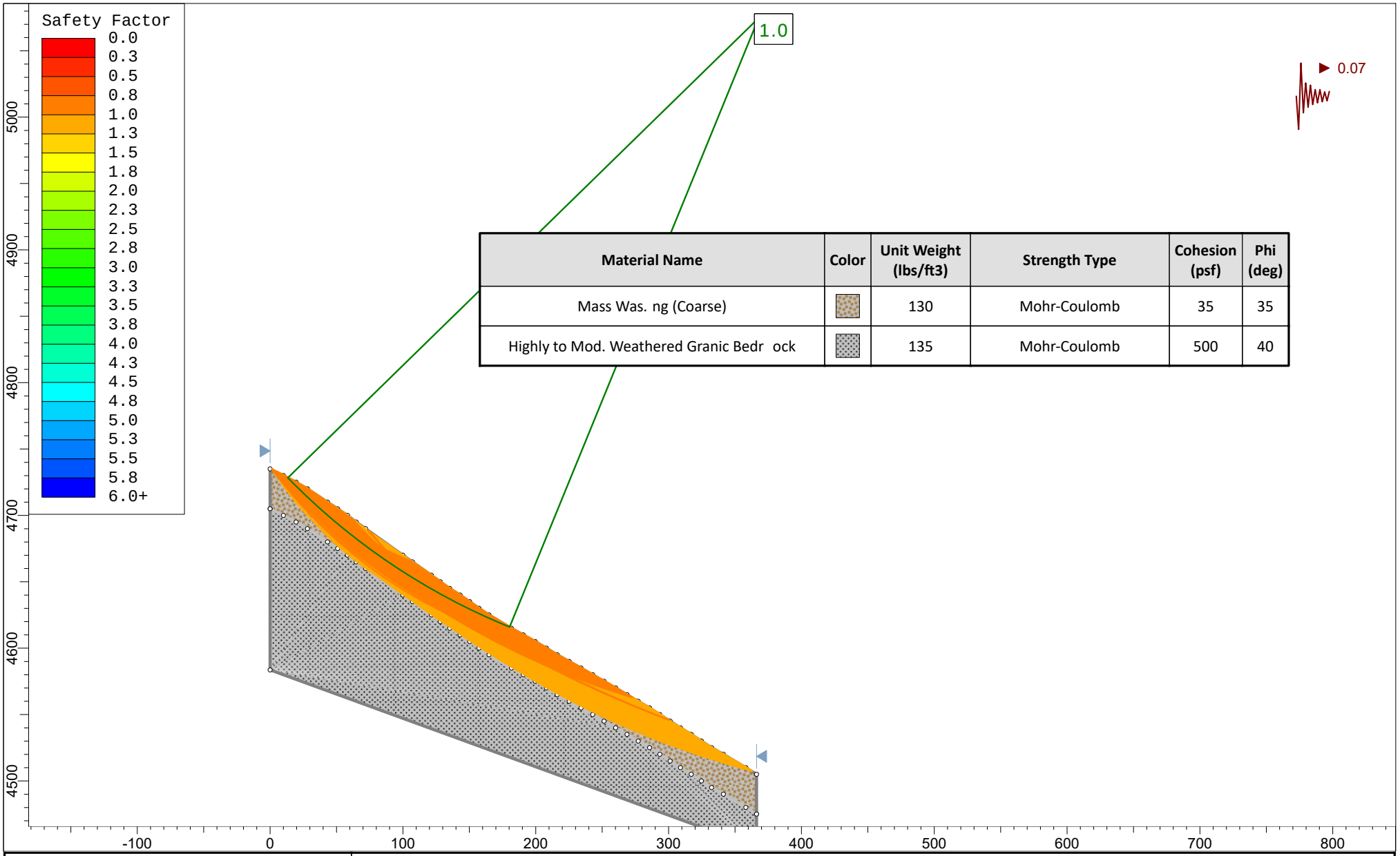

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Mass Was. ng (Coarse)		130	Mohr-Coulomb	35	35
Highly to Mod. Weathered Granic Bedr ock		135	Mohr-Coulomb	500	40

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

SLIDEINTERPRET 7.037

Project	Proposed Access Roadway - Mission Ridge Expansion Project		
Analysis Description	Section D-D' - Existing Condition - Spencer Method - Pseudostatic		
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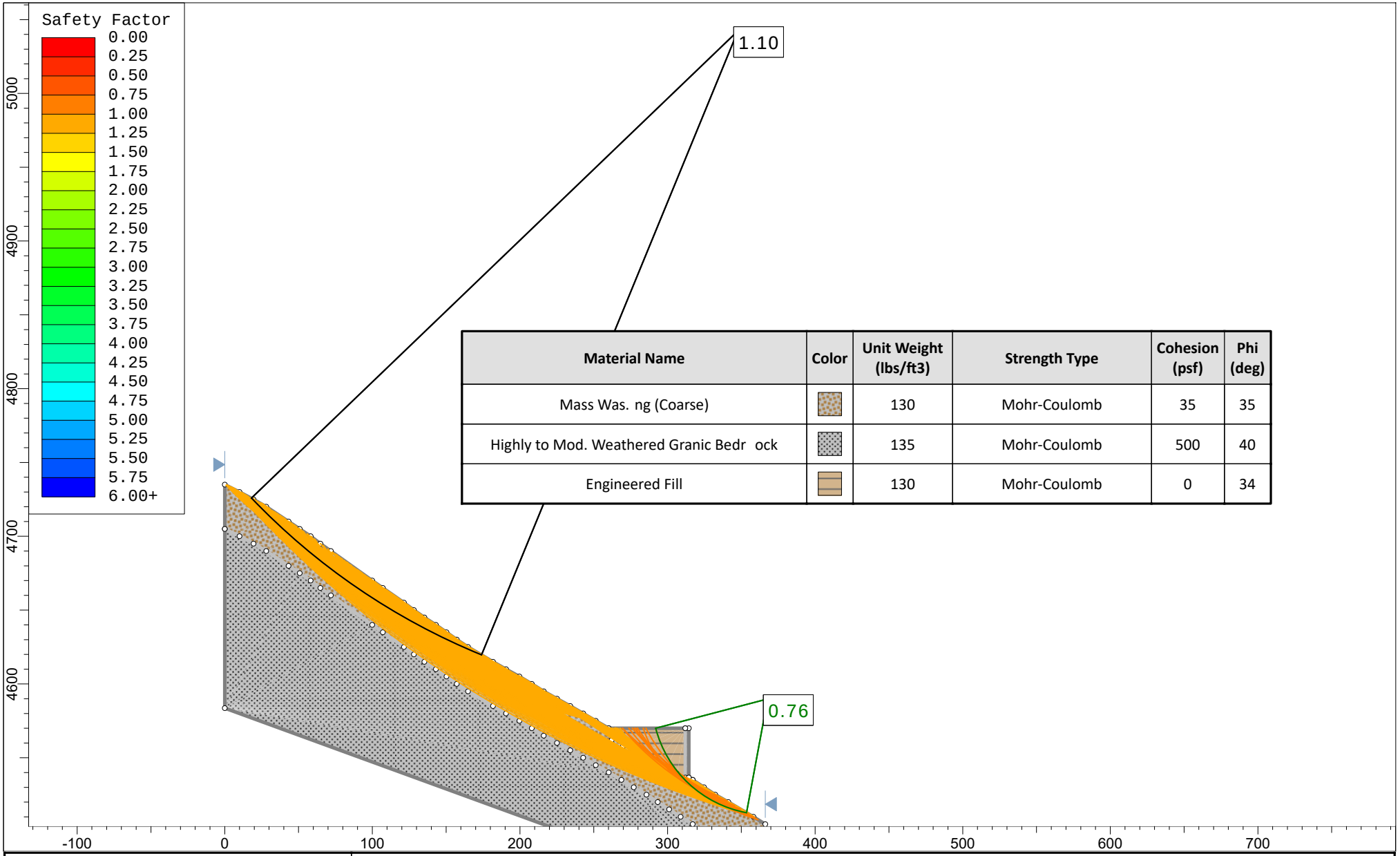
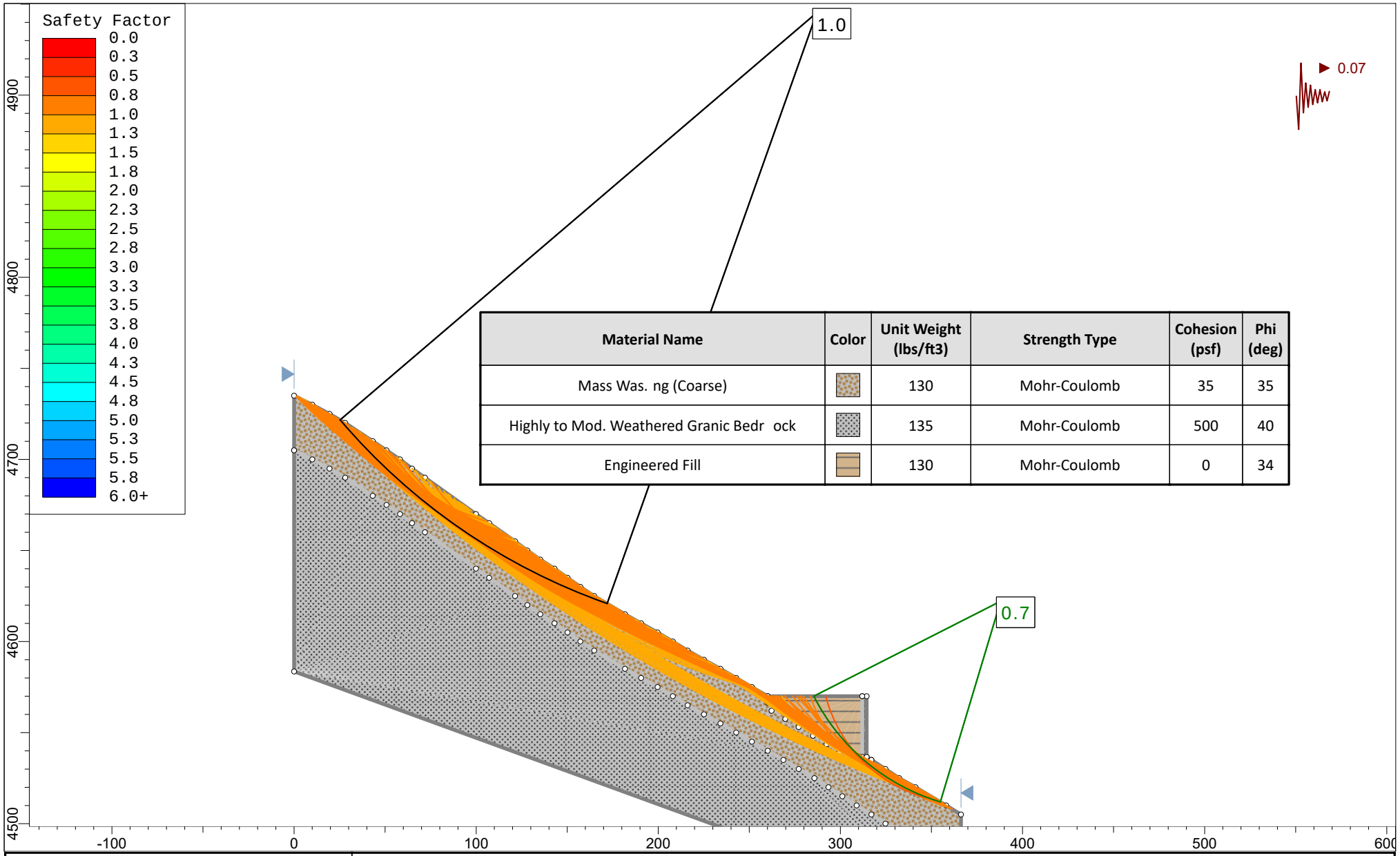


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Mass Was. ng (Coarse)		130	Mohr-Coulomb	35	35
Highly to Mod. Weathered Granic Bedr ock		135	Mohr-Coulomb	500	40
Engineered Fill		130	Mohr-Coulomb	0	34

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

Project	Proposed Access Roadway - Mission Ridge Expansion Project		
Analysis Description	Section D-D' - New Fill & Retaining Wall - Spencer Method - Static		
Drawn By	MYM	Scale 1:1078	Company GN Northern, Inc.
Date			File Name SecDD_fill_static.slim

SLIDEINTERPRET 7.037



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Mass Was. ng (Coarse)		130	Mohr-Coulomb	35	35
Highly to Mod. Weathered Granic Bedr ock		135	Mohr-Coulomb	500	40
Engineered Fill		130	Mohr-Coulomb	0	34

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

Project	Proposed Access Roadway - Mission Ridge Expansion Project		
Analysis Description	Section D-D' - New Fill & Retaining Wall - Spencer Method - Pseudostatic		
Drawn By	MYM	Scale 1:873	Company GN Northern, Inc.
Date			File Name SecDD_fill_seismic.slim

SLIDEINTERPRET 7.037

APPENDIX C

2019 Fire Protection Plan

AEGIS ENGINEERING
13024 Beverly Park Rd, Ste 202
Mukilteo, WA 98275
www.AEGISengineering.com
(425) 745-4700 phone
(206) 801-5797 fax

MISSION RIDGE EXPANSION
MASTER PLANNED RESORT
FIRE PROTECTION PLAN

April 18, 2018
Revised December 7, 2019

for:

Mission Ridge Resort, Inc.
7500 Mission Ridge Road
Wenatchee, WA 98807-1668

Fire Protection ▪ Building Code
Consult ▪ Design ▪ Engineer

BACKGROUND

AEGIS Engineering, PLLC has been retained by Mission Ridge Resort, Inc. to assist in developing a fire protection plan for the Mission Ridge Expansion (MRE) Master Planned Resort (MPR). AEGIS Engineering Principal Brian Thompson, P.E. is licensed as a civil engineer and fire protection engineer. A native of the Pacific Northwest, his undergraduate coursework at Marquette University involved emphasis in urban planning. Thompson earned his Master's Degree in fire protection engineering from Worcester Polytechnic Institute and served for nearly 10 years with Bainbridge Island Fire Department, including as a volunteer resident Firefighter/EMT. His breadth of knowledge and experience affords him a unique perspective and ability to contribute toward development of fire protection strategies for the Mission Ridge Expansion.

Consistent with the purpose of a MPR as provided in 11.89.010 of the CCC (Chelan County Code), this Fire Protection Plan will describe how this development compliments the area without significant effects on natural and environmental features with regard to fire, outlining fire safety strategies to be implemented. Elements and considerations addressed in this document draw upon the collaborative efforts of Mission Ridge and Upper Squilchuck Valley stakeholders, including Chelan County representatives, for fire safety in the community in an effort to appropriately protect structures and the surrounding landscape.

PROJECT SUMMARY

Mission Ridge Ski & Board Resort has been in operation for over 50 years and involves 2,000 acres of forest land. The resort includes multiple lifts, a midway café, office buildings, ski school, equipment rentals, and Hampton Lodge. The Mission Ridge Expansion involves a combination of residential and commercial development situated between the resort and an existing development of single-family homes, with adjacent State and federal lands.

Figures 6 and 10 in Chapter 11 of the December 2017 Chelan County Comprehensive Plan (DCP) identify Mission Ridge Road as a Minor Collector and a LINK Transit route, respectively. Figure 3 in DCP Chapter 11 recognizes Squilchuck State Park and Mission Ridge Ski Area as "Key Destinations." Access to Mission Ridge is via Highway 711 (Squilchuck Road/Mission Ridge Road) from Wenatchee. This highway involves limited access, approximately 11 miles with no outlet. The highway serves other existing developments in addition to the resort. An existing development of single-family homes at Forest Ridge abuts the MRE property.

A representation of the MRE master plan is shown in Figure 1 of this report. This illustrates how the MRE establishes a village base area with commercial buildings and medium-density residential construction around a new recreation area, and single-family homes dispersed in and around the periphery. The MRE will be served by a new road with a minimum travelled surface of 28 feet, highlighted red in Figure 1. This new roadway will be constructed to provide interconnectivity to the adjacent property of the existing resort. Each residence and commercial structure in the MRE will be connected to this new roadway via

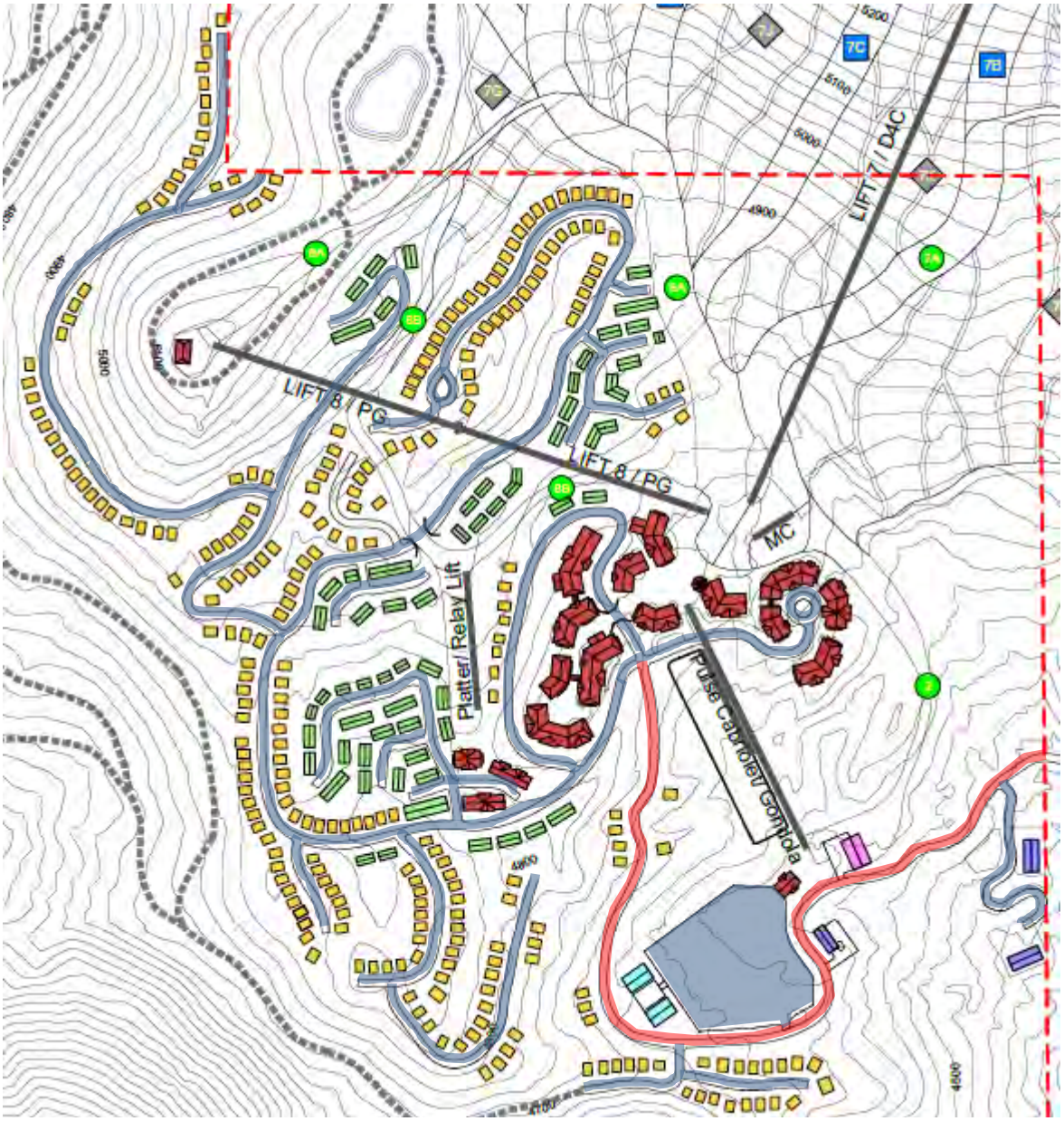


FIGURE 1: SITE LAYOUT. *Mission Ridge Expansion Site Layout and Topography (NTS)*

network of roads and access ways. Roads and driveways required for fire apparatus access as an Emergency Vehicle Access Road (EVAR) will comply with applicable provisions of CCC 15.30, including deviations to overcome adverse topography and allow for reasonable solutions without adversely affecting safety, maintainability or aesthetics as provided for in CCC 15.30.100.

The mixed-use buildings generally involve condominium homes atop retail shops and/or parking garage spaces. One lodge building is to be located at the village base area and another with a restaurant at the mountain peak within the development area. Space for a future Chelan County Fire District #1 (CCFD1) fire station is designated with the Ski Operations & Maintenance area along the main MRE access road.

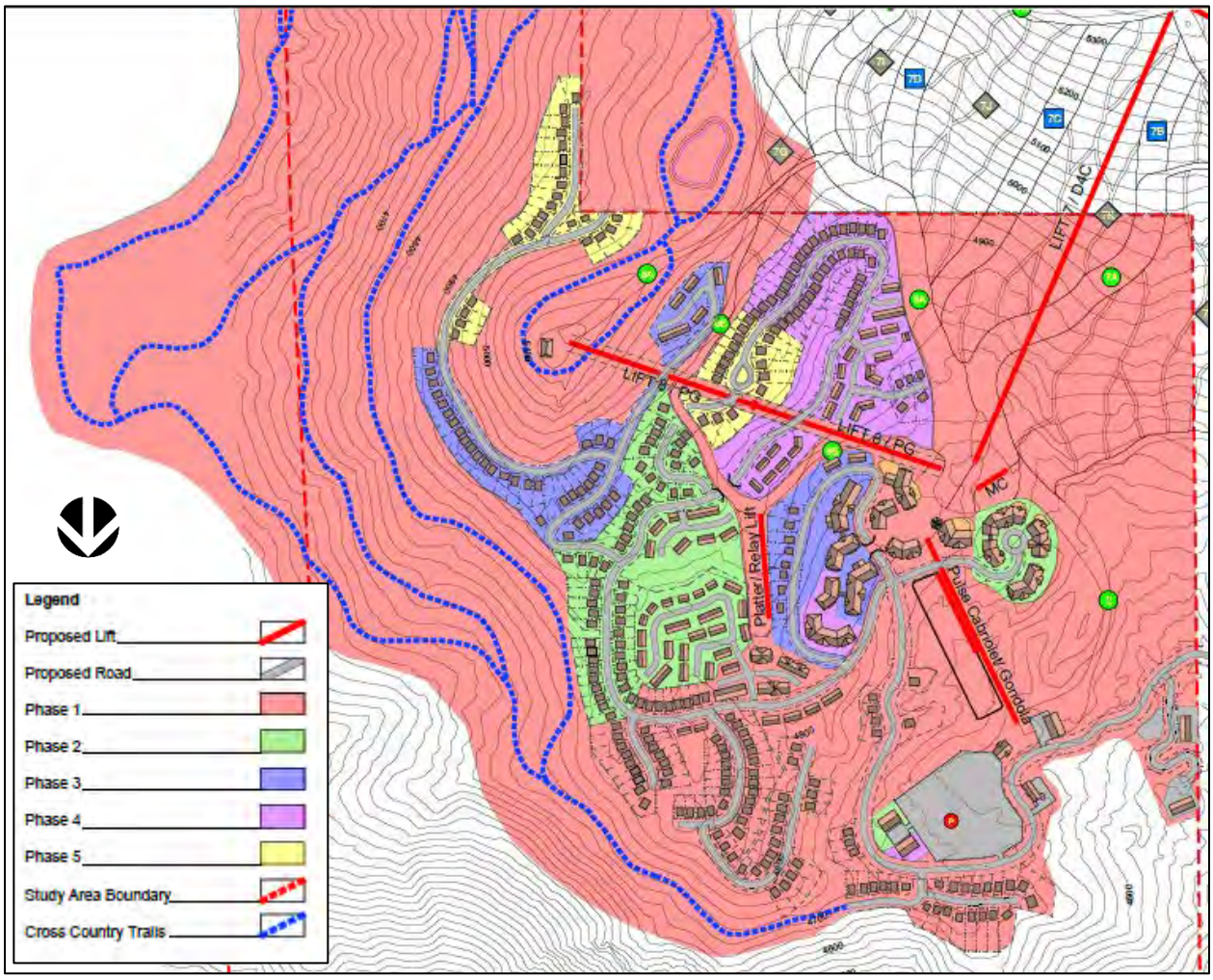


FIGURE 2: PHASING PLAN. *Phasing plan for the Mission Ridge Expansion. (NTS)*

Complete development of the Mission Ridge Expansion MPR contemplates five (5) phases as indicated in Figure 2 above. Roads developed with each phase will provide for future

connectivity to subsequent MRE phase(s). Due to the unusual circumstances present with the project, including its remote location and extreme topography, no logical location of an access point for interconnectivity to surrounding property is apparent. Therefore, as provided for in CCC 15.30.230(4) in the absence of such interconnectivity, other means of assuring public safety shall be implemented, as described in this report.

FIRE HAZARDS

The isolated location of the Mission Ridge site presents inherent challenges with regard to access for emergency responders in event of an emergency. The topography around the subject development area ranges from about 25% to 100% slopes, contributing to the extreme conditions present at the site. A compounding factor is the extreme seasonal climatic conditions, which contribute to snow accumulation during winter months and potential wildfires in the summer. Primary fire hazards contemplated involve structures and vehicles within the development, as well as wildland fires approaching from outside the site.

Chapter 6 of the DCP describes how CCFD1 provides fire protection to the Squilchuck area in which the MRE is located. In addition to multiple apparatus in 7 stations, CCFD1 maintains three helicopters to support fire protection.

STRUCTURAL FIRE

Automatic fire sprinkler systems will be installed throughout occupied buildings in the development area in accordance with applicable code requirements. National Fire Protection Association (NFPA) 80A (2017) concludes in Section 5.6.3 that no exposure hazard is considered to exist where an exposing building is protected throughout by an approved, properly maintained automatic fire protection system of adequate design for the hazard. Selection of appropriate level of protection is discussed in a subsequent section.

To limit the impact of a potential structure fire, in residential construction where automatic fire sprinkler systems are not required each dwelling unit would be equipped with a portable fire extinguisher having a minimum rating of 2-A:10-B:C. Such nonrequired fire protection equipment would be installed in accordance with IFC Section 901.4.2 as an additional measure of safety.

In addition to contributing toward structural fire protection, the resulting distribution of portable fire extinguishers throughout the development offers an enhanced level of safety against vehicle fires; exceeding that of communities not subject to this MPR condition.

WILDLAND FIRE

A 2006 risk assessment by State of Washington Department of Natural Resources (DNR) for the area, utilizing field surveys for wildfire risk developed by the National Fire Protection

Association, rated the community fire risk as “high;” the middle of three risk categories: Moderate, High, or Extreme. Based on the hazard level identified by DNR, the MRE property is subject to review as a wildland-urban interface area per CCC 15.40.050.

Chelan County Conservation District, with assistance from Washington Department of Natural Resources, Washington State Parks, United States Forest Service and Chelan County Fire District #1, prepared the Squilchuck Valley Area Community Wildfire Protection Plan (CWPP) in January 2005 which specifically addresses Forest Ridge and encompassed the Mission Ridge Ski & Board Resort and MRE property in the planning area.

APPLICABLE CRITERIA

State of Washington currently mandates adoption of the IBC, IRC and IFC (International Building, Residential and Fire Codes, respectively, as amended by the State Building Code Council (SBCC)). Obsolete references exist in Development Standards with Title 15 of Chelan County Codes (CCC) to UFC (Uniform Fire Code), which was last published in 1997. Similar outdated references are present with wildland-urban interface provisions. State of Washington has adopted the 2018 International Wildland-Urban Interface Code (IWUIC) in WAC 51-54A-8200 for enforcement beginning in 2020.

WILDLAND-URBAN INTERFACE CODE

The following is an excerpt from CCC Section 15.40.050(3):

> The fire marshal may reference the current edition of the following publications when reviewing development projects in the wildland urban interface for determining specific fire protection requirements necessary for approval:
> (A) Urban Wildland Interface, by the International Fire Code Institute;
> (B) NFPA 299, Standard for Protection of Life and Property from Wildfire.

Reference (A) is outdated, though its technical content is the basis for the IWUIC. Reference (B) is also obsolete, now renumbered NFPA 1144 and retitled *Standard for Reducing Structure Ignition Hazards from Wildland Fire*. CCC Section 15.40.050(3) should be updated to adopt IWUIC in 2020, consistent with WAC 51-54A-8200.

Adoption of IWUIC is supported by Forest Ridge Wildfire Coalition (FRWC) and Squilchuck Valley Area CWPP Steering Committee, as stated in Amendment 1 (May 2015) of the 2005 Squilchuck Valley Area Community Wildfire Protection Plan (CWPP).

Accordingly, prior to formal adoption by Chelan County, application of IWUIC provisions are proactively considered and incorporated into this report. This revision of the report is updated to incorporate 2018 IWUIC provisions as recently adopted by State of Washington, including Appendices B and D.

Additionally, the Fire Hazard Severity Form of Appendix C will continue to be referenced in our analysis, consistent with State of Washington consideration of 2015 IWUIC as IFC Appendix N, which indicates adoption of IWUIC Appendix C. Based on the Fire Hazard Severity Form of IWUIC Appendix C, AEGIS Engineering determined the score for the MRE to be a "high hazard" severity (Attachment A). The 2005 CWPP also ranked the fire risk assessment for the Squilchuck Valley as "high." Amendment 1 to the CWPP, released in May 2015, maintained a hazard rating of "high."

Where IWUIC provisions are dependent upon the fire hazard severity, this fire protection plan report for the MRE presents the applicable criteria for the high hazard category.

COMMUNITY WILDFIRE PROTECTION PLAN

In addition to prescribed code requirements, many neighbors and agencies have spent years developing and refining recommendations presented in CWPP and Amendment 1. While these tend to address existing developments and structures, most applicable recommendations are incorporated into the fire protection plan for the MRE. As appropriate, consideration is also given to potential mitigation measures identified in the November 2008 Chelan County Community Fire Plan (CFP) by Cascadia Conservation District.

However, Table 1 of the June 2019 Stemilt/Squilchuck Landscape Evaluation (SSLE) describes, "A finer-scale analysis showing current fire severity and behavior has departed from historical and future fire severity and behavior." Therefore, application of historical CWPP and CFP findings are considered in conjunction with the more recent SSLE conclusions.

CODES AND STANDARDS

Referenced sections presented in this document are based on the current 2015 Edition of the codes. Provisions applicable to future construction should be based on the most recent edition of the code as enforced at that time together with the additional conditions presented in this document. The following is a list of select codes and standards referenced in this fire protection outline:

- Chelan County Code (CCC)
  - Chapter 3.04, International Codes Adopted
  - Chapter 8.24, Construction Specifications–Roads and Bridges
  - Chapter 15.30, Development Standards
  - Chapter 15.40, Fire Protection Standards
- International Building Code (IBC)
- International Residential Code (IRC)
- International Fire Code (IFC)
- International Wildland-Urban Interface Code (IWUIC)

- NFPA 13D Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes
- NFPA 13R Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies
- NFPA 13 Standard for the Installation of Sprinkler Systems
- NFPA 72 National Fire Alarm and Signaling Code

CODE MODIFICATION

Development proposed with the Mission Ridge Expansion MPR has been contemplated for over 30 years. A ski-in/ski-out community on the side of a mountain is unique and uncommon, with challenging topography and grades.

Both IBC and IFC provisions accommodate such conditions, providing for modification of code requirements in Section 104.10 and 104.8, respectively. The IFC authorizes the fire code official to grant modifications for individual cases when, “special individual reason makes the strict letter of the code impractical, the modification is in compliance with the intent and purpose of the code and that such modification does not lessen health, life and fire safety requirements.”

Modification of fire flow is specifically provided for in CCC Section 15.40.040(2)(A), “for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.”

Similarly, with regard to access, CCC Sections 15.30.100 and 15.30.230(4) offer relief for “unusual circumstances” and provide for an alternative method where regular criteria is “impractical.” Section 15.50.055 also provides for administrative waiver where compliance is “impossible or impractical.” An example is “Area 12,” where the mountaintop restaurant is located, for which the access way is impassable by a standard emergency vehicle.

With the challenges inherent with the subject development, relief from strict compliance with prescriptive County standards is reasonable, anticipated, and accommodated by CCC provisions such as identified above.

FIRE PROTECTION OUTLINE

The following outline is intended to identify fire protection considerations to be addressed with the Mission Ridge Expansion. Identified fire protection components are presented as generally applicable to the entire development and as specifically applicable with individual elements.

Code excerpts in this report are not intended to substitute for complete applicable code language, and the code references provided should not be considered to address all applicable code provisions. This outline is intended to present concepts and considerations

which are based on a collaborative effort of project stakeholders to establish the Mission Ridge Expansion Fire Protection Plan.

FIRE PROTECTION

Several fire protection considerations are applicable to the development as a whole. Specific consideration to these items is outlined below.

WATER SUPPLY

Over 4 million gallons of reservoir capacity is anticipated. While the domestic demand has not yet been determined, this associated storage volume should be sufficient to also support the quantity prescribed for fire flow.

The volume of water provided for fire flow is to be reserved in the reservoir to maintain the required level of fire protection. To help preserve the volume of water available for fire flow, the MPR will prohibit individual structures from employing continuous flowing exterior fire protective systems.

DISTRIBUTION

Fire water will be distributed underground via fire hydrants or standpipes from which firefighters may draw water. Fire hydrants will be installed in areas of the development accessible to standard fire apparatus at maximum 1,000-foot spacing (IWUIC Appendix C) to facilitate a more traditional/conventional firefighting strategy. To limit the impact of snowfall, the ports will be installed 3 feet above grade, such as with the Alpine Hydrant by AVK. Hydrants would be kept dug-out as part of road maintenance; flags or poles may be attached to assist in locating them.

As common with municipal systems, fire hydrants may be connected to the domestic water supply. Standpipe hose connections may be distributed to remote areas of the MRE, served by the snow making equipment to be provided for ski runs located within the MRE. Spacing and locations of standpipes will be coordinated to correspond with emergency response capabilities and the location of structures served.

FIRE FLOW

The water supply must contain sufficient volume to support the duration of hose stream operation. CCC Section 15.40.040 addresses fire-flow requirements for buildings. While this section references UFC Appendix III-A, this project will consider IFC Appendix B, as SBCC adoption of IFC supersedes the legacy UFC. Section B103.1 of the IFC is consistent with the allowance in CCC Section 15.40.040(2)(A) which recognizes that fire flow may be

impractical to isolated buildings or groups of buildings. Where practical, fire flow will be provided as prescribed by code; instances where specific approval is sought is described below.

Section B103.3 of the IFC authorizes the fire code official to rely upon the IWUIC with regard to water supplies for firefighting purposes for areas without water supplies. Therefore, with the Mission Ridge Expansion, adequate water supply is assessed as provided for in IWUIC Section 404.5. As identified in IWUIC Section 404.1, private garages, carports, sheds and agricultural buildings with a floor area of not more than 600 square feet are exempt from water supply criteria.

Consistent with the inclusion of townhouses and other Group R occupancies with provisions for one- and two-family dwellings in IFC Section B105.1, water supply provisions for one- and two-family dwellings in the IWUIC will also be applicable to townhomes. When equipped with automatic fire sprinkler protection in accordance with NFPA 13D, as specified in IFC Table B105.1(1), minimum fire-flow of 500 gpm for 30 minutes is required for such residential buildings up to 3,600 square feet; 750 gpm for 30 minutes if greater than 3,600 square feet per the reduction provided for in IWUIC Section 404.5 as shown in Table 1. If no automatic sprinkler protection is present, the full fire flow prescribed in IWUIC Section 404.5 is applicable, also shown in Table 1 below.

AREA OF STRUCTURE	FIRE-FLOW (GPM)	DURATION (MINUTES)	WATER SUPPLY (GALLONS)
AS – Up to 3,600 SF	500	30	15,000
AS – Greater than 3,600 SF	750	30	22,500
NS – Up to 3,600 SF	1,000	30	30,000
NS – Greater than 3,600 SF	1,500	30	45,000

AS – Automatic Sprinkler System
NS – No Automatic Sprinkler System

TABLE 1: RESIDENTIAL FIRE-FLOW AND WATER SUPPLY PER IWUIC 404.5

For other than the residential buildings as outlined above, commercial structures, including condominiums located above retail or parking garage space, the fire flow and total water supply is prescribed in IFC Table B105.2. In the presence of sprinkler protection, the subject IFC provisions consider only the type of sprinkler system present in the building, and not whether the building is of combustible or non-combustible construction, nor the specific occupancy or use of the building.

This MPR generally contemplates light hazard occupancies with limited ordinary hazard occupancies, and generally excludes factories, warehouses and more hazardous uses. Based on the limited hazards present and the installation of automatic fire sprinklers, the prescribed fire-flows and durations are excessive for the built-out conditions of the MRE.

However, in the absence of active sprinkler protection, such as during construction, the larger fire-flows and extended durations are reasonable. With construction of commercial

buildings in the MRE, the fire flow and duration indicated in IFC Table B105.2 will be applied to account for combustible or noncombustible construction, as shown in Table 2.

STRUCTURE	FIRE-FLOW (GPM)	DURATION (MINUTES)	WATER SUPPLY (GALLONS)
Noncombustible Construction or Up to 3,600 SF	1,000	120	120,000
Combustible Construction and Greater than 3,600 SF	1,500	120	180,000

TABLE 2: FIRE-FLOW AND WATER SUPPLY PROVIDED FOR MRE COMMERCIAL CONSTRUCTION, BASED ON IFC TABLE B105.2

FIRE WATER VOLUME

The fire water volume is a portion of the water supply which is maintained for fire protection. As the water supply is provided from a common reservoir, the minimum fire water volume to ultimately be maintained in the Mission Ridge Expansion is based on the total volume of:

A. The largest prescribed water supply for a single residential building, 45,000 gallons;

plus

B. The water supply for commercial construction prescribed in IFC Section 914.3.2, such as (0.20 gpm x 1500 sf x 1.3 + 250 gpm) x 60 minutes = 38,400 gallons

for a total minimum fire water storage volume of 83,400 gallons in the MPR.

CONSTRUCTION ACTIVITIES

While the unique conditions of the master plan work together to support reducing the water supply required for commercial fire-flow with completed structures in the MRE, special consideration is warranted during construction. Consistent with IFC Section 3312, the total applicable fire-flow and water supply indicated in Table 2 should be maintained throughout construction of a building. This should support a reasonable level of protection during construction in the absence of automatic fire protection.

In addition to fire-flow and water supply, fire safety during construction activities must be in accordance with IFC Chapter 33. General precautions and responsibilities must minimally be established in accordance with IFC Section 3304 and 3308.

This discussion is not intended to represent the prefire plan prescribed in IFC Section 3308. An individual prefire plan should be developed for construction of each building. Individual plans should address applicable aspects of IFC Chapter 33, such as temporary heating equipment, temporary wiring, and hot work, including powder-driven fasteners, in accordance with IFC Sections 3303, 3304 and 3308, respectively.

FIGURE 3: WILDFIRE DETECTOR. FIREALERT MK I DETECTS WILDFIRE OVER 1-MILE LINE-OF-SIGHT RADIUS.

Fire reporting in accordance with IFC Section 3309.1 requires readily accessible emergency telephone facilities. If not publicly accessible, then in accordance with IBC Section 3301.1, a public fire alarm box should be provided consistent with NFPA 241 Section 7.4.1. Due to the remoteness of the site, consideration should also be given to installation of an automatic fire detection device, such as the FireALERT MK I shown in Figure 3 at left which monitors a 1-mile radius, or a "FirePosse" early warning detection system by Firebreak. These devices automatically transmit a signal upon detection of flames.

Such automatic detection sensors could be strategically located to afford early warning of a fire developing during construction. As construction was completed, detectors could be added or repositioned to support early warning of a developing wildfire outside the MPR boundary.

FUEL MANAGEMENT

In and around the development area, fuel management includes establishing and maintaining defensible space for individual structures providing for a fuel break around the perimeter.

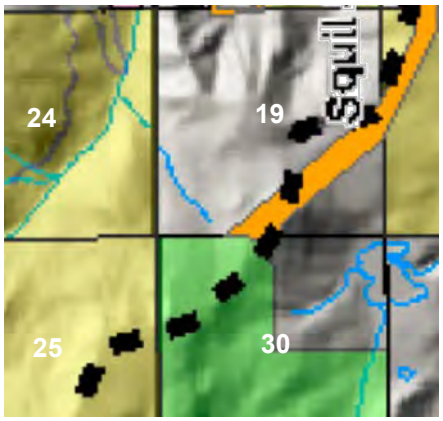
FUEL BREAK

Page 18 of the 2005 CWPP indicates a planned fuel break to serve as a defensible space between the Squilchuck and Stemilt Basins. The contemplated fuel break, shown below in Figure 4, was to begin in SE ¼ SW ¼ Section 19 (TWP 21N RGE 20E W.M.) and extend generally northeasterly. Aerial images indicate this fuel break was never established.

Considering the 2019 SSLE findings, "A finer-scale analysis showing current fire severity and behavior has departed from historical and future fire severity and behavior," Figures 5 and 6 illustrate forecast forest conditions and priority fuel treatment, respectively, in the vicinity of the MPR.

The highway and existing Resort generally afford separation between the MRE and forest area to the west. The forest area to the north is forecast to have a low to moderate moisture deficit, such that no priority fuel treatment is identified in the 2019 SSLE. Similarly, no priority fuel treatment is indicated over much of the area south of the subject property.

As shown in Figure 7, a continuous fuel break, such as contemplated in the 2005 CWPP to occur on the east side of the property, is planned with the MPR. However, rater than extend northeasterly, it generally follows the terrain and perimeter of structural development,



2005 CWPP PROPOSED PROJECTS

Legend

- Fuels reduction planned for 2005
- Shaded fuel breaks planned for 2005
- Public Land – Federal
- Public Land – State
- Basin Boundary

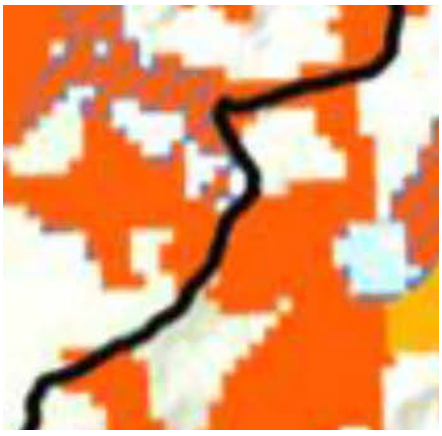
FIGURE 4: 2005 CWPP (PG. 18). *EXCERPT OF MAP WITH PROPOSED PROJECTS IN VICINITY OF MPR (NTS).*

2019 SSLE MOISTURE DEFICIT LEVEL FORECAST – YEARS 2041-2070

Legend

- Low: Moist-Cold Forest
- Moderate: Dry-Moist Forest
- High: Dry Forest
- Extreme: Woodland-Steppe
- Basin Boundary

FIGURE 5: 2019 SSLE (PG. 22). *EXCERPT OF MAP WITH FUTURE FOREST TYPES IN VICINITY OF MPR (NTS).*



2019 SSLE PRIORITY TREATMENT AREAS

Legend

- High Priority - Mechanical Treatment/Prescribed Fire
- High Priority - Prescribed Fire
- Riparian and North Aspects
- Basin Boundary

FIGURE 6: 2019 SSLE (PG. 24). *EXCERPT OF MAP WITH POTENTIAL TREATMENTS IN VICINITY OF MPR (NTS).*

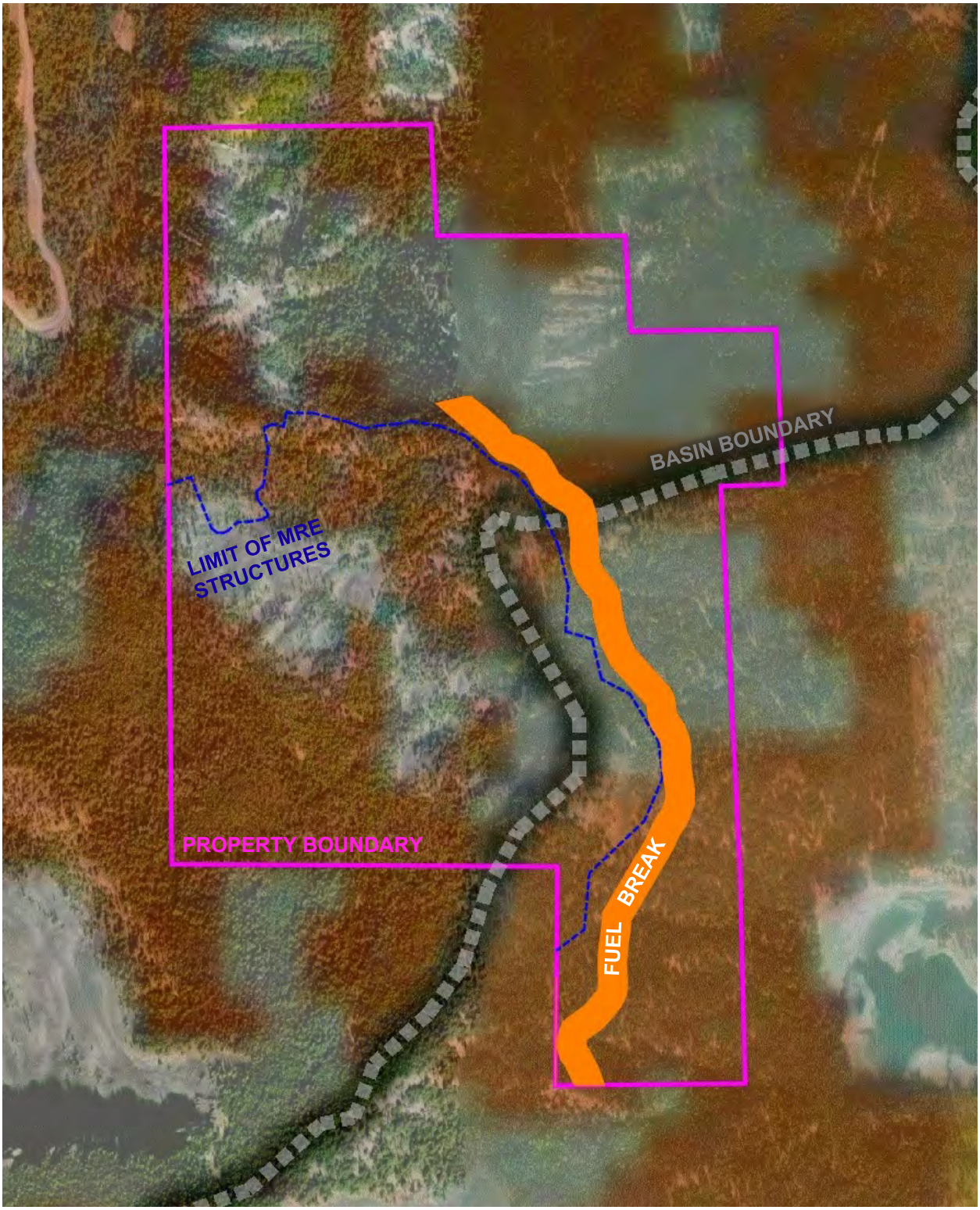


FIGURE 7: PROPOSED FUEL BREAK. *Fuel break (orange) to establish defensible space along MRE at Stemilt Basin depicted on aerial photo with 2019 SSLE Priority Treatment overlay (NTS).*

spanning the region where priority fuel treatment is identified in the 2019 SSLE east of the MPR.

The fuel break shown in Figure 7 to be established with the MPR generally follows the terrain and limits of Phase 1 development, rather that indiscriminately extending to the northwest as presented in the 2005 CWPP. The southern terminus of the fuel break aligns with the southern property boundary and lies near a natural fuel break where limited vegetative growth is apparent on the aerial photo. The northern terminus occurs at the boundary of Phase 1 activity, and extends through the area identified in the 2019 SSLE for priority treatment to the vicinity of another natural fuel break.

The subject fuel break could be established to help segregate the MRE and forest area to the west and support a safe area for the base lodge and parking to the north.

In order to further preserve natural open space, the fuel break depicted in Figure 5 above may be accomplished by either fuel reduction, or with the presence of an early wildfire warning system together with equipment and materials capable of a rapid firefighter response to a detected threat. The equipment and materials would be manually deployed to afford similar protection to retard or suppress wildfire advancement through a physical fire break.

Such equipment and materials would be identified in collaboration with local fire officials. Elements may include strategic locations for connections of hose or nozzles, which may be supplied by the pumps also used for snow-making; or mobile platforms, such as a trailer or skid load with proportioning equipment capable of spraying water or long-term fire retardant. Shelter for storage of the equipment and stock of appropriate type and quantities of materials would be accommodated with the utilities and operations buildings of the first phase.

DEFENSIBLE SPACE

In accordance with IWUIC Section 603.2, the defensible space for each structure in the MPR shall be minimum 30 feet or to the lot line, whichever is less. The defensible space provided also influences the construction type of the buildings, as described with Table 3 below. Defensible space in this MPR shall be measured as illustrated in Figure 8 below, based on IWUIC Figure 603.2.

In accordance with IWUIC Section 603.2.2, within defensible space, a minimum 10-foot horizontal distance shall be maintained between crowns of adjacent trees, as well as between crowns of trees and structures or unmodified fuel. Groundcover within defensible space shall be in accordance with Section 603.2.3. Defensible space shall be maintained in accordance with IWUIC Section 604.

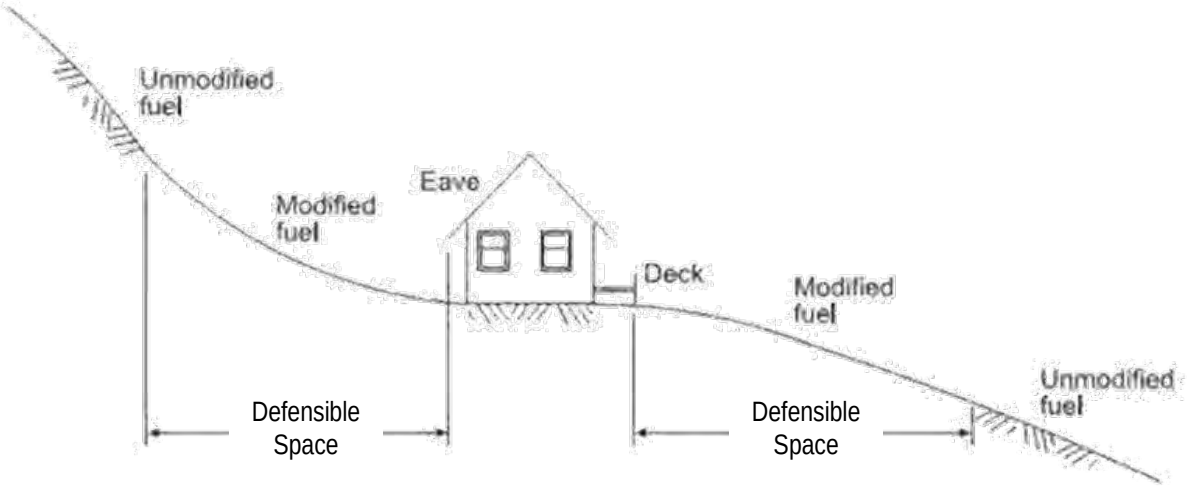


FIGURE 8: DEFENSIBLE SPACE MEASUREMENT. *Diagram based on IWUIC Figure 603.2 illustrating horizontal measurement of defensible space for assessing distances from Table 3 below (NTS).*

CONSTRUCTION TYPE

In addition to applicable CCC, IBC and/or IRC requirements, each structure will be of ignition-resistant construction as prescribed by IFC Table N503.1. In this table, the applicable class of construction is dependent upon defensible space.

For new subdivisions, IWUIC Section 402.1 requires fire apparatus access and water supplies to be approved. Based on this conforming infrastructure and the high hazard severity for the site as determined from IWUIC Appendix C, the resulting table is presented below to represent applicable ignition-resistant construction criteria for this MPR:

DEFENSIBLE SPACE	CONSTRUCTION
< 30 feet	None
30 to 50 feet	IR 1
50 to 75 feet	IR 2
> 75 feet	IR 3

TABLE 3: MPR IGNITION-RESISTANT CONSTRUCTION CLASSIFICATIONS. *Adapted from IFC Table N503.1 and Section 603.2 to account for identified site conditions.*

From IWUIC Section 603.1, the defensible space is the area between a structure and unmodified fuel load. As indicated in Table 3 above, the level of ignition-resistant construction can vary depending upon the proximity of the structure to unmodified fuels. These criteria are applicable around the perimeter of the development.

The prescribed IWUIC dimensions ignore whether the building is a row of townhomes or a detached single-family home. As a structure represents a modified fuel load and multiple

dwellings are permitted to be constructed with zero separation (as with townhomes), the distance between buildings need not satisfy the distances presented above in Table 3. However, buildings in such close proximity shall offer a consistent degree of ignition-resistant construction. Applicable ignition-resistant construction criteria of buildings forming a cluster within this MPR shall be determined as presented with Figure 9 below.

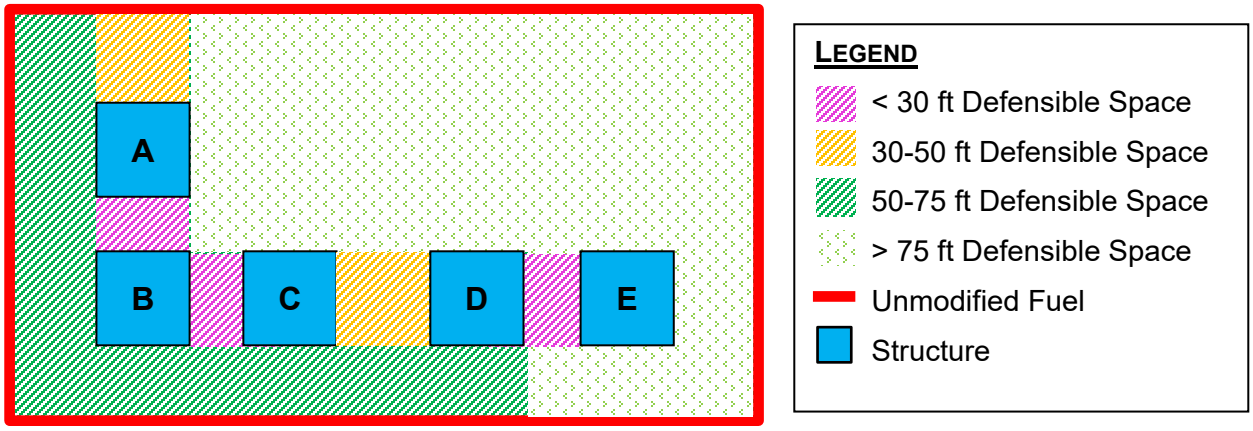


FIGURE 9: IGNITION-RESISTANT CONSTRUCTION DIAGRAM. *Depicted is an arrangement of various defensible space conditions to illustrate selection of Ignition-Resistant construction criteria within this MPR. (NTS)*

Figure 9 illustrates two clusters of buildings. Each cluster is comprised of buildings separated from each other by less than the 30-foot minimum distance identified in IWUIC Section 603.2.

In the cluster of buildings A, B and C, one of the structures is located within 50 feet of unmodified fuel. As indicated in Table 3 above, this requires type IR 1 construction for Building A. While Buildings B and C are each more than 50 feet from unmodified fuel, because they are within 30 feet of Building A, they would also be subject to type IR 1 construction within this MPR. This cluster of buildings ends where more than 30 feet of defensible space is provided between Buildings C and D.

As less than 30 feet of separation is provided between Buildings D and E, they represent a cluster. With a portion of Building D provided with a defensible space of 50-75 feet, it requires type IR 2 construction as shown in Table 3 above. Though Building E is surrounded with more than 75 feet of defensible space to unmodified fuels, because it is less than 30 feet from Building D, it must also be type IR 2 construction.

Where the distance between structures less than that prescribed for defensible space, fuels between the structures shall be modified as required for defensible space or each proximal structure shall be of type IR 1 construction. In accordance with IWUIC Section 602.1, automatic fire protection is required to be installed with IR 1 construction.

Where LP storage tanks are present, they shall be located within the defensible space in accordance with the IFC.

For commercial buildings, as an additional safeguard in lieu of strict EVAR compliance, subject to specific approval, the construction type could be upgraded beyond the minimum otherwise prescribed by code. This could afford increased fire-resistive construction or noncombustible construction, compared to minimum standard otherwise allowed by code.

CONSIDERATIONS

Select recommendations excerpted from the CWPP to be incorporated into this MPR fire protection plan with regard to fuel management are outlined below:

- Implement 2017 FireWise recommendations around all homes/structures. Actions can include defensible space, adequate turn-around space for emergency equipment and clear consistent address signs.
- Mitigate fuels within 100 feet of roads and driveways. This can include work to thin, limb and clear all road easements, and shaded canopy defensible space on both sides with road signs and evacuation arrows.
- Develop and maintain additional Safe Areas in strategic locations. This could include constructing the base Lodge as a safe area, and providing sufficient parking to afford one space for each dwelling unit.
- Encourage adjacent landowners and agencies to perform complementary adjacent treatments.
- Ecosystem thinning on non-commercial ground.
- Slash disposal planning and timing.
- Explore and employ methods to recycle biomass from fuel reduction project waste, construction waste and other wood products.

FIRE APPARATUS ACCESS

Section 402.1.1 of the IWUIC requires access in accordance with the IFC. As adopted by State of Washington, Chelan County Fire Code supersedes IFC access provisions. Fire apparatus access throughout the Mission Ridge Expansion community will be phased with the progression of development.

CCC Section 15.30.230(4) identifies in the first paragraph that the absence of an internal road network within a subdivision can be approved. This section also offers relief from interconnectivity in “unusual circumstances,” and requires “other means of assuring public safety” when interconnectivity is not possible. Given the terrain of the MRE Project and the adverse topography, the road network will be designed and anticipated to comply with the provisions of CCC 15.30.100 “to overcome adverse topography or allow for more affordable solutions without adversely affecting safety, maintainability, or aesthetics.” To contribute to overcoming a single access road, the MPR contemplates space for a fire station.

Subsection 15.30.230(4)(B) prescribes a minimum traveled surface width of 28 feet if interconnectivity is not provided and secondary access is impractical. However, the second-to-last paragraph of CCC Section 15.30.230(4) presents that where secondary access within the subdivision is "impractical," widths sufficient to assure maneuverability of emergency vehicles "shall be allowed."

The subject increased width is anticipated to be applied to the access road between the existing Mission Ridge base area and into the Mission Ridge Expansion where shown red with Figure 1 above. The internal road network generally involves spurs with lengths exceeding 150 feet. Due to the inherent challenge in providing a cul-de-sac due to the slopes present, alternative EVAR turnarounds are anticipated to be incorporated into the MPR, as provided for in CCC 15.30.100.

EVACUATION ROUTE SIGNS

In addition, consideration is given to CWPP findings that roads in the Squilchuck Valley community are one way in/out. Road right-of-ways must be made Firewise and maintained for emergency exit. This will include approved signage of wildfire evacuation routes, such as described in Section 2N.03 of the MUTCD (Manual on Uniform Traffic Control Devices, rev. 2012), to support efficient evacuation by the public or emergency responders.

EMERGENCY PLANNING

Due to the location and conditions in which the Mission Ridge Expansion is developed, a coordinated emergency plan is essential. Similar to how hotel rooms have evacuation maps on the back of the door, and residential purchase and sale agreements involve lead paint declarations, every dwelling unit and owner in this MPR will be aware of the community's emergency plan, and their personal responsibilities.

EVACUATION/RESCUE PLAN

- Road Signs – Develop uniformity of all road signs and install signs at strategic locations
- Address Coordination – use of reflective address signs.
- Escape Routes
  - Signage (e.g. hurricane/tsunami evacuation route)
  - Map provided with each dwelling unit showing:
    - Emergency access routes
    - Safe area
- Evacuation Plan – install community warning siren/giant voice:
  - Level 1 – Advisement Issued via phone, text, email, media, etc.
  - Level 2 – Evacuation Advised via Tone B (e.g. tornado watch)

- Level 3 – Immediate Evacuation Advised via Tone A (e.g. tornado warning)

EDUCATION AND OUTREACH

The following represent other considerations for the Mission Ridge Expansion, excerpted from CWPP recommendations:

- Post fire hazard level sign at MRE entrance
- Review and support improvements to the cell phone towers serving the CWPP area
- Develop appropriate information to be provided for each home/emergency guide, such as:
  - Individual fire safety responsibilities & residential and personal security
  - Individual preparedness: How to Create a Personal Emergency Action Plan; Provide information regarding the Ready, Set, Go! (RSG) program; How to Create a Wildfire Emergency Evacuation Checklist; Personal escape routes; Disaster supply list; Personal communication plan; Awareness of Chelan County Special Needs Registry.
  - What to do & what not to do in case of wildfire; protecting your home/land
  - Interacting with local Firefighting officials, neighborhood Firewise board
  - Firewise construction and landscaping information
- Public Outreach
  - Establish Firewise communities and Boards
  - Hold workshops for residents on Firewise landscaping, insect control, fire resistant construction methods, and other pertinent subjects.
  - Encourage the use of the Firewise Communities/USA website.
  - Outline specific measures/projects/tasks for disseminating information; determining audience, etc.
  - Annually update and distribute community emergency phone trees for residents.
  - Complete and distribute emergency access/evacuation information to existing owners that is updated as future roads in the MPR are developed

FIRE SPRINKLERS

While IFC Sections 903.4 and 903.4.1 provide exceptions to omit supervision and monitoring of some sprinkler systems, to contribute to early warning and promote reliability of the fire protection systems, supervision and monitoring is required for all fire sprinkler systems in the MRE. To prevent nuisance alarms, systems designed in accordance with NFPA 13D to serve dwelling units should utilize a stand-alone sprinkler system. Increased sprinkler protection may be incorporated as part of EVAR deviations, such as building proximity or dead-end length. Subject to specific approval for individual buildings, this could include system design based on a 13D system where none is otherwise required,

13R in lieu of 13D, NFPA 13 in lieu of 13R, or ordinary hazard protection in lieu of light hazard densities.

FIRE ALARM

A monitored fire alarm system is recognized by IFC Section 901.4.4 as an additional safeguard. Monitored fire alarm systems will be installed in accordance with NFPA 72 for commercial buildings and individual residences in the MPR. This is intended to provide for automatic transmission of an alarm signal to ensure early notification of the fire department, regardless of whether or not the building is occupied.

In addition to monitoring of occupied structures, automatic transmission of a wireless signal in the event of exterior flame detection is also anticipated to be incorporated for early warning of a developing fire emergency. This also represents an additional safeguard.

PORTABLE FIRE EXTINGUISHER

Similar to fire alarm systems, portable extinguishers are recognized by IFC Section 901.4.4 as additional fire protection.

The provision of a portable extinguisher is intended to improve occupants' abilities to suppress a fire early in its development in an effort to limit the potential consequences of an encumbered fire department response.

Installation of portable fire extinguishers is already prescribed for commercial buildings. Each dwelling unit of a one- and two-family home or townhome within the MPR, if not equipped with automatic fire sprinklers, is to maintain a minimum 2A:10B:C rated extinguisher for partial protection in accordance with IFC Section 901.4.2.

KEY BOX

To facilitate non-destructive access in response to an alarm event during a period when a unit is unoccupied, a key box is to be provided near the main entry of each building in accordance with IFC Section 506.

EMERGENCY ESCAPE

Means for emergency escape may be incorporated into certain buildings as part of EVAR deviations, such as building proximity or dead-end length. Subject to specific approval, a dwelling unit or sleeping unit in a remote portion of a building to include exterior emergency escape to promote occupant self-rescue. Such features are in addition to minimum code requirements for emergency escape and rescue openings from sleeping rooms.

Each story with a sleeping room in a subject unit could be provided with at least one of the following:

A. Egress door with exterior landing and access to grade as prescribed for required egress door.

B. Emergency escape and rescue opening with a sill located maximum 74 inches above exterior landing. Exterior landing may be either grade directly below, or a platform or deck with access to grade as prescribed for a required egress door. (The 74-inch dimension is based upon the prescribed 44-inch height of emergency and rescue opening above floor, plus 30-inch elevation for which guards not required).

C. Permanent ladder or other approved emergency escape/descent facility located at an emergency escape and rescue opening or balcony guard.

Such emergency escape provisions represent an additional safeguard per IFC Section 901.4.4.

EMERGENCY GUIDE

Due to the unique conditions of the development and variety of fire safety elements present with the Mission Ridge Expansion, an emergency guide shall be prepared for each building/tenant space/dwelling unit.

Information provided in the guide should be consistent with IFC Section 403.10.2.2.1, as applicable for the occupancy served. A copy of the guide should be maintained in each subject space for reference by the occupants. In commercial tenant spaces, the guide may be accessible to employees only.

The information to be provided should be approved in accordance with IFC Sections 401.2 and 403.10.2.2.2. A template for a dwelling unit is provided in Exhibit F. This emergency guide represents an additional safeguard in accordance with IFC Section 901.4.4 and must be maintained consistent with Sections 107.1 and 901.4.

CONCLUSION

The development area of the Mission Ridge Expansion involves a wildland-urban interface. By incorporating prescriptive fire safety measures of the IWUIC as adopted by the State

Building Code Council for enforcement beginning in 2020, and endorsed by the Forest Ridge Wildfire Coalition and Squilchuck Valley Area Community Wildfire Protection Plan Steering Committee, and intended for reference by CCC Section 15.40.050(3)(A), together with the additional safety features described in this Fire Protection Plan, the Mission Ridge Expansion compliments the area without significant effects on natural and environmental features with regard to fire.

This Fire Protection Plan presents a framework of fire safety elements to be incorporated with the Mission Ridge Expansion Master Planned Resort. This includes additional safety features in accordance with IFC Sections 901.4.2 and 901.4.4. Code excerpts in this report are not intended to substitute for complete applicable code language, and the code references provided should not be considered to address all applicable code provisions.

Please contact Brian Thompson via e-mail at BrianT@AEGISengineering.com, or by telephone at 425-745-4700, with any requests for clarification of information presented in this report.

Prepared by:

AEGIS ENGINEERING, PLLC

Brian C. Thompson, P.E.

Attachments

EXHIBIT A

INTERNATIONAL WILDLAND-URBAN INTERFACE CODE
FIRE HAZARD SEVERITY WORKSHEET

The following table illustrates the assessment of various site features as identified by the Fire Hazard Severity Form of the International Wildland-Urban Interface Code and a corresponding explanation for each score as assigned to the Mission Ridge Expansion.

CATEGORY	POINTS *Form*	POINTS **Site**	COMMENTS
A. SUBDIVISION DESIGN			
1. Ingress/Egress			
Two or more primary roads	*1*		Single access route in/out of Mission Ridge Expansion (MRE).
One road	*3*		
One-way road in/out	*5*	**5**	
2. Width of Primary Road			
20 feet or more	*1*	**1**	Access road to MRE to have min. 28-foot traveled surface per CCC 15.30.230(4).
Less than 20 feet	*3*		
3. Accessibility			
Road grade 5% or less	*1*		Varying access grades with portions exceeding 5%.
Road grade more than 5%	*3*	**3**	
4. Secondary Road Terminus			
Loop roads, cul-de-sacs	*1*		Dead end roads/driveways may exceed 200’ such as may be approved per CCC 15.30.100 or 15.30.240.
Dead-end road, max. 200’	*3*		
Dead-end road >200’	*5*	**5**	
5. Street signs			
Present	*1*	**1**	Street signs to be provided.
Not present	*3*		
B. VEGETATION			
1. Fuel Types			
Light	*1*		Fuel Model 10 per Squilchuck Creek Area Structure Protection Plan by Chelan County Fire District 1 (CWPP Appendix 1).
Medium	*5*		
Heavy	*10*	**10**	
2. Defensible Space			
70% or more of site	*1*		Protection of native trees may not support a defensible space with fuel modification.
30% to 70%	*10*		
Less than 30% of site	*20*	**20**	
C. TOPOGRAPHY			
8% or less	*1*		Topography varies and is considered to exceed 30%.
8% to 20%	*4*		
20% to 30%	*7*		
30% or more	*10*	**10**	

CATEGORY	POINTS *Form*	POINTS **Site**	COMMENTS
D. ROOFING MATERIAL			
Class A Class B Class C Nonrated	*1* *5* *10* *20*	**1**	Buildings will have minimum Class A roofing/noncombustible roof covering per CCC 15.40.050(2).
E. FIRE PROTECTION – WATER SOURCE			
500gpm hydrant w/in 1,000ft Hydrant >1,000ft Water <20 min. roundtrip Water 20 to 45 min. roundtrip Water >45min. roundtrip	*1* *2* *5* *7* *10*	**2**	Some structures may be located greater than 1,000 feet from a fire hydrant, subject to CCC 15.40.030(3).
F. BUILDING CONSTRUCTION MATERIALS			
Noncombustible siding/deck NC siding/combustible deck Combustible siding and deck	*1* *5* *10*	**5**	Construction will be enclosed in accordance with IWUIC 503 and 504 Class 1 or 2 (Class 3 could be 10).
G. UTILITIES (GAS AND/OR ELECTRIC)			
All underground utilities One underground, one above All aboveground	*1* *3* *5*	**3**	Electric utilities underground; conservatively provides for above-ground gas service (i.e. propane tanks).

TOTAL		**66**	
Moderate Hazard *High Hazard* *Extreme Hazard*	*(40-59)* *(60-74)* *(>75)*		As scored, project is “High Hazard”.

EXHIBIT B

FIREFIGHTING EQUIPMENT INVENTORY

Placeholder for agreement with local fire officials regarding wildland equipment, such as:

- Trailer/skid load specs
- Hose diameters and lengths
- Nozzles size and type
- Long-term retardant type and quantity
- Retardant proportioning appliance

EXHIBIT C

FIRE PROTECTION CONDITIONS

CRITERIA/ITEM	MIN. REQUIREMENT	PROPOSED	CONSIDERATION
FIRE PROTECTION STANDARD	None	IFC Appendix N (IWUIC with Appendix B and C)	CCC 15.40.050(3) references outdated standards. WAC 51-54A-8200 amends IWUIC for adoption as IFC Appendix N. ESSB 6109 revises RCW 19.27.031 for future adoption of IWUIC.
FUEL BREAK	2005 CWPP pg. 18, indicates a large planned fuel break	Similar physical fuel break and/or equipment for manual fire suppression/application of long-term retardant.	Help support fire crews' ability to prevent wildfire from entering Mission Ridge Expansion from canyon west of development area.
DEFENSIBLE SPACE	None	Per IWUIC Section 603.2	Minimum defensible space of 30', 50' or 75' with construction of Ignition-Resistant type IR-1,-2 or -3, respectively.
IGNITION-RESISTANT CONSTRUCTION	None	Based on IWUIC Table 503.1, with "building cluster" approach as part of MPR development conditions.	Where buildings are separated by less than 30 feet, ignition-resistant construction type is based upon smallest defensible space of any structure in the cluster (or string).
WATER SUPPLY	IFC Table B105.2 –180,000 gallons (1500 gpm. for 120 minutes)	180,000 gallons during construction. 83,400 gallons after construction (based on IFC 914.3.2 and B105.2)	During construction there is no active sprinkler protection so larger fire-flows and extended durations are reasonable. Based on limited hazards present upon occupancy and other fire protection features, in absence of construction, completed development meets amount prescribed for a high-rise building plus the fire flow of one residence.
FIRE DEPT. ACCESS	Chelan County Code 15.30.230(4) – the absence of an internal road network within a subdivision can be approved where unusual circumstances exist and other means of assuring public safety CCC 15.50.055 provides for a waiver where compliance is impossible or impractical.	Internal road network will satisfy Chelan County Code for fire apparatus access. Access road extended from existing Mission Ridge base area to be 28 feet wide and maximum 12% grade.	While codes provide for relief from strict compliance, internal road network of Mission Ridge Expansion is anticipated to satisfy standards for fire apparatus access.
WILDFIRE EVACUATION SIGNS	None	Install signage consistent with CWPP recommendation; ref. 2009 MUTCD (2012) Sec. 2N.03.	Similar to tsunami or hurricane evacuation signs, provide signage to assist wayfinding of public and emergency responders during wildfire.
HYDRANTS/OUTSIDE STANDPIPES	Fire hydrants located as approved by fire official.	Fire water distribution will be underground via fire hydrants or standpipes subject to approval by fire official.	Fire hydrants are supplied by domestic water system, outside standpipes would be served by Mission Ridge Resort snow-making pump equipment.

CRITERIA/ITEM	MIN. REQUIREMENT	PROPOSED	CONSIDERATION
FLAME DETECTION	None	Exterior wireless monitoring during construction and for wildfire detection when occupied.	Added safeguard exceeds fire safety prescribed in IFC Sections 3308 and 3309 during construction, and promotes public safety with early warning of approaching wildfire to initiate intervention/evacuation.
COMMUNITY WARNING SIREN	None	Install a community warning siren.	Siren could be activated remotely by emergency services, increasing public safety by promoting advance evacuation of the community prior to arrival of personnel in neighborhood. Different tones could be used to distinguish between evacuation levels.
EVACUATION AREA	None	Construct and maintain base as a safe area, providing parking to afford one space for each dwelling unit.	This establishes an additional safe area in a strategic location, consistent with implementation of CWPP vision.
FIRE ALARM	Homes constructed per IRC require only single or multiple station, interconnected smoke alarms and CO detection.	Install monitored fire alarm systems in accordance with NFPA 72 for all commercial buildings and individual residences.	Provides for early notification of fire alarm condition to the fire department regardless of whether or not the building is occupied, and promotes early self-evacuation of occupants.
KEY BOX	None for dwelling units.	A key box is to be provided near the main entry of each structure in accordance with IFC 506.	The key box is to facilitate non-destructive access in response to an alarm event during a period when the structure is unoccupied, including townhomes, duplexes and single-family homes.
PORTABLE FIRE EXTINGUISHER	None for dwelling units.	In absence of fire sprinklers in a dwelling unit of a one- or two-family home or a townhome, maintain a minimum 2A:10B:C rated extinguisher in the unit.	This provision is intended to improve occupants' abilities to suppress a fire early, limiting reliance upon fire department response for manual firefighting.
EMERGENCY ESCAPE LANDING	None	If portion of exterior wall is greater than 150 feet from fire apparatus access road, every affected unit provided with an exterior escape landing.	While code prescribes only emergency escape and rescue openings, where standard fire department access is exceeded, an emergency escape landing will be provided as described in the fire protection report to promote occupant self-rescue.
EMERGENCY GUIDE	Required only for Group R-2 per IFC 403.10.2.2	Maintain an emergency guide in each building, tenant space, and sleeping/dwelling unit.	The conditions of the development and variety of fire protection features to be provided are unique. Fire safety and evacuation plans are only required for select occupancies (and subject to certain thresholds) per IFC 403.4, 403.6 and 403.9. Ensuring an emergency guide is provided regardless of occupant load and in every dwelling unit represents an additional safeguard in accordance with IFC 901.4.4, contributing to public safety.

EXHIBIT D

EXCERPTED 2018 IWUIC PROVISIONS FOR CLASS 1, 2 & 3 IGNITION-RESISTANT CONSTRUCTION IN MISSION RIDGE EXPANSION

202 Definitions.

Approved. Acceptable to the code official.

Log Wall Construction. A type of construction in which exterior walls are constructed of solid wood members and where the smallest horizontal dimension of each solid wood member is at least 6 inches (152 mm).

Noncombustible. As applied to building construction material means a material that, in the form in which it is used, is either one of the following:

1. Material of which no part will ignite and burn when subjected to fire. Any material conforming to ASTM E 136 shall be considered noncombustible within the meaning of this section.
2. Material having a structural base of noncombustible material as defined in Item 1 above, with a surfacing material not over 1/8 inch (3.2 mm) thick, which has a flame spread index of 50 or less. Flame spread index as used herein refers to a flame spread index obtained according to tests conducted as specified in ASTM E 84 or UL 723.

"Noncombustible" does not apply to surface finish materials. Material required to be noncombustible for reduced clearances to flues, heating appliances or other sources of high temperature shall refer to material conforming to Item 1. No material shall be classified as noncombustible that is subject to increase in combustibility or flame spread index, beyond the limits herein established, through the effects of age, moisture or other atmospheric condition.

501.3 Fire-resistance-rated construction.
Where this code requires 1-hour fire-resistance-rated construction, the fire-resistance rating of building elements, components or assemblies shall be determined in accordance with the test procedures set forth in ASTM E 119 or UL 263.

Exceptions:

1. The fire-resistance rating of building elements, components or assemblies based on the prescriptive designs prescribed in Section 721 of the *International Building Code.*
2. The fire-resistance rating of building elements, components or assemblies based on the calculation procedures in accordance with Section 722 of *the International Building Code.*

SECTION 503
IGNITION-RESISTANT
CONSTRUCTION AND MATERIAL

503.1 General. Buildings and structures hereafter constructed, modified or relocated into or within *wildland-urban interface* areas shall meet the construction requirements in accordance with Table 503.1. Class 1, Class 2 or Class 3, ignition-resistant construction shall be in accordance with Sections 504, 505 and 506, respectively. Materials required to be ignition-resistant materials shall comply with the requirements of Section 503.2.

503.2 Ignition-resistant building material. Ignition-resistant building materials shall comply with any one of the following:

1. Material shall be tested on all sides with the extended ASTM E 84 (UL 723) test or ASTM E 2768, except panel products shall be permitted to test only the front and back faces. Panel products shall be tested with a ripped or cut longitudinal gap of 1/8 inch. Materials that, when tested in accordance with the test procedures set forth in ASTM E 84 or UL 723, for a test period of 30 minutes, or ASTM E 2768, comply with the following:

1.1. Flame spread. Material shall exhibit a flame spread index not exceeding 25 and shall not show evidence of progressive combustion following the extended 30-minute test.

1.2. Flame front. Material shall exhibit a flame front that does not progress more than 10 ½ feet (3200 mm) beyond the centerline of the burner at any time during the extended 30-minute test.

1.3. Weathering. Ignition-resistant building materials shall maintain their performance in accordance with this section under conditions of use. Materials shall meet the performance requirements for weathering (including exposure to temperature, moisture and ultraviolet radiation) contained in the following standards, as applicable to the materials and the conditions of use:

1.3.1. Method A "Test Method for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing" in ASTM D 2898, for fire-retardant-treated wood, wood-plastic composite and plastic lumber materials.

1.3.2. ASTM D 7032 for wood-plastic composite materials.

1.3.3. ASTM D 6662 for plastic lumber materials.

1.4. Identification. All materials shall bear identification showing the fire test results.

Exception: Materials comprised of a combustible core and a noncombustible exterior covering, comprised of

either aluminum at a minimum 0.019 inch (0.48 mm) thickness or corrosion resistant steel at a minimum 0.0149 inch (0.38 mm) thickness, shall not be required to be tested with a ripped or cut longitudinal gap.

2. Noncombustible material. Material that complies with the requirements for *non-combustible* materials in Section 202.

3. Fire-retardant-treated wood. Fire-retardant-treated wood identified for exterior use and meeting the requirements of Section 2303.2 of the *International Building Code.*

4. Fire-retardant-treated wood roof coverings. Roof assemblies containing fire-retardant-treated wood shingles and shakes that comply with the requirements of Section 1505.6 of the *International Building Code* and classified as Class A roof assemblies as required in Section 1505.2 of the *International Building Code.*

SECTION 504
CLASS 1 IGNITION-RESISTANT CONSTRUCTION

504.1 General. Class 1 ignition-resistant construction shall be in accordance with Sections 504.2 through 504.11.

504.2 Roof covering. Roofs shall have a roof assembly that complies with a Class A rating when tested in accordance with ASTM E 108 or UL 790. For roof coverings where the profile allows a space between the roof covering and roof decking, the space at the eave ends shall be firestopped to preclude entry of flames or embers, or have one layer of 72-pound (32.4 kg) mineral-surfaced, nonperforated cap sheet complying with ASTM D 3909 installed over the combustible decking.

Exceptions:

1. Class A roof assemblies include those with coverings of brick, masonry or an exposed concrete roof deck.
2. Class A roof assemblies also include ferrous or copper shingles or sheets, metal sheets and shingles, clay or concrete roof tile or slate installed on noncombustible decks or ferrous, copper or metal sheets installed without a roof deck on noncombustible framing.
3. Class A roof assemblies include minimum 16 oz/sq. ft. (0.0416kg/m^2) copper sheets installed over combustible decks.

504.2.1 Roof valleys. When provided, valley flashings shall be not less than 0.019 inch (0.48 mm) (No. 26 galvanized sheet gage) corrosion-resistant metal installed over a minimum 36-inch-wide (914 mm) underlayment consisting of one layer of 72- pound (32.4 kg) mineral-surfaced, nonperforated cap sheet complying with ASTM D 3909 running the full length of the valley.

504.3 Protection of eaves. Eaves and soffits shall be protected on the exposed underside by ignition-resistant materials or by materials *approved* for a minimum of 1-hour fire-resistance-rated construction, 2-inch (51 mm) nominal dimension lumber, or 1-inch (25 mm) nominal fire-retardant-treated lumber or ¾ -inch (19.1 mm) nominal fire-retardant-treated plywood, identified for exterior use and meeting the requirements of Section 2303.2 of the *International Building Code*. Fascias are required and shall be protected on the backside by ignition-resistant materials or by materials *approved* for a minimum of 1-hour fire-resistance-rated construction or 2-inch (51 mm) nominal dimension lumber.

504.4 Gutters and downspouts. Gutters and downspouts shall be constructed of *noncombustible* material. Gutters shall be provided with an *approved* means to prevent the accumulation of leaves and debris in the gutter.

504.5 Exterior walls. Exterior walls of building or structures shall be constructed with one of the following methods:

1. Materials approved for a minimum of 1-hour fire-resistance-rated construction on the exterior side.
2. *Approved noncombustible* materials.
3. Heavy timber or log wall construction.
4. Fire-retardant-treated wood on the exterior side. The fire-retardant-treated wood shall be labeled for exterior use and meet the requirements of Section 2303.2 of the *International Building Code*.
5. Ignition-resistant materials on the exterior side.

Such material shall extend from the top of the foundation to the underside of the roof sheathing.

504.6 Underfloor enclosure. Buildings or structures shall have all underfloor areas enclosed to the ground with exterior walls in accordance with Section 504.5.

Exception: Complete enclosure shall not be required where the underside of exposed floors and exposed structural columns, beams and supporting walls are protected as required for exterior 1-hour fire-resistance-rated construction or heavy timber construction or fire-retardant-treated wood. The fire-retardant-treated wood shall be labeled for exterior use and meet the requirements of Section 2303.2 of the *International Building Code*.

504.7 Appendages and projections. *Unenclosed accessory structures* attached to buildings with habitable spaces and projections, such as decks, shall not be less than 1-hour fire-resistance-rated construction, heavy timber construction or constructed of one of the following:

1. *Approved noncombustible* materials;
2. Fire-retardant-treated wood identified for exterior use and meeting the requirements of Section 2303.2 of the *International Building Code*; or
3. Ignition-resistant building materials in accordance with Section 503.2.

504.7.1 Underfloor areas. When the attached structure is located and constructed so that the structure or any portion thereof projects over a descending slope surface greater than 10 percent, the area below the structure shall have underfloor areas enclosed to within 6 inches (152 mm) of the ground, with exterior wall construction in accordance with Section 504.5.

504.8 Exterior glazing. Exterior windows, window walls and glazed doors, windows within exterior doors, and skylights shall be tempered glass, multilayered glazed panels, glass block or have a fire protection rating of not less than 20 minutes.

504.9 Exterior doors. Exterior doors shall be *approved* noncombustible construction, solid core wood not less than 1¾ inches thick (44 mm), or have a fire protection rating of not less than 20 minutes. Windows within doors and glazed doors shall be in accordance with Section 504.8.

Exception: Vehicle access doors.

504.10 Vents. Attic ventilation openings, foundation or underfloor vents, or other ventilation openings in vertical exterior walls and vents through roofs shall not exceed 144 square inches (0.0929 m^2) each. Such vents shall be covered with *noncombustible* corrosion-resistant mesh with openings not to exceed ¼ inch (6.4 mm), or shall be designed and *approved* to prevent flame or ember penetration into the structure.

504.10.1 Vent locations. Attic ventilation openings shall not be located in soffits, in eave overhangs, between rafters at eaves, or in other overhang areas. Gable end and dormer vents shall be located not less than 10 feet (3048 mm) from lot lines. Underfloor ventilation openings shall be located as close to grade as practical.

504.11 Detached accessory structures.
Detached accessory structures located less than 50 feet (15,240 mm) from a building containing habitable space shall have exterior walls constructed with materials *approved* for not less than 1-hour fire-resistance-rated-construction, heavy timber, log wall construction, or constructed with *approved noncombustible* materials or fire-retardant-treated wood on the exterior side. The fire-retardant-treated wood shall be labeled for exterior use and meet the requirements of Section 2303.2 of the *International Building Code*.

504.11.1 Underfloor areas. When the detached structure is located and constructed so that the structure or any portion thereof projects over a descending slope surface greater than 10 percent, the area below the structure shall have all underfloor areas enclosed to within 6 inches (152 mm) of the ground, with exterior wall construction in accordance with Section 504.5 or underfloor protection in accordance with Section 504.6.

Exception: The enclosure shall not be required where the underside of all exposed floors and all exposed structural columns, beams and supporting walls are protected as required for exterior 1-hour fire-resistance-rated construction or heavy-timber construction or fire-retardant-treated wood on the exterior side. The fire-retardant-treated wood shall be labeled for exterior use and meet the requirements of Section 2303.2 of the *International Building Code.*

SECTION 505
CLASS 2 IGNITION-RESISTANT CONSTRUCTION

505.1 General. Class 2 ignition-resistant construction shall be in accordance with Sections 505.2 through 505.11.

505.2 Roof covering. Roofs shall have a roof assembly that complies with a Class B rating when tested in accordance with ASTM E 108 or UL 790 or an *approved noncombustible roof* covering. For roof coverings where the profile allows a space between the roof covering and roof decking, the space at the eave ends shall be firestopped to preclude entry of flames or embers, or have one layer of 72-pound (32.4 kg) mineral-surfaced, non-perforated cap sheet complying with STM D 3909 installed over the combustible decking.

505.2.1 Roof valleys. When provided, valley flashings shall be not less than 0.019 inch (0.48 mm) (No. 26 galvanized sheet gage) corrosion-resistant metal installed over a minimum 36-inch-wide (914 mm) underlayment consisting of one layer of 72-pound (32.4 kg) mineral-surfaced, nonperforated cap sheet complying with ASTM D 3909 running the full length of the valley.

505.3 Protection of eaves. Combustible eaves, fascias and soffits shall be enclosed with solid materials with a minimum thickness of ¾ inch (19 mm). Exposed rafter tails shall not be permitted unless constructed of heavy timber materials.

505.4 Gutter and down pouts. Gutters and downspouts shall be constructed of *noncombustible* material. Gutters shall be provided with an *approved* means to prevent the accumulation of leaves and debris in the gutter.

505.5 Exterior walls. Exterior walls of buildings or structures shall be constructed with one of the following methods:

1. Materials *approved* for a minimum of 1-hour fire-resistance-rated construction on the exterior side.
2. *Approved* noncombustible materials.
3. Heavy timber or log wall construction.
4. Fire-retardant-treated wood on the exterior side. The fire-retardant-treated wood shall be labeled for exterior use and meet the requirement of Section 2303.2 of the *International Building Code.*
5. Ignition-resistant materials on the exterior side.

Such material shall extend from the top of the foundation to the underside of the roof sheathing.

505.6 Underfloor enclosure. Buildings or structures shall have all underfloor areas enclosed to the ground, with exterior walls in accordance with Section 505.5.

Exception: Complete enclosure shall not be required where the underside of all exposed floors and all exposed structural columns, beams and supporting walls are protected as required for exterior 1-hour fire-resistance-rated construction or heavy timber construction or fire-retardant-treated wood. The fire-retardant-treated wood shall be labeled for exterior use and meet the requirements of Section 2303.2 of the *International Building Code*.

505.7 Appendages and projections. *Unenclosed accessory structures* attached to buildings with habitable spaces and projections, such as decks, shall be not less than 1-hour fire-resistance-rated construction, heavy timber construction or constructed of one of the following:

1. *Approved noncombustible* materials;
2. Fire-retardant-treated wood identified for exterior use and meeting the requirements of Section 2303.2 of the *International Building Code*;
3. Ignition-resistant building material in accordance with Section 503.2

505.7.1 Underfloor areas. When the attached structure is located and constructed so that the structure or any portion thereof projects over a descending slope surface greater than 10 percent, the area below the structure shall have underfloor areas enclosed to within 6 inches (152 mm) of the ground, with exterior wall construction in accordance with Section 505.5.

505.8 Exterior glazing. Exterior windows, window walls and glazed doors, windows within exterior doors, and skylights shall be tempered glass, multilayered glazed panels, glass block or have a fire -protection rating of not less than 20 minutes.

505.9 Exterior doors. Exterior doors shall be *approved noncombustible* construction, solid core wood not less than 1 ¾ inches thick (45 mm), or have a fire protection rating of not less than 20 minutes. Windows within doors and glazed doors shall be in accordance with Section 505.8.

Exception: Vehicle access doors.

505.10 Vents. Attic ventilation openings, foundation or underfloor vents or other ventilation openings in vertical exterior walls and vents through roofs shall not exceed 144 square inches (0.0929 m^2) each. Such vents shall be covered with *noncombustible* corrosion-resistant mesh with openings not to exceed ¼ inch (6.4 mm) or shall be designed and *approved* to prevent flam or ember penetration into the structure.

505.10.1 Vent locations. Attic ventilation openings shall not be located in soffits, in eave overhangs, between rafters at eaves, or in other overhang areas. Gable end and dormer vents shall be located at least 10 feet (3048 mm) from lot lines. Underfloor ventilation openings, shall be located as close to grade as practical.

505.11 Detached accessory structures. Detached accessory structures located less than 50 feet (15,240 mm) from a building containing habitable space shall have exterior walls constructed with materials *approved* for not less than 1-hour fire-resistance-rated construction, heavy timber, log wall construction, or constructed with *approved noncombustible* materials or fire-retardant-treated wood on the exterior side. The fire-retardant-treated wood shall be labeled for exterior use and meet the requirements of Section 2303.2 of the *International Building Code*.

505.11.1 Underfloor areas. When the detached accessory structure is located and constructed so that the structure or any portion thereof projects over a descending slope surface greater than 10 percent, the area below the structure shall have all underfloor areas enclosed to within 6 inches (152 mm) of the ground, with exterior wall

construction in accordance with Section 505.5 or underfloor protection in accordance with Section 505.6.

Exception: The enclosure shall not be required where the underside of all exposed floors and all exposed structural columns, beams and supporting walls are protected as required for exterior 1-hour fire-resistant rated construction or heavy-timber construction or fire-retardant-treated wood on the exterior side. The fire-retardant-treated wood shall be labeled for exterior use and meet the requirements of Section 2303.2 of the *International Building Code*.

SECTION 506
CLASS 3 1GNITION-RESISTANT CONSTRUCTION

506.1 General. Class 3 ignition-resistant construction shall be in accordance with Sections 506.2 through 506.4.

506.2 Roof covering. Roofs shall have at least a roof assembly that complies with Class C rating when tested in accordance with ASTM E 108 or UL 790 or an *approved noncombustible* roof covering. For roof coverings where the profile allows a space between the roof covering and roof decking, the space at the eave ends shall be firestopped to preclude entry of flames or embers, or have one layer of 72-pound (32.4 kg) mineral-surfaced, non- perforated cap sheet complying with ASTM D 3909 installed over the combustible decking.

506.2.1 Roof valleys. Where provided, valley flashings shall be not less than 0.019-inch (0.44 mm) (No. 26 galvanized sheet gage) corrosion-resistant metal installed over a minimum 36-inch-wide (914 mm) underlayment consisting of one layer of 72-pound (32.4 kg) mineral-surfaced, nonperforated cap sheet complying with ASTM D 3909 running the full length of the valley.

506.3 Underfloor protection. Buildings or structures shall have underfloor areas enclosed to the ground with exterior walls.

Exception: Complete enclosure shall not be required where the underside of all exposed floors and exposed structural columns, beams and supporting walls are protected as required for exterior 1-hour fire-resistance-rated construction or heavy timber construction. Fire-retardant-treated wood shall be labeled for exterior use and meet the requirement of Section 2303.2 of *the International Building Code*.

506.4 Gutters and down spouts. Gutter and downspouts shall be constructed of *noncombustible* material. Gutters shall be provided with an *approved* means to prevent the accumulation of leaves and debris in the gutter.

EXHIBIT E

FIRE HYDRANT AND STANDPIPE LAYOUT

(Placeholder for plans depicting approved fire hydrant and standpipe layout for each phase.)

EXHIBIT F

EMERGENCY GUIDE TEMPLATE

MISSION RIDGE EXPANSION SAFETY INFORMATION

IN CASE OF EMERGENCY
DIAL 9-1-1

POISON CONTROL: 1-800-222-1222

House Address:_____

House Phone #:_____

> **Note:** This packet represents a general template intended for Mission Ridge Expansion dwelling units only, and must be edited/supplemented/customized and maintained in each unit to address the unique features of the individual residence and master planned resort. Items *shown with italics* identify some of the content which must be modified based on specific characteristics of the individual property.

This safety information packet may be required by Chelan County as a condition for construction of this Mission Ridge Expansion dwelling unit. The homeowner is responsible for maintaining this packet and presenting it upon request (e.g. prior to final permit approval of a home improvement project, in conjunction with the sale of the home, during a Firewise community audit, etc.). It is intended to familiarize you with some of the unique features of this dwelling unit and the Mission Ridge and Squilchuck Valley community.

This packet is to be kept in the *kitchen drawer*.

!!! DO NOT REMOVE !!!

Updated *DD/MM/YYYY*

CONTENTS

1. Method for Reporting a Fire or Other Emergency
2. Emergency Evacuation & Assembly Area
3. Fire Safety Equipment
    a. Floor Plans with Locations
    b. Instructions and Maintenance Information
4. Household Hazards
5. Fire Department Access
6. Mission Ridge Community Map
7. Community Contacts / Directory
8. Service Provider Contacts / Directory
    a. Emergency / Non-emergency
    b. Mission Ridge Ski Patrol

1. METHOD FOR REPORTING A FIRE OR OTHER EMERGENCY

Dial 9-1-1 to report an emergency.

In case of fire emergency, evacuate the home and call 9-1-1 from a safe location.

This dwelling is equipped with a monitored household fire alarm system. This service automatically alerts the fire department if the fire alarm system is activated.

Carbon monoxide alarms in this dwelling *are not connected to the fire alarm system*. If a carbon monoxide alarm sounds, evacuate the home and call 9-1-1 from a safe location.

2. EMERGENCY EVACUATION & ASSEMBLY AREA

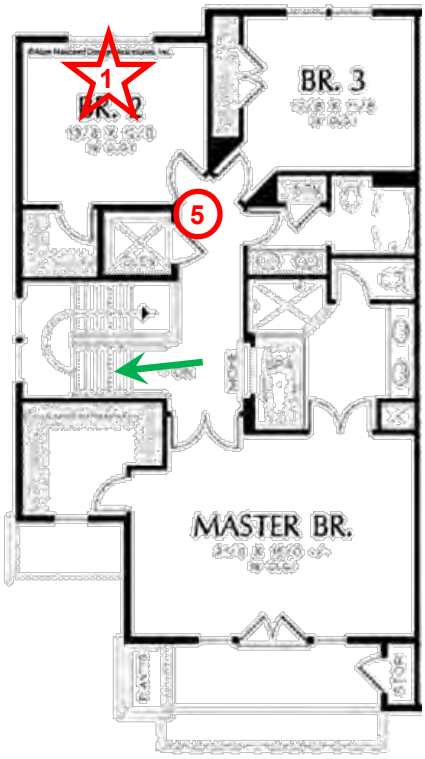
The fire alarm system will sound upon activation of a smoke detector or fire sprinkler waterflow (if provided). When the alarm sounds, exit the home using the nearest available exit. Get out, stay out. In an emergency, *meet in the driveway.*

In the case of inclement weather, the Lodge may be available for temporary shelter – contact the Fire Department for access.

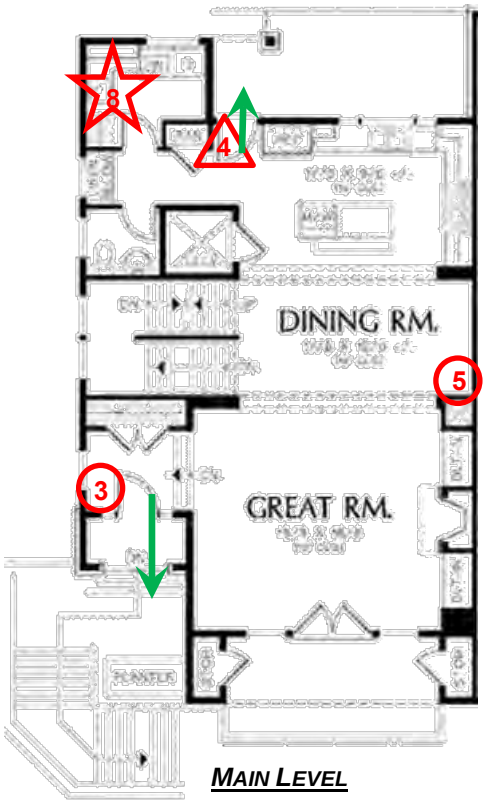
Emergency escape features are shown on the floor plans included with this guide. Keep evacuation routes clear of debris, snow and ice (including exterior *decks and stairs*). Also, beware of potential hazards of falling tree limbs, snow and ice!

3.A FIRE SAFETY EQUIPMENT LOCATIONS

(Replace with floor plans customized for dwelling unit).



UPPER LEVEL

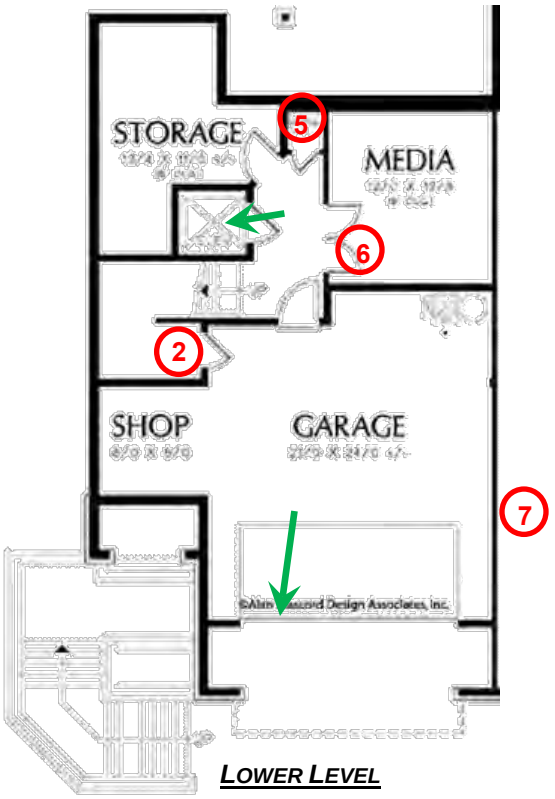


MAIN LEVEL

Legend

1. *Emergency escape window*
2. *Sprinkler system shut-off valve*
3. *Fire alarm system control panel*
4. *Fire extinguisher*
5. *Carbon monoxide alarm*
6. *Electrical panel*
7. *Gas Valve*
8. *First aid kit*

Main Exit from Floor



LOWER LEVEL

FIRE HYDRANTS

Fire hydrants are distributed throughout the community.

Please help keep fire hydrants accessible for fire department use. This can involve clearing vegetation or snow or compacting snow to maintain a firm path around the hydrant.

FIREWISE COMMUNITY

To limit the potential for a forest fire to encroach upon the dwellings in Mission Ridge, or for a forest fire to begin within Mission Ridge, annual neighborhood events are coordinated by the Mission Ridge community Firewise Board. Contact a Board Member for more information.

3.B EQUIPMENT INSTRUCTIONS/MAINTENANCE

Proper use and maintenance is necessary to support reliability of fire safety equipment.

Please familiarize yourselves with the proper use of safety equipment in the event you may need it during your stay!

EMERGENCY ESCAPE LADDER

Instructions for use and maintenance of the emergency escape ladder (if provided) are stored with the equipment. In accordance with manufacturer instructions, each ladder should be inspected *monthly*.

Based on the NFPA (National Fire Protection Association) recommendation, practice emergency evacuation twice a year during the day and at night, such that each ladder is deployed and tested at least once annually. Please do not remove the tag which indicates the last time the device was tested.

SMOKE DETECTORS

Smoke detectors should be tested *weekly* in accordance with manufacturer's instructions, located *with the fire alarm control panel*. Smoke detectors are powered by the fire alarm system, so there are no batteries to change!

Removing a smoke detector causes the fire alarm system to transmit a trouble signal to the monitoring company. To temporarily silence a nuisance alarm, *press the Silence button on the fire alarm control panel* and call the monitoring company.

CARBON MONOXIDE ALARMS

Test carbon monoxide alarms weekly *by pressing the test button*. Your host will ensure the batteries are changed *every 6 months with the record maintained at the fire alarm control panel.*

FIRE ALARM SYSTEM

Manufacturer recommended inspection and maintenance information is located *with the fire alarm control panel*. The fire alarm system is tested annually. Test records are indicated *on the sticker inside the fire alarm control panel*.

FIRE SPRINKLERS (IF PROVIDED)

Do not hang anything from the fire sprinklers or sprinkler pipe!

Do not paint the fire sprinklers or their cover plates!

Fire sprinklers are to be inspected weekly in accordance with manufacturer recommendations. Manufacturer maintenance documentation is kept *by the main system shut-off valve.*

Fire alarm system monitoring of waterflow is to be conducted annually. Test records are indicated *on the sticker by the main system shut-off valve*.

If the main system shut-off valve is closed, there will be no water to the home and the sprinkler system will not work! Keep the thermostat set to *at least 65ºF* to prevent the pipes from freezing.

FIRE EXTINGUISHER

To use: PASS (Pull – Aim – Squeeze – Sweep)

In accordance with NFPA standards, fire extinguishers should be serviced or replaced annually; consistent with the date noted on the tag attached to the extinguisher.

4. HOUSEHOLD HAZARDS

Common household hazards exist in this home. Take customary precautions, including never leave candles burning unattended.

Take appropriate precautions when cooking. This includes: avoid wearing loose clothing, position handles of containers with hot liquids and electrical cords of small appliances so as to avoid spills, etc.

Handle and store flammable and combustible materials or other hazardous substances or chemicals with care.

5. FIRE DEPARTMENT ACCESS

All vehicles share the access road between the original Mission Ridge base area and the Mission Ridge Expansion – please yield to emergency traffic! See Mission Ridge Community Map.

Key boxes are provided near the main entry of the home to facilitate non-destructive access by the Fire Department if the dwelling is unoccupied during alarm activation.

6. COMMUNITY MAP

(A community map will be generated for each project phase in collaboration with local fire department officials to identity applicable fire safety elements).

7. COMMUNITY CONTACTS / DIRECTORY

NAME	PHONE	NOTES
		Firewise Board Member

8. SERVICE PROVIDER DIRECTORY

Emergency: **Dial 9-1-1** (Fire / Medical / Sheriff)

Non-emergency: XXX.XXX.XXXX

Mission Ridge Ski Patrol
Dispatch: XXX.XXX.XXXX (business)
EMERGENCY: XXX.XXX.XXXX

EXHIBIT G

EVACUATION ROUTES AND SIGN LOCATIONS

(Placeholder for plans depicting approved routes
and sign locations for each phase.)

EXHIBIT H

RECORD OF COORDINATION WITH OFFICIALS/STAKEHOLDERS

APPENDIX D

2023 Mission Ridge Expansion - Secondary Access Report

2022 Analysis of 5 Secondary Road Options to Mission Ridge Ski and Board Resort

APPENDIX D - Secondary Access Road Reports

2023 Mission Ridge Expansion - Secondary Access Report

914 164th St SE Ste B12 #205
Mill Creek, WA 98012-6366
www.AEGISengineering.com
phone 425.745.4700

January 20, 2023

Via E-Mail: jjorgensen@missionridge.com

Josh Jorgenson
Mission Ridge Resort, Inc.
7500 Mission Ridge Road
PO Box 1668
Wenatchee, WA 98807-1668

MISSION RIDGE EXPANSION
SECONDARY ACCESS – REVIEW OF OPTIONS

Dear Josh,

AEGIS Engineering has been retained to provide Mission Ridge Resort, Inc. ("Client") with fire protection engineering consulting services ("Services") regarding development of an expansion adjacent to the existing Mission Ridge Ski and Board Resort located at 7500 Mission Ridge Road in Wenatchee, Washington.

PROJECT CONDITIONS

The existing Mission Ridge Ski Resort (Resort) is provided a single route of access from South Wenatchee via Squilchuck Rd and Mission Ridge Rd. With the Mission Ridge Expansion (MRE) project area located near the Resort, consideration of secondary access provisions is required.

The project is subject to the Chelan County Code (CCC). Section 15.30.230(4) of CCC requires projects with more than 400 average daily traffic (ADT) address secondary access. Subsection A applies to development where secondary access and/or interconnectivity is possible. Subsection B addresses design criteria where secondary access within the development is not practical.

This document has been prepared by AEGIS Engineering to assess the secondary access options identified within the EcoSign study, and refers to our Fire Protection Plan, dated December 7, 2019.

SECONDARY ACCESS OPTIONS

EcoSign has prepared a study, received December 15, 2022 (attached), identifying five routes that could provide secondary access for the MRE project area, together with commentary on the feasibility of these routes. Routes are illustrated in Figure 1 below.

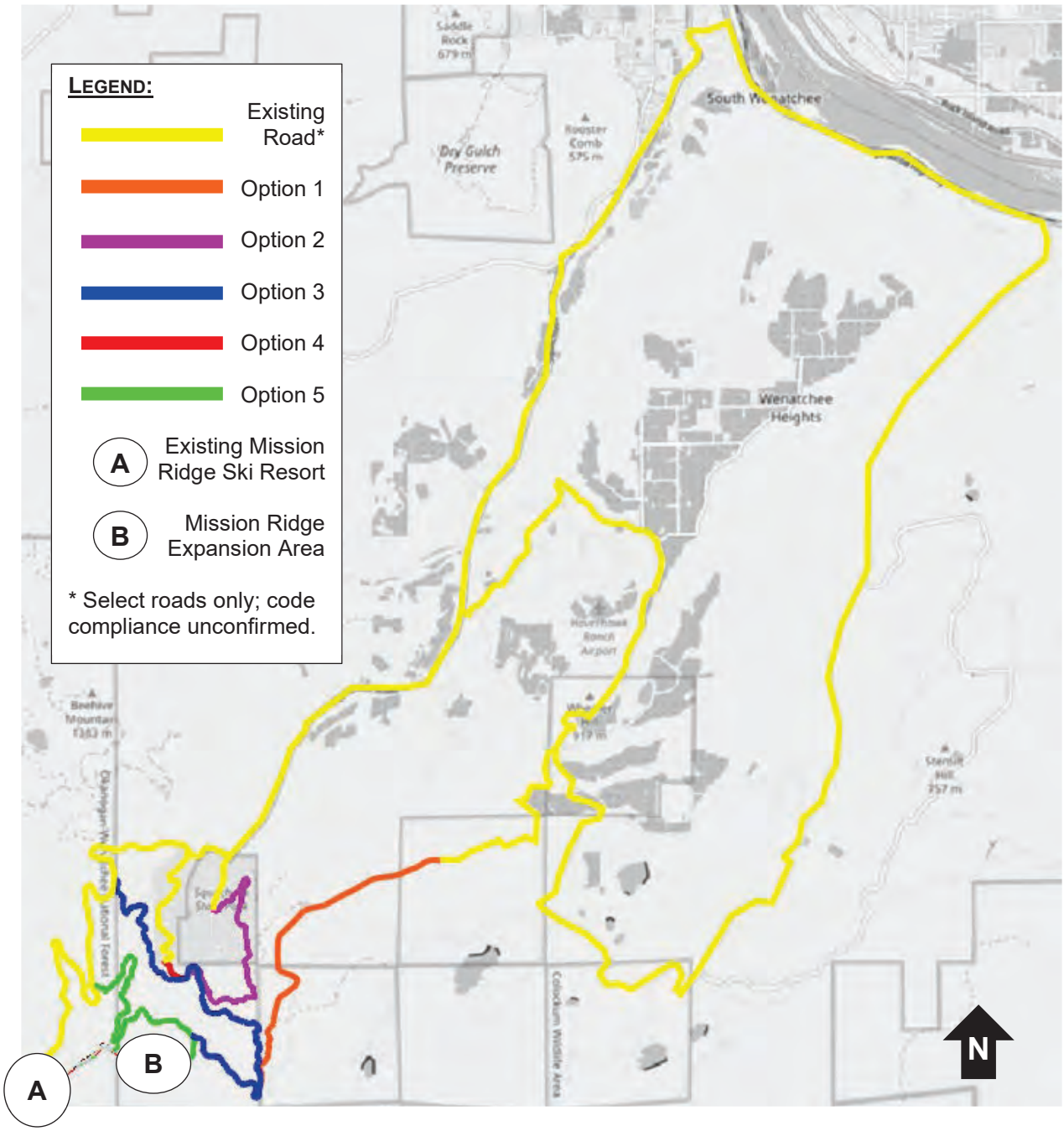


FIGURE 1: *ILLUSTRATION OF SECONDARY ROAD OPTIONS*
NOT TO SCALE

SECONDARY ACCESS OPTIONS

EcoSign has prepared a study, received December 15, 2022 (attached), identifying five routes that could provide secondary access for the MRE project area, together with commentary on the feasibility of these routes. Routes are illustrated in Figure 1 below.

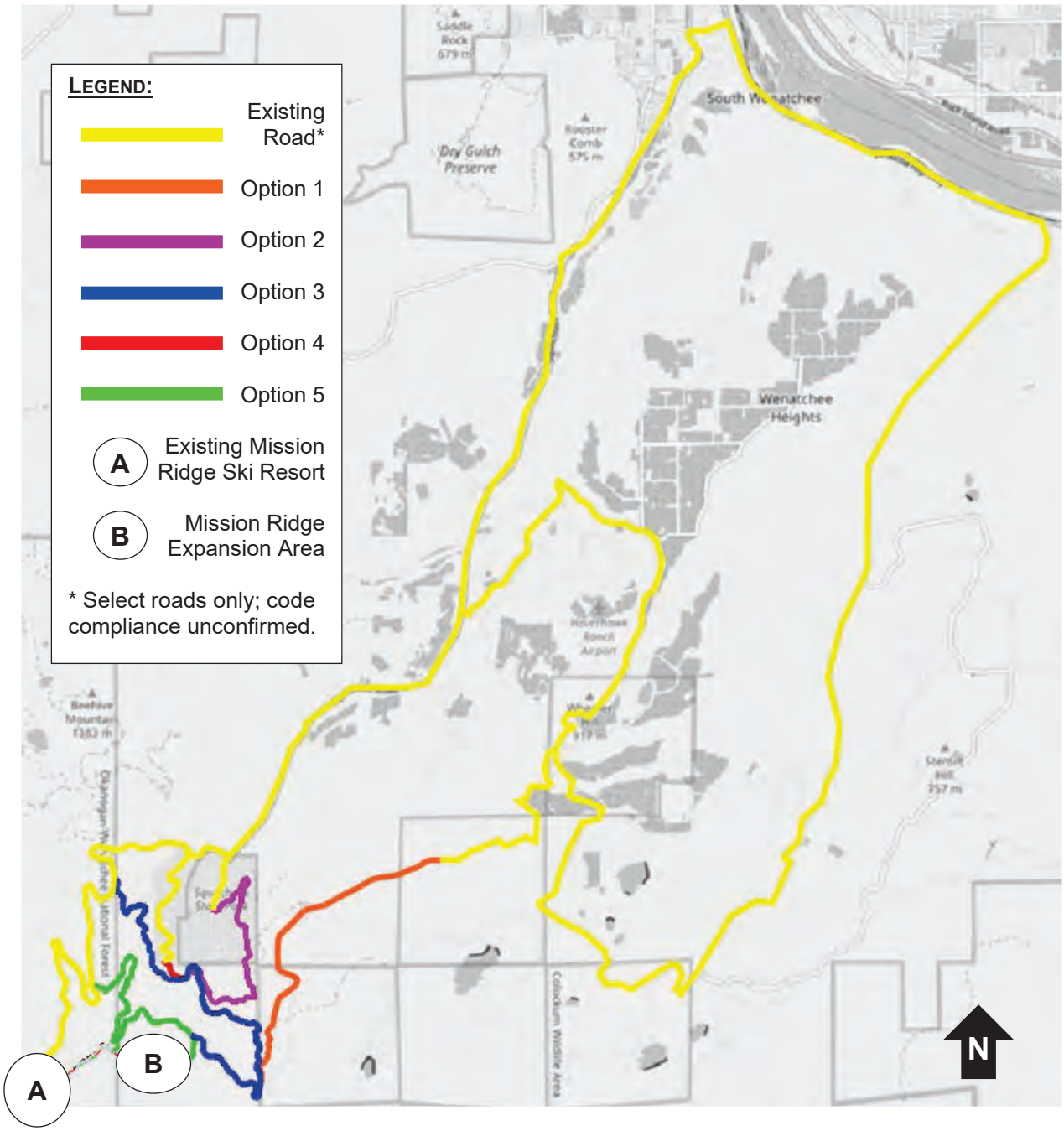


FIGURE 1: *ILLUSTRATION OF SECONDARY ROAD OPTIONS*
NOT TO SCALE

A summary of the study by EcoSign is presented in Table 1 below:

OPTION	ALIGNMENT	MAXIMUM GRADE	EARTHWORK (CU.YD.)	ECOSIGN CONCLUSION
Option 1	3.3 miles of new road that traverses property owned by others, including State of Washington.	12%	Over 79,000	*Practical?* No. Large imbalance of cut/fill earthwork (hauling about 60,000 cu.yd. excess cut). *Within the development?* No. Relies upon use of land (owned by others) outside of the development.
Option 2	4.0 miles of new road that traverses property owned by others, including State of Washington.	12%	Over 212,000	*Practical?* No. Substantial earthwork imbalance (hauling about 165,000 cu.yd. excess cut). *Within the development?* No. Relies upon use of land (owned by others) outside of the development.
Option 3	3.3 miles of new road that traverses property owned by others.	10%	Over 392,000	*Practical?* No. Extreme earthwork imbalance (hauling about 291,000 cu.yd. excess cut). *Within the development?* No. Relies upon use of land (owned by others) outside of the development.
Option 4	2.4 miles of new road that traverses property owned by others.	20%	Over 10,000	*Practical?* No. Excessive grade and earthwork (hauling about 9,000 cu.yd. excess cut). *Within the development?* No. Relies upon use of land (owned by others) outside of the development.
Options 5A & 5B	2.1 miles of new road along steep cross slopes.	10%	Over 196,000	*Practical?* No. Substantial earthwork imbalance (hauling about 153,000 cu.yd. excess cut). *Within the development?* No. Expands boundary of proposed development area.

TABLE 1: *SUMMARY OF ECOSIGN FINDINGS OF SECONDARY ROAD OPTIONS*

As indicated in the table above, secondary access within the development of the MRE project area is unreasonable and impractical for a combination of the following reasons:

- Road alignments traverse property owned by others (including State land).
- Construction of roads would require significant amounts of tree and vegetation removal, as well as substantial earthwork.

In addition to these findings from EcoSign, we understand the intent of the secondary access is to maintain ingress and egress routes in the event one route is blocked. However, only Option 1 offers a separate and distinct route, the other four options merely create larger loops at the end of Squilchuck Road.

With Option 1, after 3.3 miles of new road, this route is shown to join an extension of Upper Wheeler Road on State-owned land. From that intersection down to Loop Road, the existing 1.65 miles of the road is unpaved and appears to involve at least one turn with an inside radius of less than 20 feet. Therefore, we find the route as presented in Option 1 would not achieve code compliance.

ALLOWANCES

Based on the findings described above, consistent with CCC Section 15.30.230(4)(B), we find secondary access is not practical. Additionally, given the unusual circumstances of the site, such as the remoteness of the development and extreme terrain, no logical location for access for future connectivity with a surrounding property is apparent. Therefore, consistent with CCC Section 15.30.230(4)(B), interconnectivity is not provided, and Section 15.30.230(4)(A) should not apply.

Additionally, CCC Section 15.30.100 recognizes the prescribed standards indicate “appropriate practice under most conditions,” and allows deviations to prescribed criteria for “alternative solutions to real world situations.” As referenced in CCC 15.30.100(4):

> It is fully expected that creative engineering will continue to take place. Situations will present themselves where deviations may be preferred to allow conformance with existing conditions, to overcome adverse topography or to allow for more affordable solutions without adversely affecting safety, function, appearance, emergency vehicle response, and maintainability. These standards are intended to provide predictability yet still allow for the flexibility necessary for innovation.

AEGIS Engineering’s Fire Protection Report outlines a creative engineering approach for protection of the MRE project area which should be considered as an acceptable substitute to strict compliance with CCC Section 15.30.230, given the adverse topography present within and around the development.

AEGIS Engineering's Fire Protection Report presents a combination of prescriptive and performance-based elements, including features which exceed the level of safety prescribed by the code. Through the report, consistent with CCC Section 15.30.100(2), it is demonstrated that the subject fire protection strategy should meet the level of safety prescribed without adversely affecting safety, maintainability, or aesthetics.

CONCLUSION

AEGIS Engineering has reviewed the summary provided by EcoSign with respect to secondary access options for the MRE project area. Based on our review, we concur that providing for secondary access within the development is unreasonable and impractical. Accordingly, CCC Section 15.30.230(4)(A) should not be applicable. Further, as accommodated in CCC Section 15.30.100, the Fire Protection Report prepared by AEGIS Engineering should be considered toward assessment of code compliance with the MRE.

Please contact Brian Thompson by e-mail at BrianT@AEGISengineering.com or at 425.745.4700 for any clarification of the information presented in this document.

Prepared by,

AEGIS ENGINEERING

Grant Lilly, EIT-MD
Fire Protection Associate II

Reviewed By,

AEGIS ENGINEERING

Brian C. Thompson, P.E.
Principal

BRIAN C. THOMPSON
STATE OF WASHINGTON
41425
REGISTERED
PROFESSIONAL ENGINEER

Digitally signed by Brian C Thompson
DN: cn=Brian C Thompson, o=AEGIS Engineering, ou=Principal, email=briant@aegisengineering.com, c=US
Date: 2023.01.20 09:20:17 -08'00'

APPENDIX D

2022 Analysis of 5 Secondary Road Options to Mission Ridge Ski and Board Resort

ecosign
Mountain Resort Planners Ltd.

With Ecosign Analysis of 5 Secondary Road Options to Mission Ridge Ski and Board Resort

Introduction

Ecosign has been asked by Mission Ridge Ski and Board Resort to provide a review and analysis of 5 secondary road options for ingress / egress to their proposed future development site**.** The primary goal of this analysis is to determine whether these proposed routes are reasonable or practical while considering potential construction cost and overall impact of each alignment. This analysis is based off draft profiles, alignments, and earthworks estimation of the 5 road Options supplied by Torrence Engineering LLC which have been appended. For this analysis, Ecosign has referenced the following definitions of reasonable and practical which will be used throughout this analysis:

Meriam-Webster
https://www.merriam-webster.com/dictionary/practical
https://www.merriam-webster.com/dictionary/reasonable

Reasonable adjective

1a: being in accordance with reason
a *reasonable* theory
b: not extreme or excessive
reasonable requests
c: MODERATE, **FAIR**
a *reasonable* chance
a *reasonable* price
d: INEXPENSIVE

2a: having the faculty of reason
b: possessing sound judgment
a *reasonable* man

Practical adjective

1a: of, relating to, or manifested in practice or action: not theoretical or ideal
a *practical* question
for all *practical* purposes
b: being such in practice or effect: **VIRTUAL**
a *practical* failure

2: actively engaged in some course of action or occupation
a *practical* farmer

3: capable of being put to use or account: **USEFUL**
he had a *practical* knowledge of French

4a: disposed to action as opposed to speculation or abstraction
b (1): qualified by practice or practical training
a good *practical* mechanic
(2): designed to supplement theoretical training by experience

5: concerned with voluntary action and ethical decisions
practical reason

Design Criteria:

As supplied by the client, the minimum design criteria for the access route options are as follows: The road must be twenty-eight feet wide, paved, have a maximum slope of 8-12% and be open and maintained all year.

Route Option 1:

Alignment:

This proposed route option approaches the future development site from the east and follows the existing alignment of Wheeler Ridge Road. The upper portion of the access route links onto upper Route 3 for the remainder of the approach to site. In total, this access route option requires ~3.3 miles of refurbished and newly constructed road. The alignment is physically the most divergent relative to the existing access road, and therefore provides the largest physical separation / redundancy from a fire escape perspective. As this option minimizes impact by following the existing alignment of Wheeler Creek Rd for that majority of its length, Ecosign rates the alignment of Route Option 1 as Reasonable and Practical. However, the alignment travels through adjacent properties owned by Wheeler Ridge LLC and WDWF. As ownership of the land is not controlled by Mission Ridge, it is Unreasonable and Impractical to consider this alignment.

Profile:

In general, the profile of Route Option 1 conforms to the design criteria. This route has a maximum slope of 12% and conforms to natural gradients. Since this profile conforms well to natural ground and avoids excessive steep grades, Ecosign rates the profile of Route Option 1 as Reasonable and Practical.

Earthworks:

Route Option 1 requires total estimated earthworks of 69,453 yd^3 cut and 9,927 yd^3 fill, leaving a net surplus of 59,527 yd^3 material to be trucked off-site. Due to the large excess of material to be removed from site, Ecosign rates the earthworks of Route Option 1 as Unreasonable and Impractical.

Route Option 2:

Alignment:

This proposed route option approaches the future development site from the north and traverses' steep cross slopes through Squilchuck State Park. The upper portion of the access route links onto upper Route 3 for the remainder of the approach to site. In total, this access route option requires ~4.0 miles of newly constructed road. As this option traverses very steep terrain and disturbs land within Squilchuck State Park, Ecosign rates the alignment of Route Option 2 as Unreasonable and Impractical.

Profile:

In general, the profile of Route Option 2 conforms to the design criteria. This route has a maximum slope of 12% and conforms to natural gradients, except for some deep cuts at the switchback turn onto upper Route 3. Since this profile conforms mostly well to natural ground and avoids excessive steep grades, Ecosign rates the profile of Route Option 2 as Reasonable and Practical.

Earthworks:

Route Option 2 requires total estimated earthworks of 188,375 yd^3 cut and 23,707 yd^3 fill, leaving a net surplus of 164,668 yd^3 material to be trucked off-site. Due to the large cut volumes and excess of material to be removed from site, Ecosign rates the earthworks of Route Option 2 as Unreasonable and Impractical.

Route Option 3:

Alignment:

This proposed route option approaches the future development site from the northwest and traverses' steep cross slopes, especially along the mid portion of the route. The alignment also encroaches very close to existing properties on Forest Ridge Drive. In total, this access route option requires ~3.3 miles of newly constructed road. As this option traverses very steep terrain and encroaches on properties off Forest Ridge Drive, Ecosign rates the alignment of Route Option 3 as Unreasonable and Impractical.

Profile:

In general, the profile of Route Option 3 conforms to the design criteria. This route has a maximum slope of 10% and conforms to natural gradients. Since this profile conforms mostly well to natural ground and avoids excessive steep grades, Ecosign rates the profile of Route Option 3 as Reasonable and Practical.

Earthworks:

Route Option 3 requires total estimated earthworks of 342,029 yd^3 cut and 50,613 yd^3 fill, leaving a net surplus of 291,415 yd^3 material to be trucked off-site. Due to the large cut volumes and excess of material to be removed from site, Ecosign rates the earthworks of Route Option 3 as Unreasonable and Impractical.

Route Option 4:

Alignment:

This proposed route option is a short connector road which branches off Forest Ridge Drive and connects into the upper half of Route 3. This route traverses directly through at least one existing private property at the top of Forest Ridge Drive. In total, this access route option requires ~2.4 miles of newly constructed road. As this option directs traffic through an existing subdivision and traverses directly through an existing private property

off Forest Ridge Drive, Ecosign rates the alignment of Route Option 4 as Unreasonable and Impractical.

Profile:

The profile of Route Option 4 does not conform to the design criteria. This route has a maximum slope of 20% for ~700 ft length. Since this profile does not conform to the design criteria, Ecosign rates the profile of Route Option 4 as Unreasonable and Impractical.

Earthworks:

Route Option 4 requires total estimated earthworks of 10,272 yd^3 cut and 445 yd^3 fill, leaving a net surplus of 9,927 yd^3 material to be trucked off-site. In addition, approximately half of the earthworks for Route 3 will be required to reach the site. Due to the large cut volumes and excess of material to be removed from site, Ecosign rates the earthworks of Route Option 4 as Unreasonable and Impractical.

Route Option 5A & 5B:

Alignments:

Route Option 5A is a shortened Route which branches off the proposed development access road, this alignment serves little purpose as a redundant fire egress Route and is therefore rated as Unreasonable and Impractical

The 5B proposed Route Option branches west from Mission Ridge Rd just before the "Hairpin" turn and traverses' steep cross slopes for most of its length. In total, this access route option requires ~2.1 miles of newly constructed road. Option 5B also provides the least amount of fire egress redundancy or alternative emergency access / ingress, as Route Options 5A and 5B require most of the travel to occur along the existing Mission Ridge Road. Furthermore, this option traverses very steep terrain for most of its length. For these reasons, Ecosign rates the alignment of Route Option 5B as Unreasonable and Impractical.

Profile:

In general, the profile of Route Option 5A and 5B conform to the design criteria. These routes have a maximum slope of 10% and conform to natural gradients. Since this profiles conform mostly well to natural ground and avoid excessive steep grades, Ecosign rates the profiles of Route Option 5A and 5B as Reasonable and Practical.

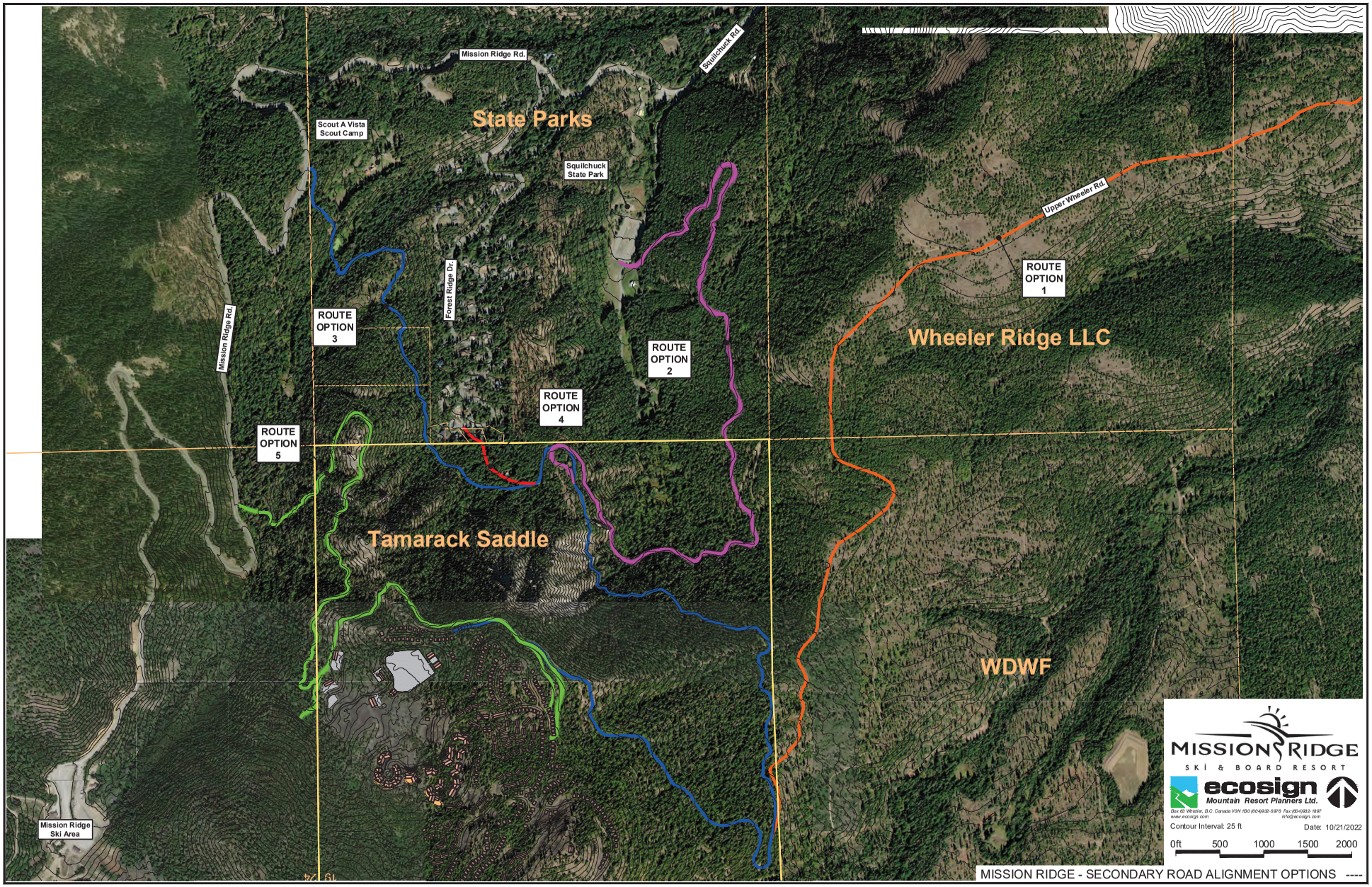
Earthworks:

Route Option 5A and 5B require total estimated earthworks of 174,691 yd^3 cut and 21,413 yd^3 fill, leaving a net surplus of 153,279 yd^3 material to be trucked off-site. Due to

the large cut volumes and excess of material to be removed from site, Ecosign rates the earthworks of Route Option 5A and 5B as Unreasonable and Impractical.

Conclusion

Through our analysis we have found that each of the 5 route options have some portion of their design, be it alignment, profile and/or earthworks which makes them Unreasonable and Impractical due to land ownership issues, cost of construction, non-conformity to design criteria, overall impact, or lack of providing a meaningful secondary emergency ingress- egress Route. It is therefore our recommendation that the project be permitted in accordance with the Chelan County Code with a single access, using the existing Mission Ridge Road as the single route of ingress-egress to and from the proposed development site.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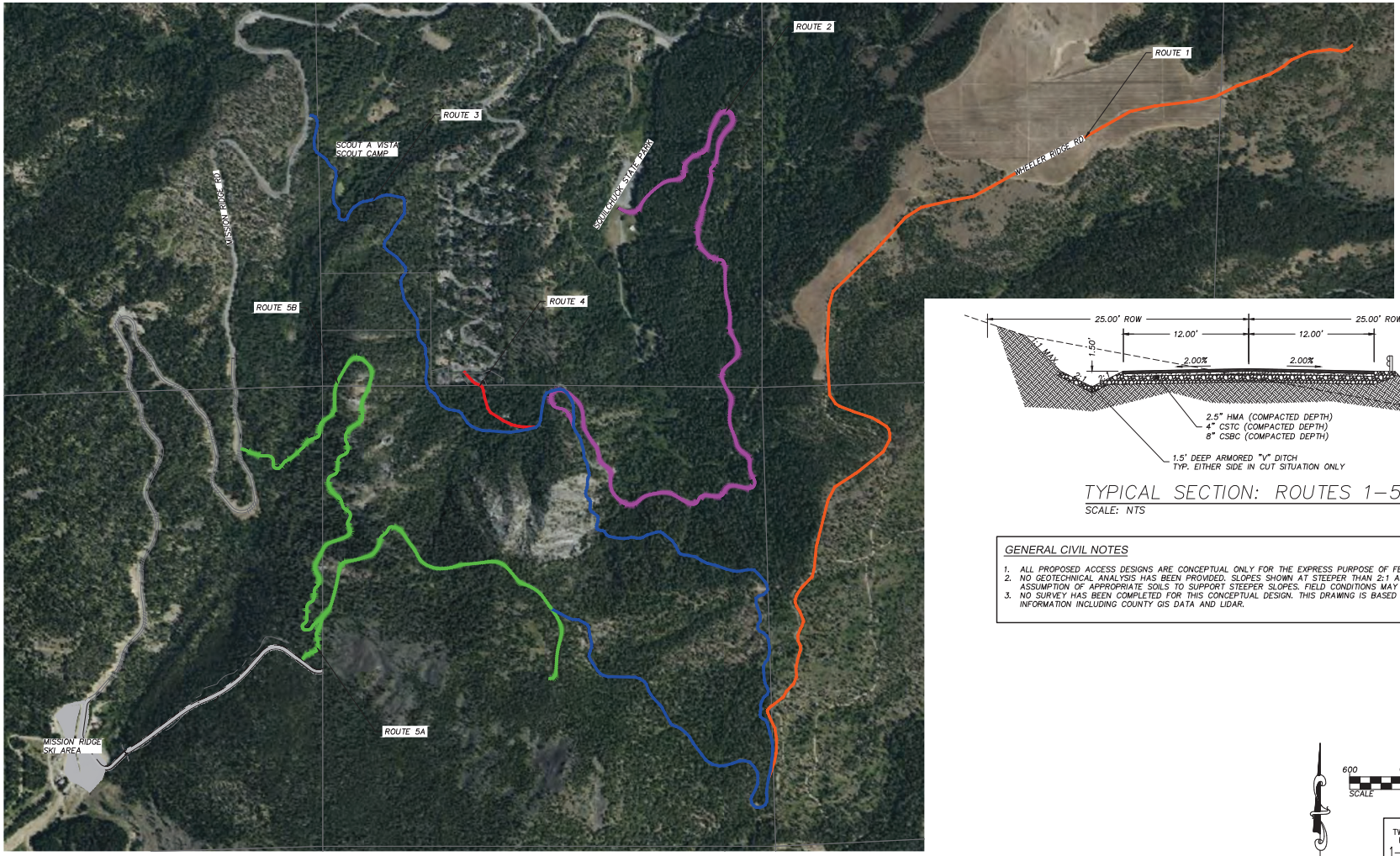
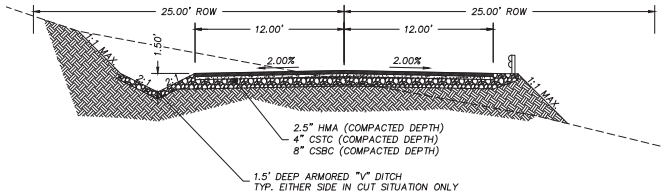
Squilchuck Rd.
State Parks
Scout A Vista
Scout Camp
Squilchuck
State Park
Upper Wheeler Rd.
Forest Ridge Dr.
Mission Ridge Rd.
ROUTE
OPTION
3
ROUTE
OPTION
1
Wheeler Ridge LLC
ROUTE
OPTION
2
ROUTE
OPTION
4
ROUTE
OPTION
5
Tamarack Saddle
WDWF
Mission Ridge
Ski Area
MISSION RIDGE
SKI & BOARD RESORT
ecosign
Mountain Resort Planners Ltd.
Box 69 Whistler, B.C. Canada V0N 1B0 (604)932-5916 Fax:(604)932-1897
www.ecosign.com info@ecosign.com
Contour Interval: 25 ft
Date: 10/21/2022
0ft 500 1000 1500 2000
MISSION RIDGE - SECONDARY ROAD ALIGNMENT OPTIONS ----

MISSION RIDGE EXPANSION PLAN

SECONDARY ACCESS - CONCEPTS

CHELAN COUNTY, WASHINGTON





TYPICAL SECTION: ROUTES 1–5

SCALE: NTS

GENERAL CIVIL NOTES

1. ALL PROPOSED ACCESS DESIGNS ARE CONCEPTUAL ONLY FOR THE EXPRESS PURPOSE OF FEASIBILITY ANALYSIS.
2. NO GEOTECHNICAL ANALYSIS HAS BEEN PROVIDED. SLOPES SHOWN AT STEEPER THAN 2:1 ARE BASED ON THE ASSUMPTION OF APPROPRIATE SOILS TO SUPPORT STEEPER SLOPES. FIELD CONDITIONS MAY REQUIRE RETAINING WALLS
3. NO SURVEY HAS BEEN COMPLETED FOR THIS CONCEPTUAL DESIGN. THIS DRAWING IS BASED ON BEST AVAILABLE INFORMATION INCLUDING COUNTY GIS DATA AND LIDAR.

600 0 600 1200
SCALE FEET
1" = 600'

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MISSION RIDGE - SKI AREA
SECONDARY ACCESS - CONCEPTS
COVER
CHELAN COUNTY, WA

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SHEET 2 OF 11

MISSION RIDGE - SKI AREA
SECONDARY ACCESS - CONCEPTS

ROUTE 1 - PLAN

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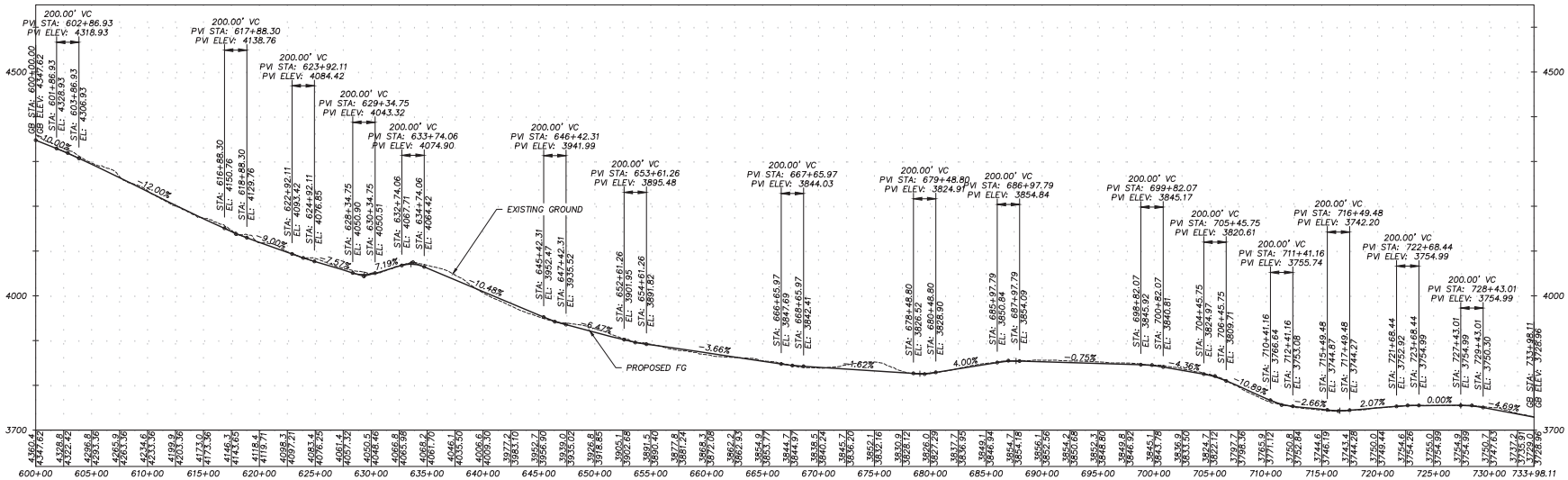

VERTICAL SCALE IS EXAGGERATED X4

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SCALE 1" = 500' FEET

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ROUTE 1 - PROFILE

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MISSION RIDGE - SKI AREA
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ROUTE 2 - PLAN

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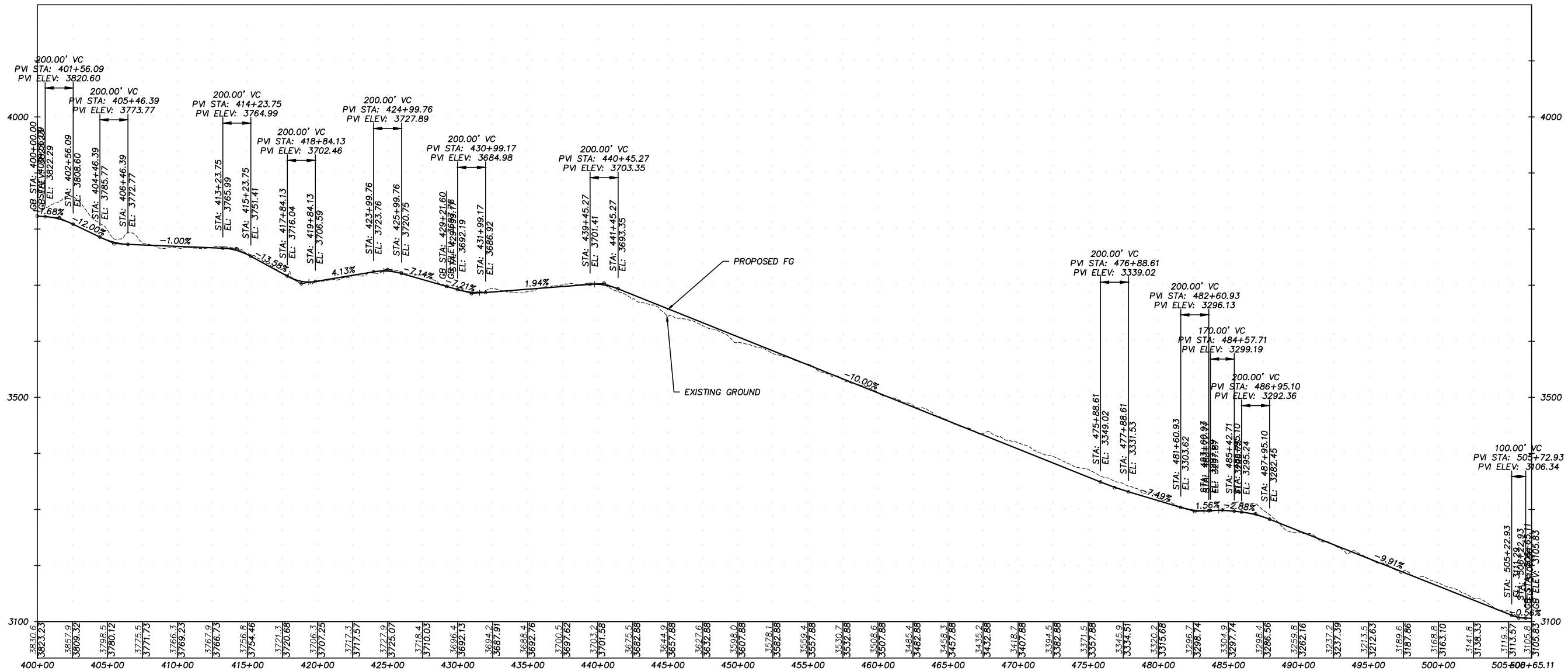

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SCALE 1" = 400' FEET

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ROUTE 2 - PROFILE
CHELAN COUNTY, WA

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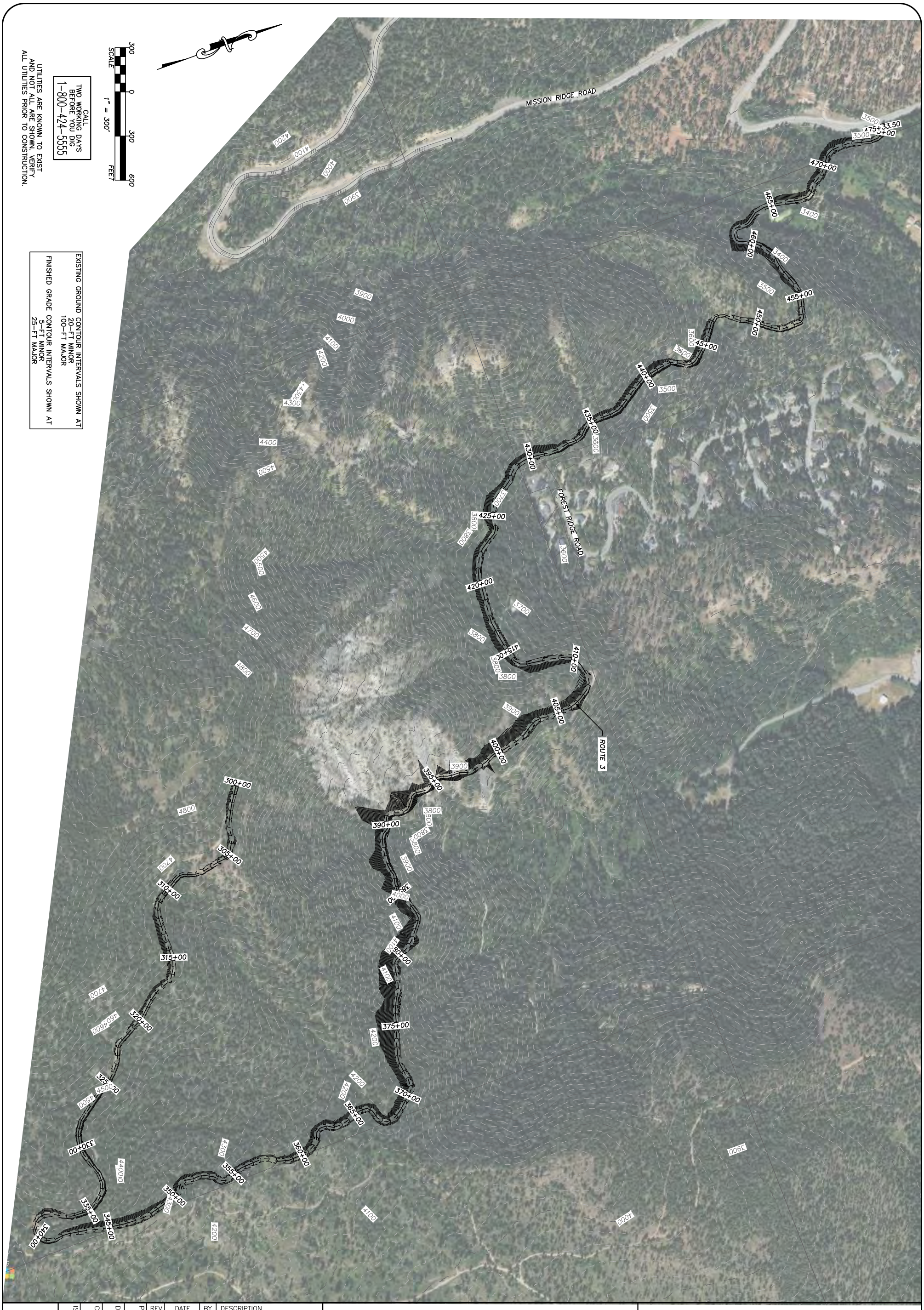

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EXISTING GROUND CONTOUR INTERVALS SHOWN AT
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100-FT MAJOR

FINISHED GRADE CONTOUR INTERVALS SHOWN AT
5-FT MINOR
25-FT MAJOR

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ROUTE 3 - PLAN

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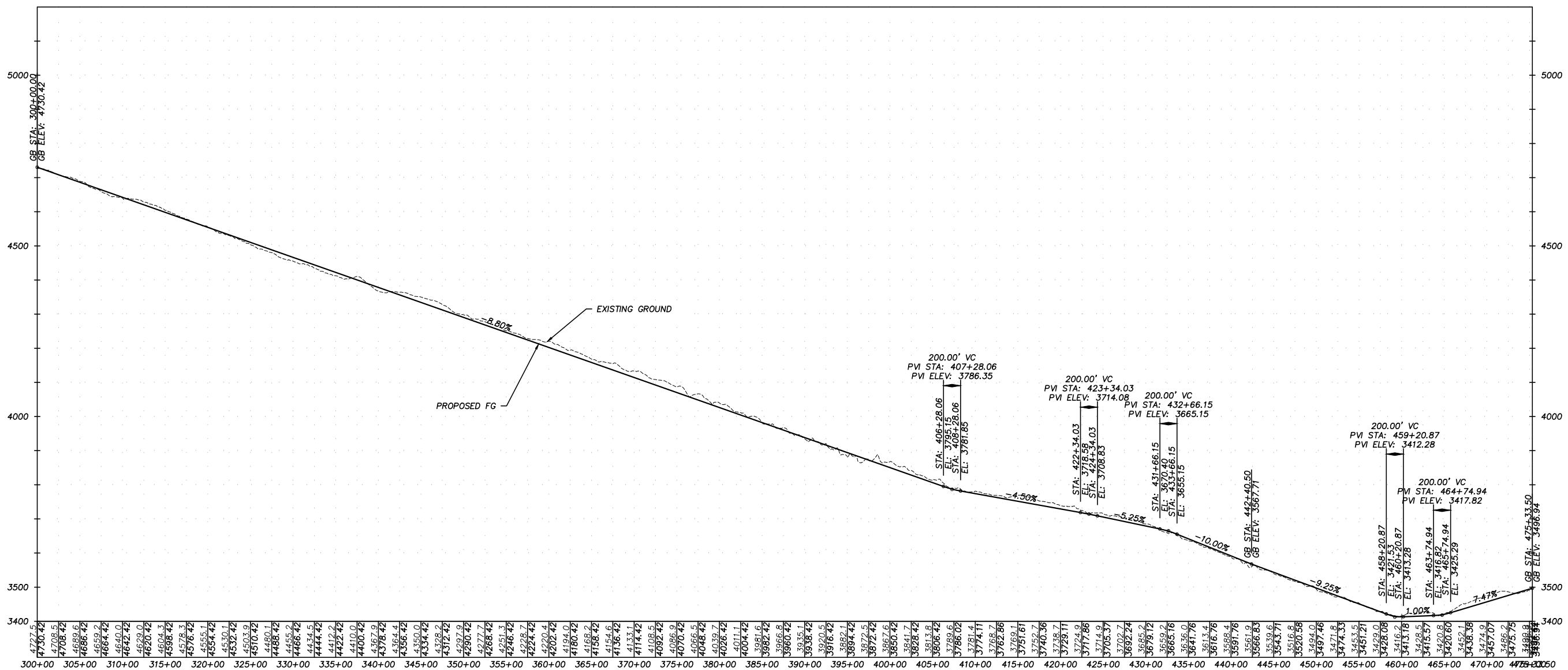

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SCALE 1" = 650' FEET

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ROUTE 3 - PROFILE

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100-FT MAJOR

FINISHED GRADE CONTOUR INTERVALS SHOWN AT
5-FT MINOR
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SCALE
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1" = 60' FEET

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FOREST RIDGE ROAD

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SECONDARY ACCESS - CONCEPTS
ROUTE 4 - PLAN

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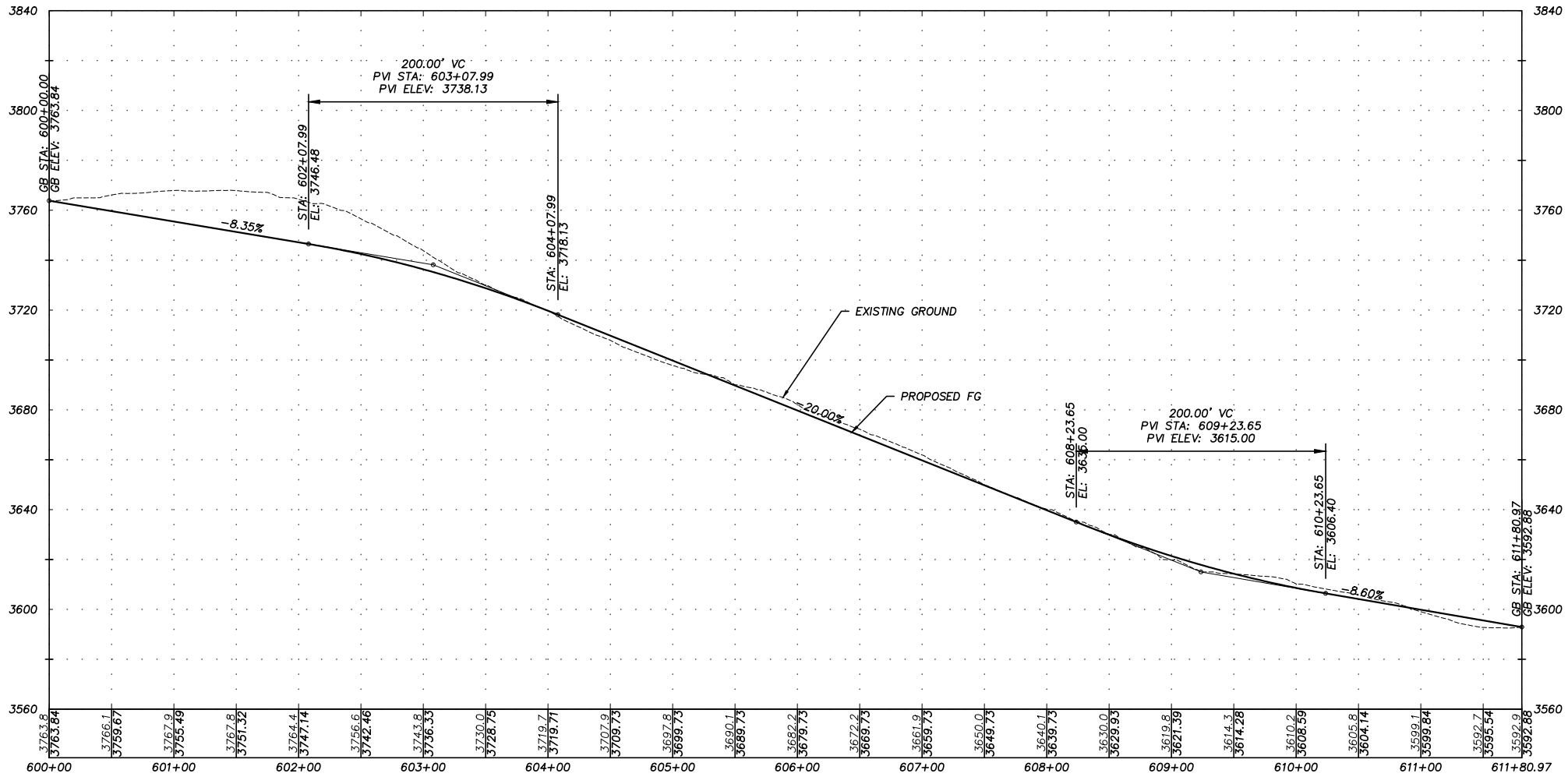

VERTICAL SCALE IS
EXAGGERATED X2

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SCALE FEET
1" = 60'

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TWO WORKING DAYS
BEFORE YOU DIG
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ROUTE 4 - PROFILE
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100-FT MAJOR

FINISHED GRADE CONTOUR INTERVALS SHOWN AT
5-FT MINOR
25-FT MAJOR

SCALE
1" = 200'
200 0 200 400
FEET

CALL
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UTILITIES ARE KNOWN TO EXIST
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ALL UTILITIES PRIOR TO CONSTRUCTION.

MISSION RIDGE ROAD
ROUTE 5A
ROUTE 5B
100+00
102+00
104+00
260+00
265+00
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MISSION RIDGE - SKI AREA
SECONDARY ACCESS - CONCEPTS
ROUTE 5 - PLAN

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SECONDARY ACCESS - CONCEPTS
ROUTE 5 - PROFILE
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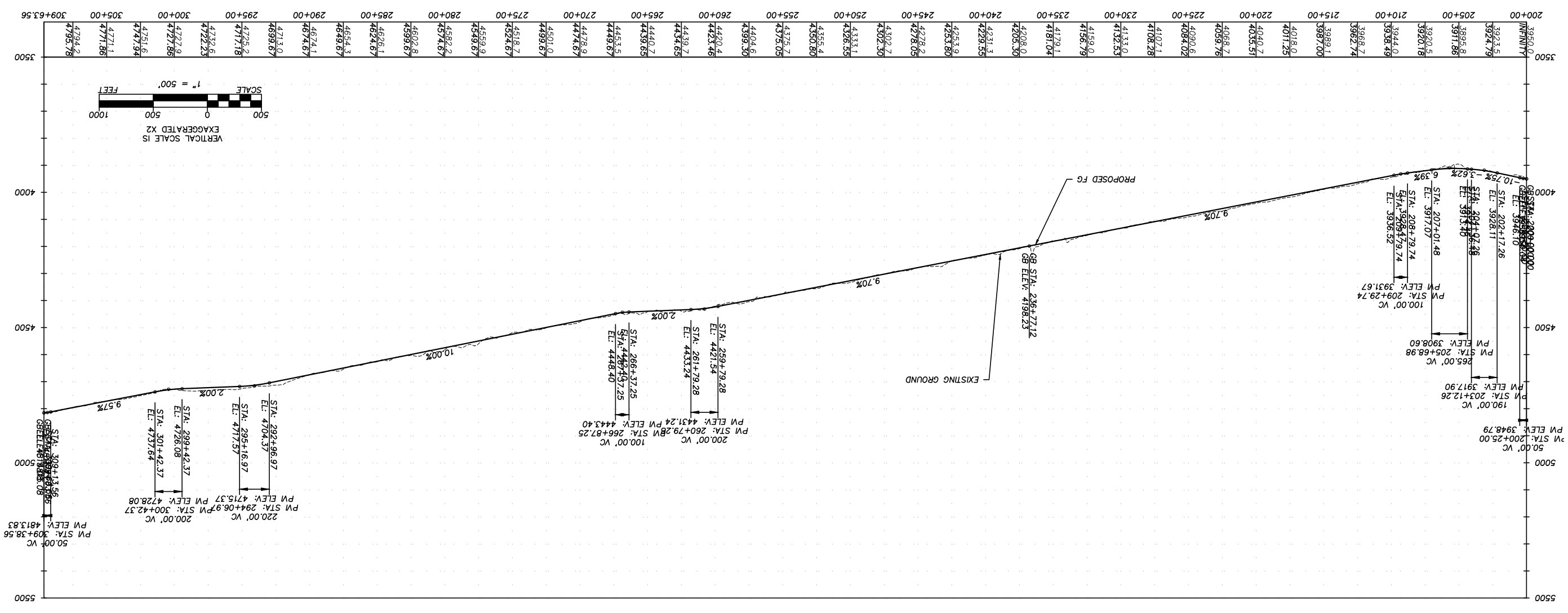

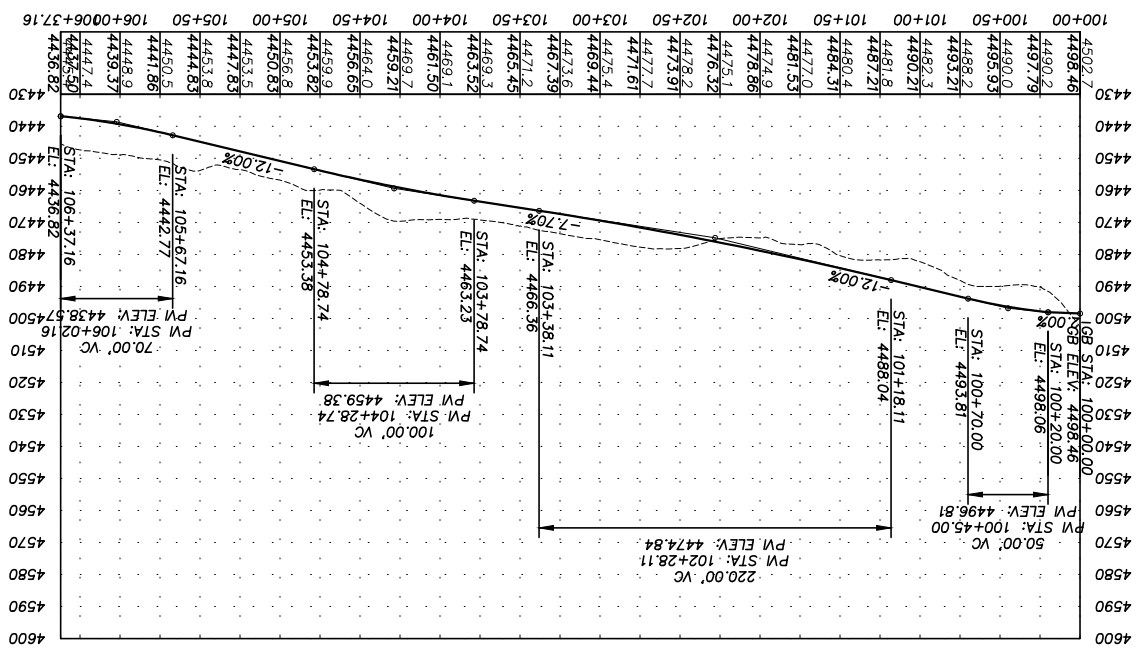

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By user: Sam

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ROUTE 3 EARTHWORKS	full	1.000	1.000	1228957.73	342028.75	50612.86	291415.89<Cut>
ROUTE 4 EATHWORKS	full	1.000	1.000	54941.89	10272.02	444.97	9827.05<Cut>
ROUTE 5 EARTHWORKS	full	1.000	1.000	784688.98	174691.11	21412.55	153278.55<Cut>

APPENDIX E

2019 Mission Ridge Hydrology Memo (WNR Group)

2022 Water Resources Memo (American Land and Water)

APPENDIX E

2019 Mission Ridge Hydrology Memo

"Solutions to water quality, quantity, permitting & planning issues"

December 31, 2019

Clay White
Director of Planning, LDC, Inc.
20210 142nd Ave NE
Woodinville, WA 98072

Re: Mission Ridge Hydrogeology for Plan Revision

Dear Mr. White:

Per your request, the Water & Natural Resource Group, Inc. (WNR Group) reviewed the proposed application revisions for Planned Residential and Commercial construction at the Mission Ridge Expansion development. On March 26th, 2018, the WNR Group prepared a Hydrogeology Review Memorandum for the proposed project. This Hydro Memorandum presented the following conclusions and recommendations:

"The preliminary hydrogeologic investigation at the site has determined that the availability of future water needs may be present in deep bedrock fractures in the vicinity of the proposed Mission Ridge Expansion project as defined by EMS and VLF geophysical surveys. These fractures appear to be in some degree of hydraulic continuity with surface water in the Squilchuck Creek drainage. Several water rights are currently used at the Mission Ridge ski area for indoor use and snow making activities. Although these approved diversions are located within the lower drainage area, it appears that the deep bedrock aquifers may be the source for the intermittent creeks, and as such can be inferred to be within the same hydrologic water budget.

Proposed water use at the expansion project will primarily occur during winter and spring months when water is most available. Proposed snow making, a non consumptive use, will also be a benefit to creek flows in spring and summer months, by allowing additional snow pack melt to the creeks.

In summary, it is our opinion, that the potential availability of groundwater for domestic and snow making uses may be available from deep bedrock factures at the site. These deep bedrock fractures appear to be in hydraulic continuity with the surface waters near the ski area where current water right diversions are being utilized."

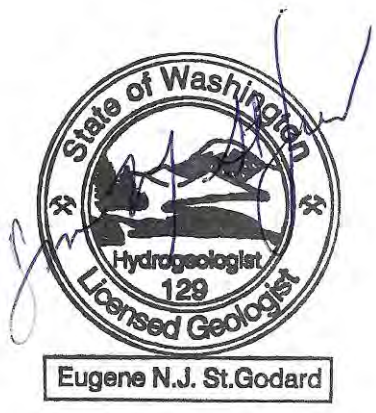
WNR Group has reviewed the changes to the phased planning related to the Mission Ridge Project. The changes proposed appear to represent a de minimus change of potential water requirements from the original application. As such, the WNR Group does not recommend any additional changes to the Hydrogeologic Memo dated March 26th, 2019.

On March 19th, 2018, the WNR Group prepared Memorandum that outlined a Scope of Work for further defining the potential for water resource availability at the site. The change under the revised application does not warrant a proposed change to the future recommendations for hydrogeologic work required for future water supply. Therefore, the WNR Group still recommends that the next phase of hydrogeologic work be conducted as outlined in our March 19th, 2018 Memorandum – "The Mission Ridge Expansion – Estimate of Future Work". The completion of the recommended Scope of Work will assist with fully defining the water availability for the site.

We appreciate the opportunity to be of service to Tamarack, LLC in providing our interpretation of groundwater conditions at the Site. Should you have any questions regarding this Memorandum, please do not hesitate to call us at your earliest convenience.

Very truly yours,
Water & Natural Resource Group, Inc.

Eugene N.J. St.Godard, R.G., L.Hg.
Principal Hydrogeologist/Owner
WNR Group, Inc.



Signed: December 31st, 2019

Water & Natural Resource Group, Inc.
Gene St.Godard, R.G., L.Hg., CWRE
PO Box 28755
Spokane, Washington 99228
Cell: 509-953-9395

MEMORANDUM

To: **Mr. Larry Scrivanich**
PO Box 2174
Woodenville, WA 98072

From: **Gene St.Godard, P.G., L.Hg., CWRE**
Water & Natural Resource Group, INC.
Spokane, WA

Date: **March 26th, 2018**

Re: **Mission Ridge Expansion Preliminary Hydro Review**

Project No: 077-001 – Mission Ridge

SITE BACKGROUND

The Mission Ridge Expansion proposed development is located within private property near the Mission Ridge Ski Area located approximately eight miles southwest of Wenatchee within Chelan County (Figure 1). The property consists of 650 acres and is located within Section 19 and the NE¼ Section 30, Township 21 North, Range 20 E.W.M. (Figure 2). The subject area is currently zoned RR20 and the general plan designation is Land Use Code 88, Designated Forest Land. The property is identified in the Chelan County records as Property Identification No. (PIN) 19014, Parcel No. 212019000000 (Sec. 19) and PIN 19051. Parcel No. 212030100050 (Sec. 30), owned by Tamarack Saddle LLC. The proposed development will require water for up to a 400-unit multifamily community comprised of an estimated 120 single family homes and 280 condominium units, constructed in four phases over many years (Figure 3).

This Memorandum outlines the preliminary study used to identify potential water sources to supply potable drinking water to the proposed community.

PHYSIOGRAPHIC SETTING

The Mission Ridge Expansion development is located within a part of the Squilchuck Basin watershed which contributes water within the basin to Squilchuck Creek; Squilchuck Cheek then flows in a generally northeasterly direction where it discharges directly to the Columbia River. The site is located in the National Watershed Boundary Dataset as Squilchuck Creek Subbasin. These subbasins are developed as follows:

> The Watershed Boundary Dataset (WBD) is a comprehensive aggregated collection of hydrologic unit data consistent with the national criteria for delineation and resolution. It

defines the areal extent of surface water drainage to a point except in coastal or lake front areas where there could be multiple outlets as stated by the "Federal Standards and Procedures for the National Watershed Boundary Dataset (WBD)" "Standard". Watershed boundaries are determined solely upon science-based hydrologic principles, not favoring any administrative boundaries or special projects, nor particular program or agency. This dataset represents the hydrologic unit boundaries to the 12-digit (6th level) for the entire United States. Some areas may also include additional subdivisions representing the 14- and 16-digit hydrologic unit (HU). At a minimum, the HUs are delineated at 1:24,000-scale in the conterminous United States, 1:25,000-scale in Hawaii, Pacific basin and the Caribbean, and 1:63,360-scale in Alaska, meeting the National Map Accuracy Standards (NMAS). Higher resolution boundaries are being developed where partners and data exist and will be incorporated back into the WBD. WBD data are delivered as a dataset of polygons and corresponding lines that define the boundary of the polygon. WBD polygon attributes include hydrologic unit codes (HUC), size (in the form of acres and square kilometers), name, downstream hydrologic unit code, type of watershed, non-contributing areas, and flow modifications. The HUC describes where the unit is in the country and the level of the unit. WBD line attributes contain the highest level of hydrologic unit for each boundary, line source information and flow modifications.

Within the Washington State database, the site is identified as being within the northern portions of the Alkali-Squilchuck Water Resource Inventory Area (WRIA 40). Figure 4 presents a map showing the identification of the Washington State WRIA boundary and the National WBD subbasin boundaries. Note on map that boundaries within the different data bases do not exactly match.

This area is mountainous terrain with a variety of ecosystems and is being developed using an environmentally sensitive design that takes advantage of the land's natural contours. The Mission Ridge Expansion development plan has been formulated recognizing that significant potential and demand exists for overnight lodging and housing at the Mission Ridge Ski Area.

The United States Geological Survey (USGS) topographic quadrangle maps for the Site and vicinity were reviewed to determine the physical setting of the Site. The Site is located within the eastern area of the Mission Ridge, Washington 7-1/2 minute quadrangle map dated 1987 and the western edge of the Wenatchee Heights, WA 7-1/2 minute quadrangle map dated 1987. As shown on Figures 4 and 5, the Site is located along the southeast valley wall of Squilchuck Creek drainage, of which the north half and southwest quarter of Section 19 drains to Squilchuck Creek. The southeast quarter of the section drains towards the Stemilt Creek subbasin. For the hydrogeologic assessment, the portion of the property which lies within the Squilchuck Creek drainage will be the focus for identifying additional potential water sources. The general slope of this portion of the property is to the northwest in the western part of the property and to the north in the northern portions of the property. Slopes generally fall to the incised drainages of Squilchuck Creek.

Elevation relief across the property is approximately 1440 feet, with the highest elevation of approximately 4840 feet above msl in the central part of the property, which is the center of Section 19 and a low elevation of approximately 3400 feet above msl in the Squilchuck Creek drainage in the northeastern area of the property. Shallow unconfined groundwater in the gravels

perched on bedrock beneath the Site is inferred to flow to the drainages, as interpreted from the topographic slope in the area of the property. This inference is examined relative to physical data in this document.

SURFACE WATER IN SITE AREA

The Mission Ridge Expansion lies within a mountainous terrain which contains numerous springs and steep incised creeks. In the immediate area of the Site, several small unnamed intermittent creeks, which are inferred to be recharged from shallow springs located near the headwaters, flow in a northwesterly direction across the property. These intermittent deeply incised creek flows appear to be highly variable for short and for long-term durations, and is representative of the precipitation, snowpack, and temperatures within the Squilchuck Creek subwatershed. Flows are inferred to correlate with available groundwater from the thin shallow perched unconsolidated aquifer, and are dependent upon snowmelt and rain-on-snow events. Various unnamed intermittent tributaries flow directly into Squilchuck Creek which is tributary to the Columbia River near Wenatchee, WA.

Flow of creeks and streams in mountainous terrain varies highly, and depends directly on precipitation and snowpack. In this type of terrain, which has been visually observed at the Site, low flows occur during late fall and throughout the winter months. This flow is produced by low precipitation and high evapotranspiration (ET) from July through September, and October through March precipitation falling as snowpack. Flows increase in the late winter months and spring as rain-on-snow events occur and melting snow provides recharge to the creeks.

GEOLOGIC SETTING

The area between Wenatchee and Osoyoos, WA is within the eastern margin of the North Cascade subcontinent (Alt & Hyndman, 2002). West of Wenatchee is the area geologically identified as the Chiwaukum Graben, in which the Chumstick Formation is located. This geologic area butts up to the south against the Miocene Columbia River basalt plateau. North of the site near the town of Chelan was the southern extent of the of the glacial advance, with all of the country north of Chelan buried under the Okanogan lobe of the big ice sheet during the last ice age (Alt & Hydnman, 2002). The area south of Chelan, in the area of the Columbia River Valley, was scoured out by the regional Spokane glacial floods.

The Washington State DNR geologic map (WDNR, 1991) for the area of the Site was reviewed to interpret geologic conditions. As shown on Figure 6, the Site is located in the Wenatchee Mountains, which are located west of the Columbia River Valley in this area. The Site is located within the southern portion of an area defined as the Chiwaukum Graben (Willis, 1953). The area of the site is underlain by geologic units of early to middle Tertiary age and are covered by Columbia River Basalt Group rocks of Miocene age in areas to the south (Gressens, 1983). As shown on Figures 6 and 7, the site is underlain primarily by Tertiary Age sedimentary rocks of the Chumstick Formation. The Chumstick Formation in the area of the site is comprised mostly of sedimentary rocks.

The geology of the immediate area of the site is best described by Gressens et. al. (1981) as:

“The Chiwaukum graben in central Washington contains two unconformity-bounded fluvial and lacustrine units, here named the "Chumstick" and "Wenatchee" Formations. The Chumstick is dated at 45 m.y. (middle Eocene), and the Wenatchee is dated at 34 m.y. (early Oligocene) by the fission-track method on zircons from tuffs. Previously, both formations were thought to be part of the Swauk Formation, which is older. The Chumstick Formation rests on weathered crystalline basement and is several thousands of meters thick. Fanglomerate occurs at the base and along the margins. Most of the formation consists of feldspathic sandstone and pebbly sandstone of fluvial origin; but within the upper part, there is a lacustrine unit, herein designated the Nahahum Canyon Member. Tuff is common in the lower part of the formation. Both of the bounding faults, the Leavenworth and the Entiat, were active during deposition of the Chumstick Formation, but relief was greatest on the northeast (Entiat) side. The Wenatchee Formation occurs in the vicinity of Wenatchee, Washington, and is ≤300 m thick. It unconformably overlies the Chumstick Formation within the graben but overlaps the northeast side of the graben, where it lies directly on weathered metamorphic basement. The Wenatchee Formation, like the Chumstick, was deposited primarily in fluvial and lacustrine environments; unlike the Chumstick, much of the sediment is mature quartz sandstone. Relief in the source area probably was very subdued during its deposition.”

The geologic maps in the area show the bedrock near the Site contains numerous large fault zones (Figure 6), which often display water-bearing splay faults. Fault lines will typically form the Site’s linear valleys. The area is heavily faulted with the NW-SE trending faults thrusting rock layers to the northeast, as depicted in Figure 8 (Gressens, 1983).

EMS SURVEYWORK

An EMS satellite survey was flown for the subject property, allowing the identification of deep water-bearing fractures. Geophysical surveying methods have been used since the 1940’s for the interpretation of various geological conditions. The technology used in this survey is used to find useful quantities of underground water that may be present in fractures and voids. Using the magnetic component of the electromagnetic field generated by VLF (very low frequency) transmitters, it is possible to locate anomalies, such as saturated fractures within the bedrock. Identification of water-bearing fractures is difficult and the geology and hydrogeology professions typically use geophysical methods to assist with the location and depth of fracture aquifers. Geophysical surveys should not be used to confirm water source information, but they do provide projections of potential water sources. Location, depth, and yield of bedrock aquifers from the interpretation of the geophysical data is a professional best-judgment, and no exact warranty of the potential aquifer characteristics exists without the completion of subsurface exploration (e.g. drilling).

Figure 9 (western area near ski area) and Figure 10 (eastern area near expansion) presents the results of the EMS geophysical survey conducted at the project site. As shown in the figures, there are numerous fractures with potential water located across the Site. The highest probability of locating groundwater is typically where two or more fractures intersect within the fractures containing the strongest geophysical signature. Numerous fractures across the Site show high signatures (5 to 6), and therefore probably contain groundwater. A more detailed site investigation using field VLF technologies was conducted at the Site on June 22, 2017 in order

to identify three to four locations which may contain the highest probability of groundwater for project use.

The VLF ground verification supported the EMS Survey in determining that points #4, #5, and #6 are the preferred drilling locations of the anomalies identified in the satellite survey. In addition, a VLF survey was conducted in the western area of the site in case an additional water supply well was needed near the ski lodge. The EMS and VLF surveys recommended site anomaly #10 in this area. These four sites are identified as proposed wells PW-4, PW-5, PW-6 and PW-10 on Figures 4, 7, and 11.

Ecology Water Well Logs - An Internet search of the Washington State Department of Ecology's water well database was conducted. Search criteria of Township 21 North, Range 20 East, Section 19, and Township 21 North, Range 19 East, Sections 24, 25 and 26 was entered. Only one well log was identified within the four sections searched. This well log is for the domestic well at the Ski Area lodge facility within the SE ¼ SW ¼ Section 24, T21N., R19E.W.M. The well log is shown in Figure 12.

The well log is only completed to a depth of 100 feet below grade and intercepted gravels and clay to a depth of 48 ft, then intercepted basalt with gravel interbeds to the full depth explored of 100 feet. Yield in the well was estimated at 100 gpm at the time of drilling.

Hydrogeologists Site Visit

Gene St.Godard, a licensed Professional Hydrogeologist in Washington (L.Hg. #129), conducted a site visit on June 22nd, 2017. The geologic conditions of the site were inspected during this site visit. The field visit also consisted of looking for bedrock outcroppings, talus and colluvium on and in the vicinity of the property to document the geologic setting of the area. Numerous outcroppings of sedimentary rocks were observed on or near the site. A generalized search of the existing ski lodge property in Section 24 and the proposed development property in Section 19 and 30 was conducted in order to document the location of the existing and proposed water source locations. Four existing water diversions are located on the ski lodge property in addition to a constructed reservoir. Locations of these sites are shown on Table 1 and Figure 11. These diversions divert water under existing water rights.

Four proposed well locations were also identified in the field and GPS locations collected. These included one location near the existing lodge (PW-10) and three within Section 19 (PW-4, PW-5, and PW-6). The GPS locations are shown in Table 2 and on Figure 11.

Table 1: Site Water Diversion GPS Coordinates

Existing Diversions	Latitude	Longitude
AEH922 (8-inch existing Dom Well)	N47.29138	W-120.39857
Lake Creek Diversion	N47.29322	W-120.40172
Developed Spring Location (36"-corrugated pipe)	N47.29316	W-120.40247
Squilchuck Diversion (within buried vault)	N47.29094	W-120.70008
Reservoir (at top of hill)	N47.28117	W-120.42853

Table 2: Proposed Well GPS Coordinates

Proposed Wells	Latitude	Longitude
PW-4	N47.29572	W-120.37807
PW-5	N47.29506	W-120.37875
PW-6	N47.29523	W-120.38130
PW-10	N47.29362	W-120.39642

HYDROGEOLOGIC CONCEPTUAL MODEL

A generalized conceptual hydrogeologic model was developed to illustrate the hydraulic continuity of the aquifers underlying the Mission Ridge Development Site and the Squilchuck Creek Valley. This generalized description of the hydrogeologic system at the Site was developed from existing published documents and data, and site-specific data collected from test pits, well points, and water well drilling. The on-site data developed during this project is discussed later in the report.

The Site's hydrogeologic regimes consist of two distinct aquifer systems. The first is the shallow, seasonal perched aquifer that is located in the shallow unconsolidated sediments above the bedrock. This seasonal aquifer system is in direct hydraulic continuity with the surface water streams on the property. After snowpack has melted, this aquifer is depleted as it recharges the creeks. The second hydrogeologic system consists of a deep bedrock fracture aquifer system. This system is not in direct hydraulic continuity with the surface waters except in areas where the deep incised drainages may cross the fracture flow system. Both hydrogeologic regimes are recharged primarily from rain and snow in the spring and winter seasons.

The shallow aquifer near the Site is a thin unconfined colluvium aquifer that is inferred to be seasonal and appears to consist of only a few feet of saturated sediments. Typically within alpine systems such as at the site, saturated conditions are present only in the winter and spring months. Groundwater in this shallow unconsolidated aquifer flows from the elevated ridges towards Squilchuck Creek drainage. Some direct flow within the creeks may be a result of recharge of bedrock fracture aquifers that may be in hydraulic continuity with the intermittent streams and creeks when hydraulic heads in the fracture aquifer are elevated above the creek elevations. The ski area currently has three areas in which they are developing water from these creeks and springs. These developed areas are inferred to have a recharge component from the deep bedrock fractured aquifers.

Most water users in the mountainous terrain get drinking water from deep bedrock fracture aquifers. In the vicinity of the Site, these are located at depths of several hundred feet within the Tertiary (Eocene Age) sedimentary rocks which are in contact with the Miocene basalts south of Squilchuck Creek. These aquifers appear not to be in direct hydraulic continuity with the shallow perched aquifer. However, some hydraulic connection to surface water in the drainages may occur where the incised drainages intersect the bedrock fracture.

Groundwater and surface-water flows in the Squilchuck Creek drainage are directly influenced by the geologic controls within the valley, and may be locally variable depending on depth to bedrock and valley width for the unconsolidated aquifer and depth, lateral extent, and thickness of the fractures. Recharge to the shallow valley aquifer primarily comprises precipitation infiltration, snowpack depth, and interaction with surface water bodies. Confined aquifers in the deeper bedrock may be recharged from some infiltration along the valley walls and/or from recharge areas further up the headwaters of the drainage where the fracture systems are incised by stream erosion. Water collected in the headwaters of Squilchuck Creek and its tributaries flows through the valley in the form of shallow groundwater and surface water, and discharges to Columbia River Valley aquifer and river near the city of Wenatchee, Washington. Therefore, in our opinion, surface and groundwater within the boundaries of the Squilchuck sub-basin as outlined in Figure 4. It would be our recommendation that an exploration hole be completed either at PW-6 or PW-5.

The water budget at the existing site is what is observed in typical mountainous terrains. Availability of water is typically found during winter and spring seasons. If the proposed development occurs, the majority of use will occur during these seasons when water is available. Potable groundwater for in house use at the site will be in highest demand during the winter months, not during the low flow time period of the hydrologic cycle. In addition, water will also be required during the winter months for snow making activities. The development of a snow pack on the ski slopes near the development is a non-consumptive use, and will also effectively help stream flows during the spring and summer months by allowing more recharge to the surface waters during the spring melt. Water during summer and fall months will be de minimus at the proposed development. Therefore, it is inferred that the proposed development, which will have highest demands during spring and winter months, will not have a major affect on the water budget within the basin.

CONCLUSIONS

The preliminary hydrogeologic investigation at the site has determined that the availability of future water needs may be present in deep bedrock fractures in the vicinity of the proposed Mission Ridge Expansion project as defined by EMS and VLF geophysical surveys. These fractures appear to be in some degree of hydraulic continuity with surface water in the Squilchuck Creek drainage. Several water rights are currently used at the Mission Ridge ski area for indoor use and snow making activities. Although these approved diversions are located within the lower drainage area, it appears that the deep bedrock aquifers may be the source for the intermittent creeks, and as such can be inferred to be within the same hydrologic water budget.

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In summary, it is our opinion, that the potential availability of groundwater for domestic and snow making uses may be available from deep bedrock factures at the site. These deep bedrock fractures appear to be in hydraulic continuity with the surface waters near the ski area where current water right diversions are being utilized.

We appreciate the opportunity to be of service to Tamarack, LLC in providing our interpretation of groundwater conditions at the Site. Should you have any questions regarding this Memorandum, please do not hesitate to call us at your earliest convenience.

Very truly yours,
Water & Natural Resource Group, Inc.

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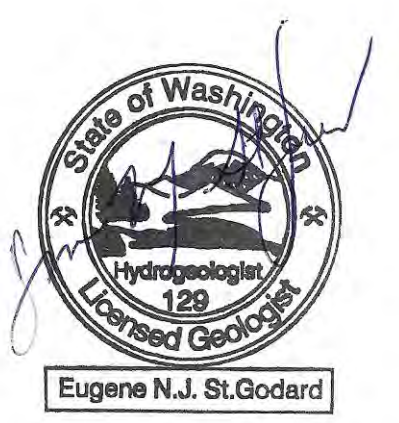
Eugene N.J. St.Godard, R.G., L.Hg.
Principal Hydrogeologist/Owner
WNR Group, Inc.



Signed: March 26th, 2018

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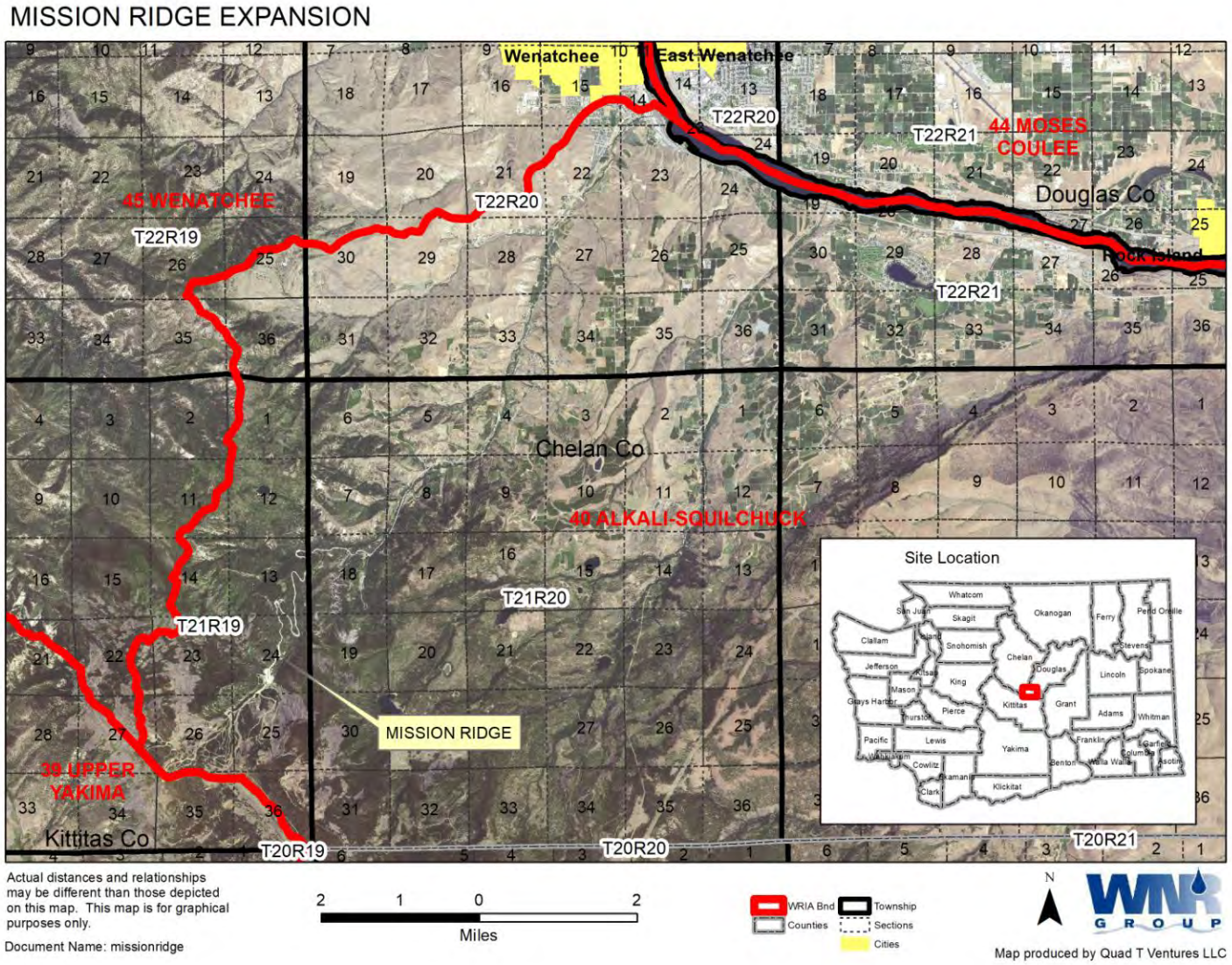


FIGURE 1: MAP SHOWING LOCATION OF MISSION RIDGE SKI AREA AND PROPOSED MISSION RIDGE EXPANSION SW OF WENATCHEE, WA.

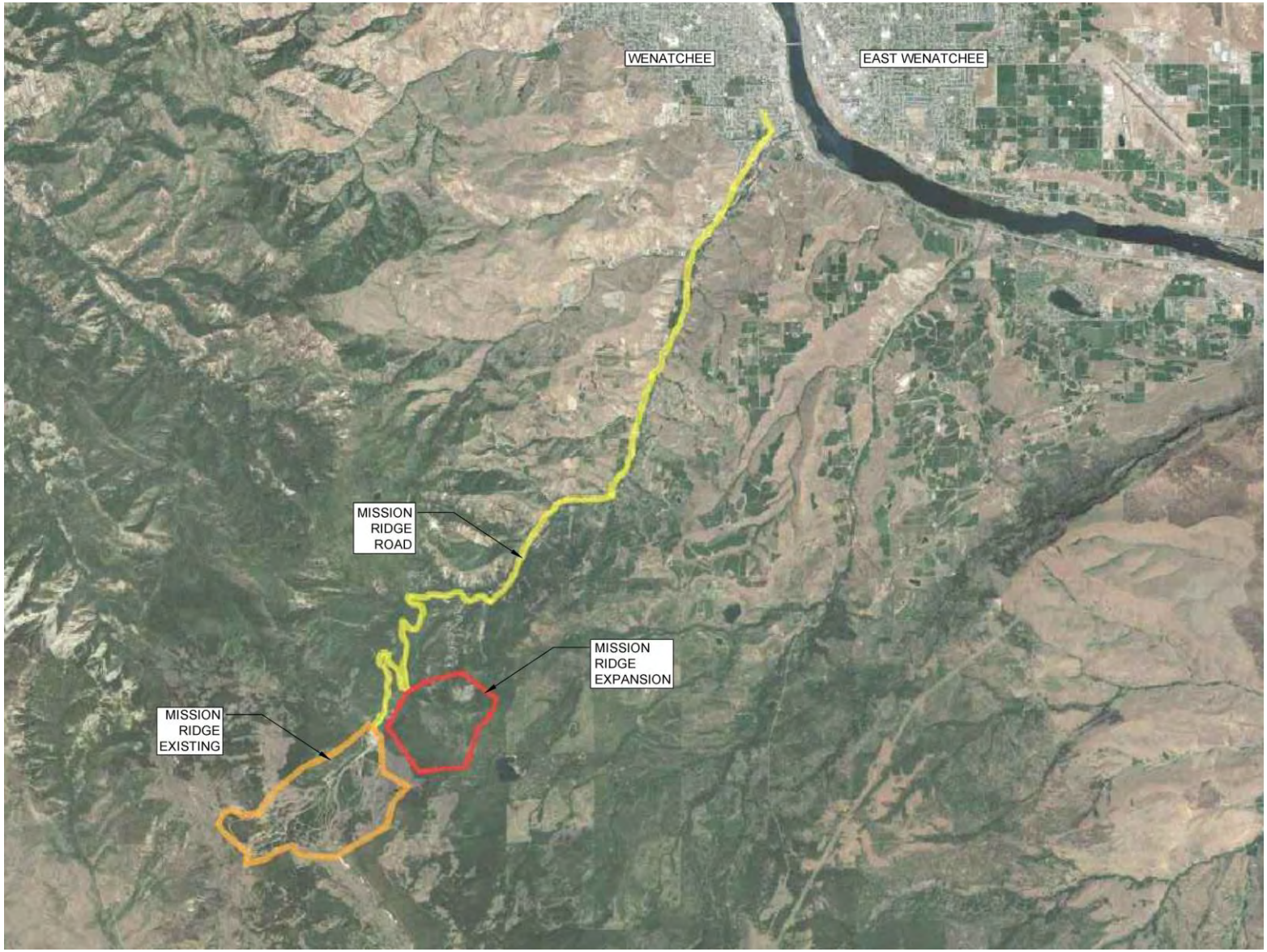
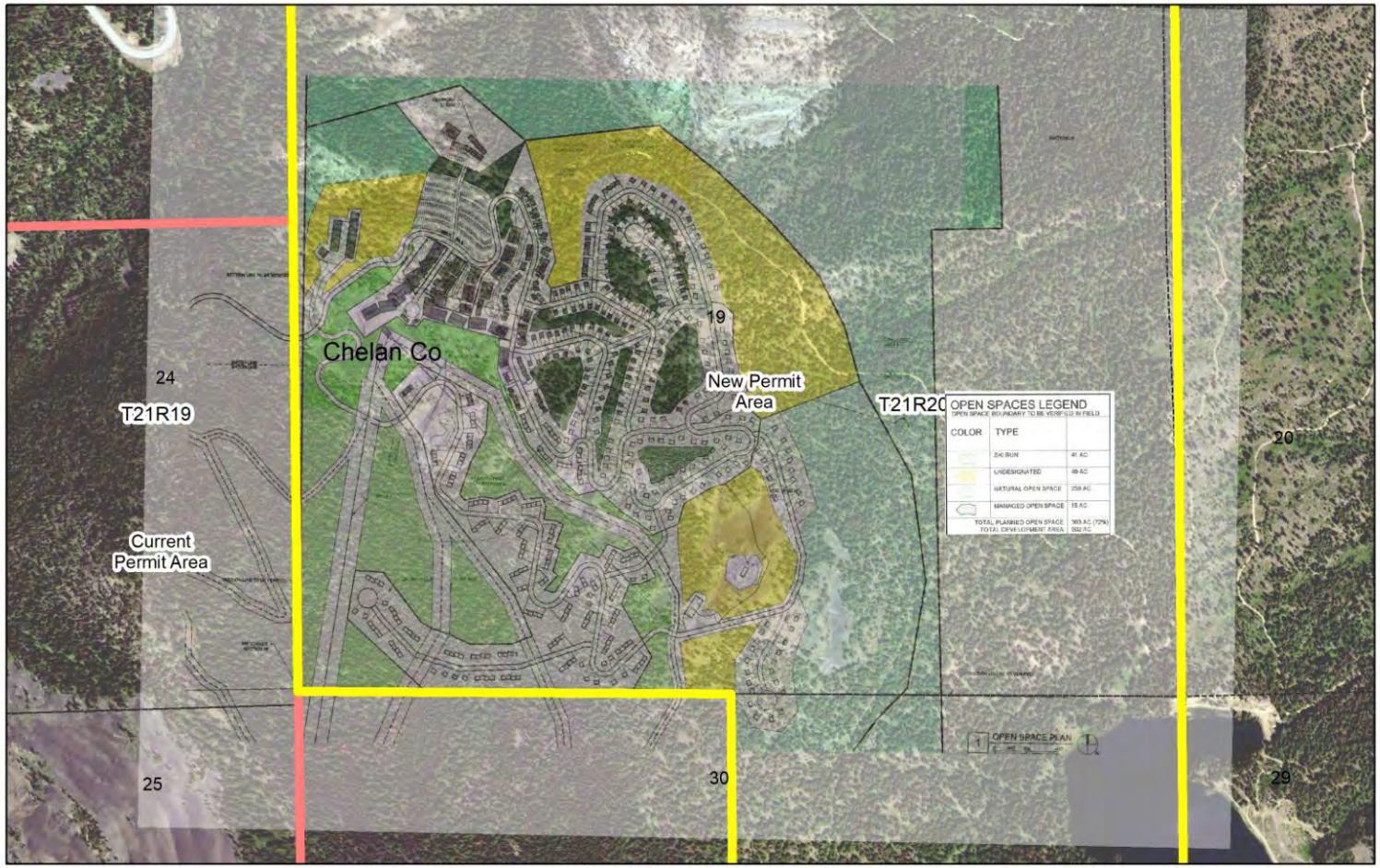


FIGURE 2: MAP SHOWING LOCATION OF PROPOSED PROJECT IN SECTION 19 (T21N, R20E.W.M.) NEXT TO MISSION RIDGE SKI AREA.

MISSION RIDGE EXPANSION



Actual distances and relationships may be different than those depicted on this map. This map is for graphical purposes only.

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0.25 0.125 0 0.25

Miles

Current Permit Area
New Permit Area
Counties
Township
Sections

N

Map produced by Quad T Ventures LLC

FIGURE 3: PROPOSED VILLAGE AT MISSION RIDGE EXPANSION WHICH WILL REQUIRE WATER.

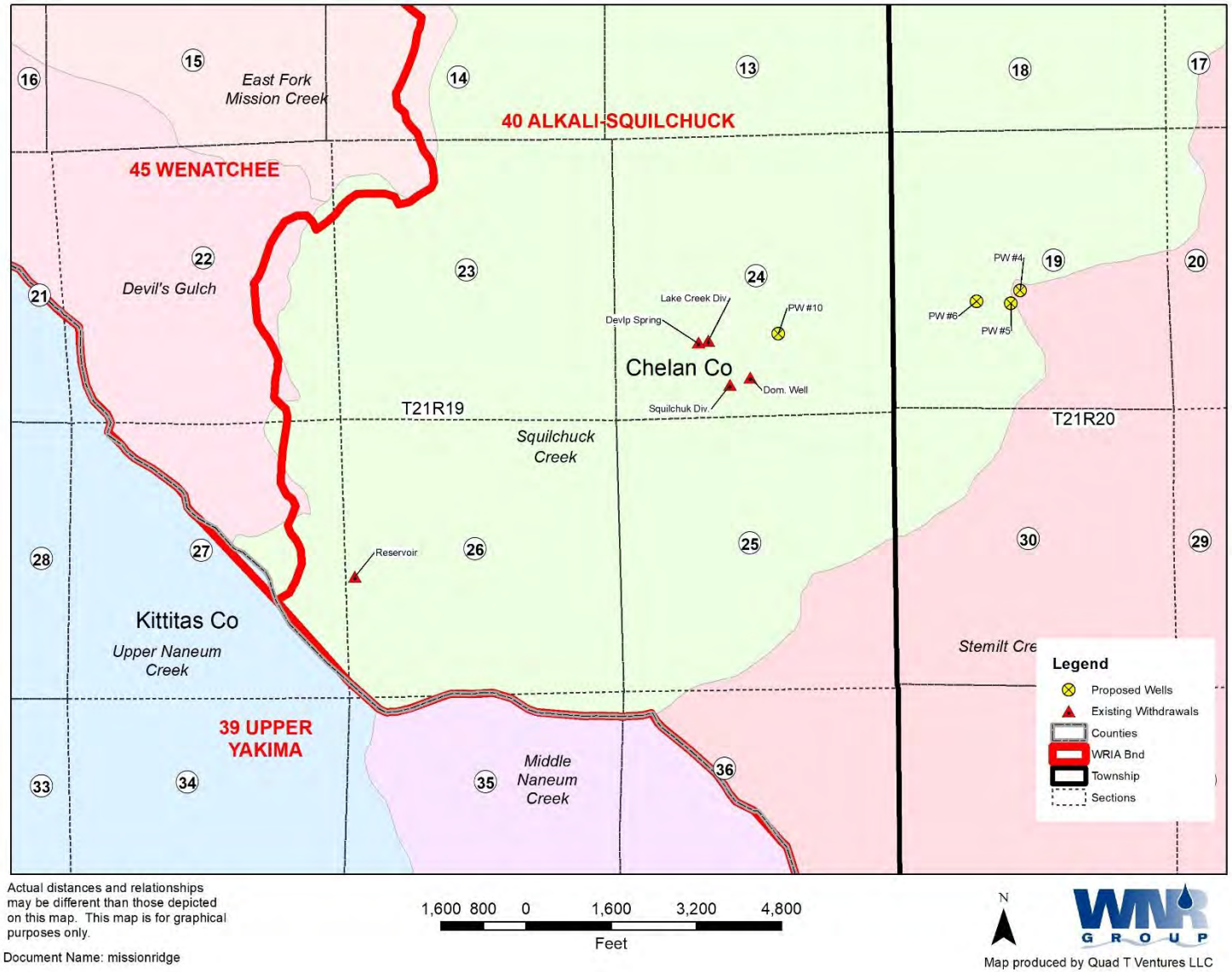


FIGURE 4: MAP SHOWING WASHINGTON STATE WRIA BOUNDARY AND NATIONAL WBD BOUNDARIES. LOCATION OF EXISITNG WATER RIGHT DIVERSION POINTS AND GEOPHYSICAL IDENTIFIED PROPOSED WELL SITES ALSO SHOWN.

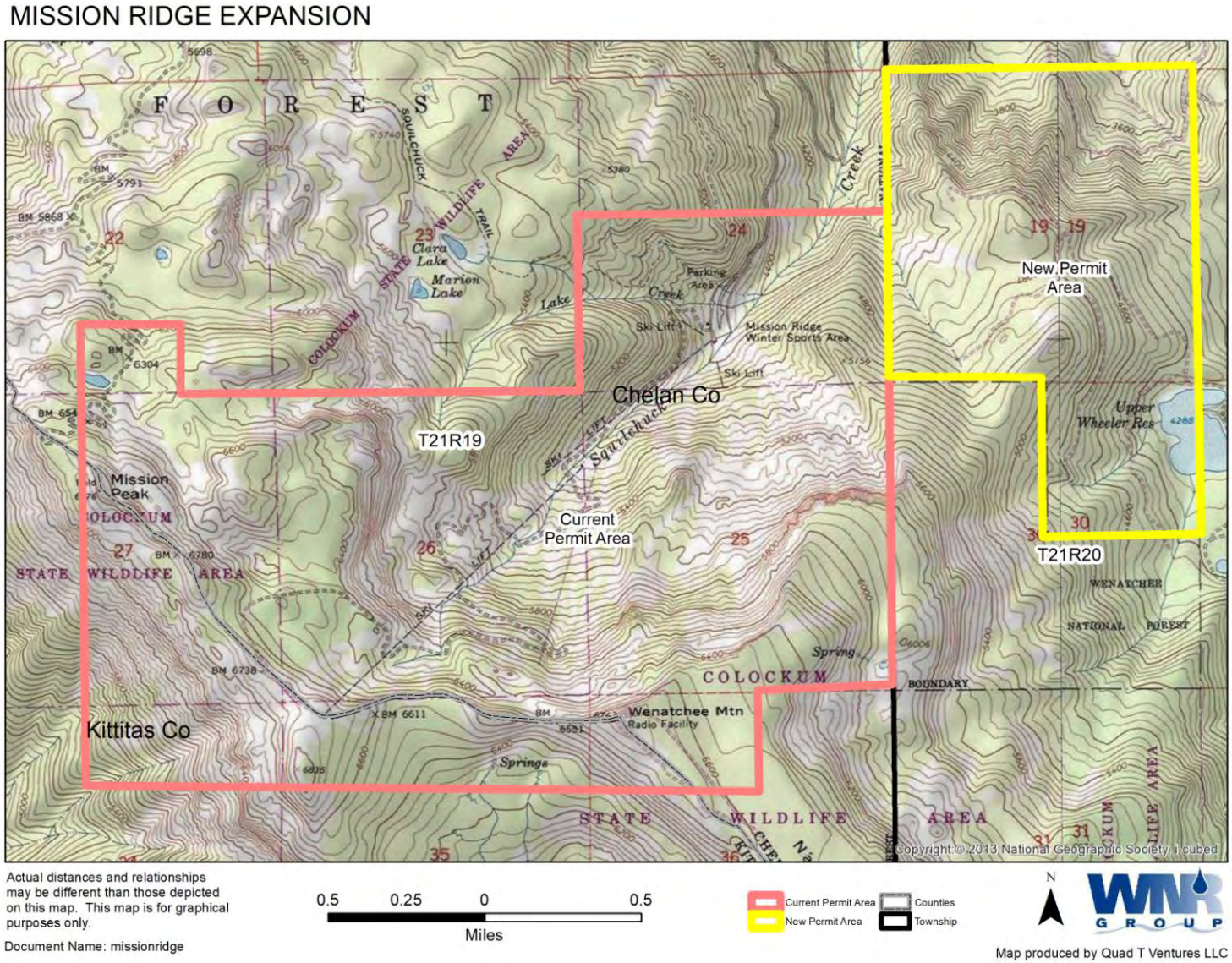


FIGURE 5: TOPOGRAPHIC MAP SHOWING LOCATION OF PROPOSED SITE IN SECTION 19 & 30, T21N, R20E.W.M.

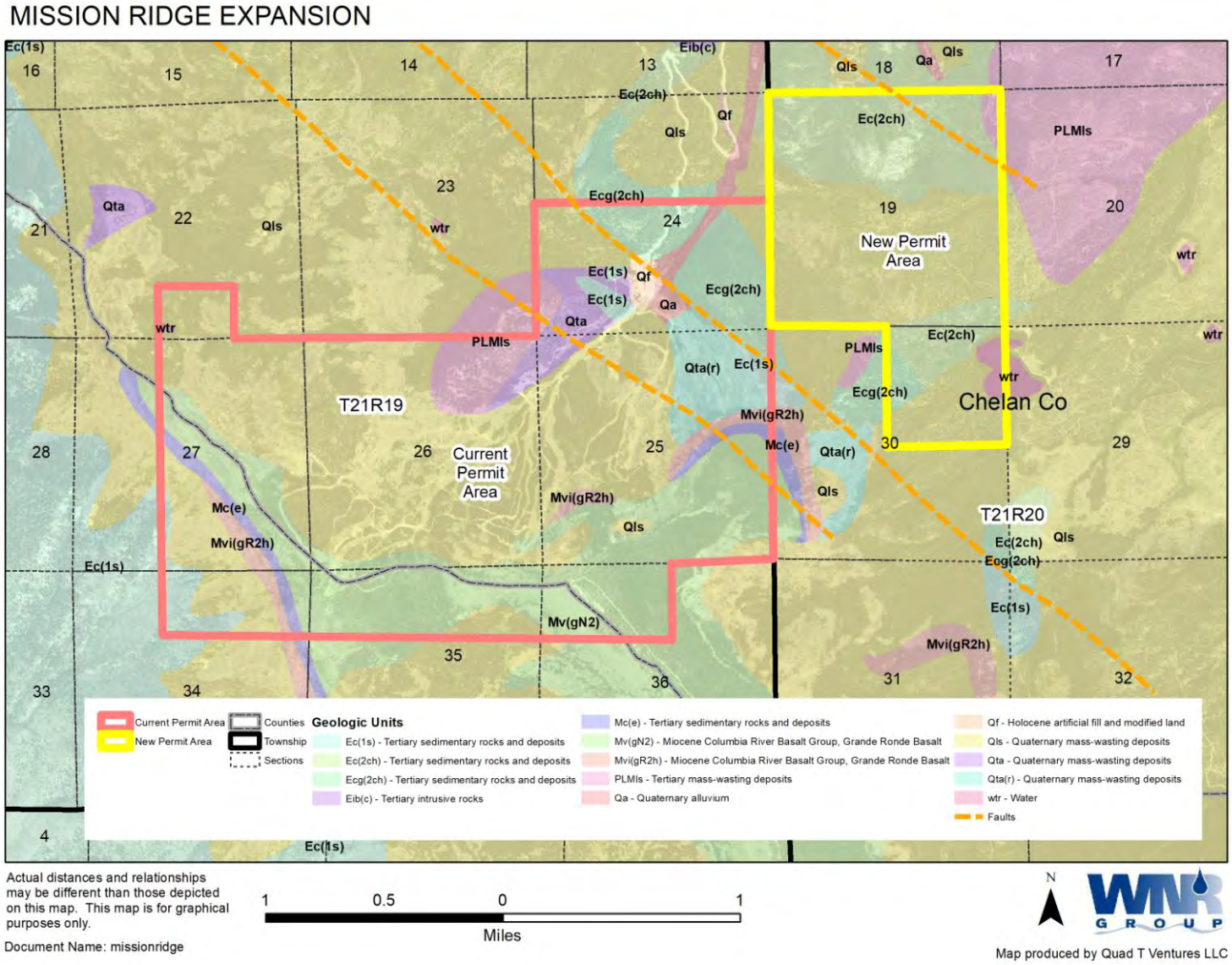


FIGURE 6: REGIONAL GEOLOGIC MAP OF THE MISSION RIDGE SKI AREA & MISSION RIDGE EXPANSION SITE.

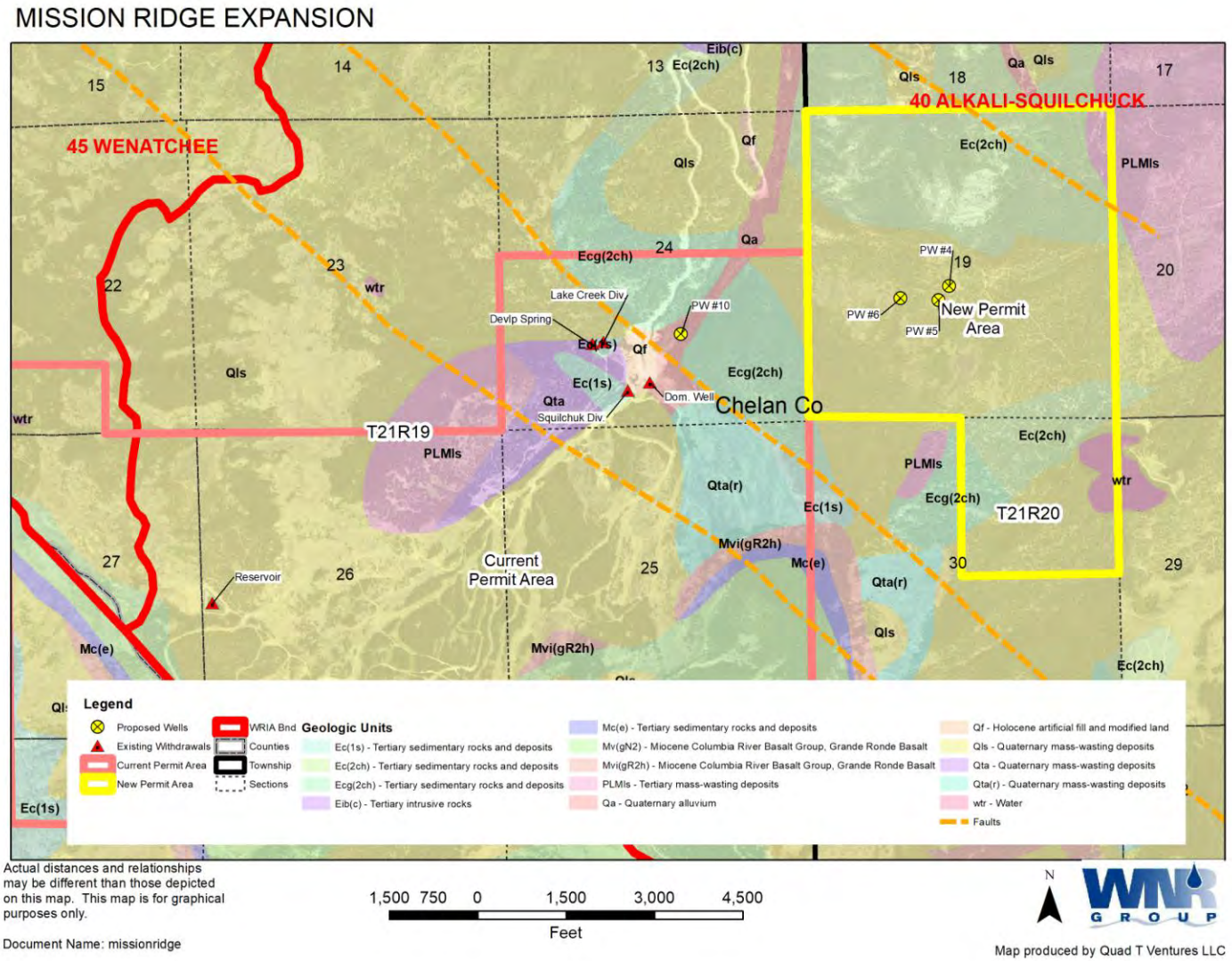


FIGURE 7: GEOLOGIC MAP OF THE IMMEDIATE AREA OF THE MISSION RIDGE EXPANSION IN SECTION 19 & 30 AND THE GENERAL AREA AROUND THE MISSION RIDGE SKI AREA WEST OF THE SITE. THE AREA IS UNDERLAIN BY TERTIARY AGE SEDIMAENTARY ROCKS COVERED WITH QUARTERNARY AGE MASS WASTING DEPOSITS. SEVERAL NW-SE TRENDING FAULTS ARE IDENTIFIED IN THE AREA (WDNR, 1991).

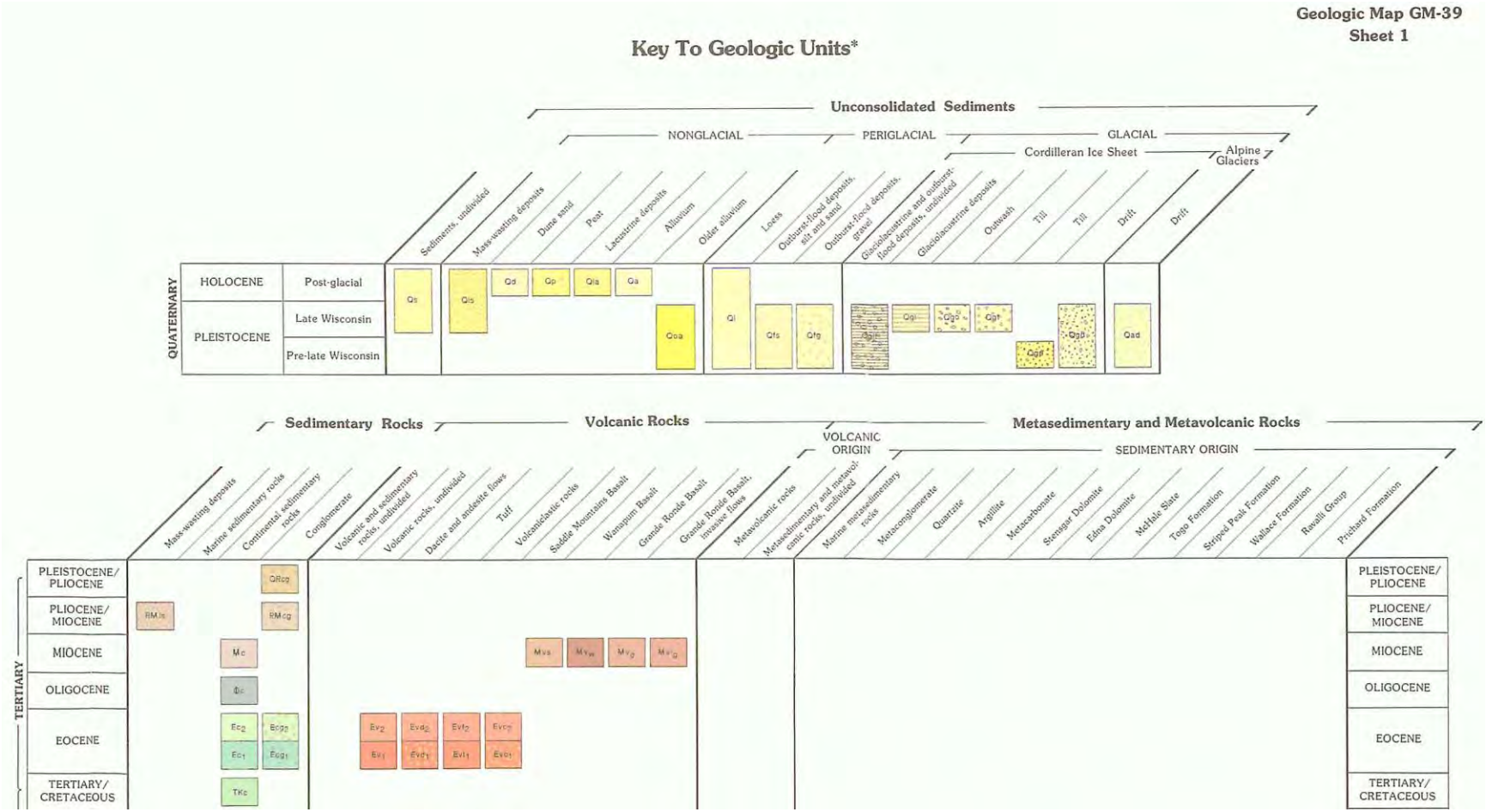


FIGURE 7-A: KEY TO GEOLOGIC MAP SYMBOLS.

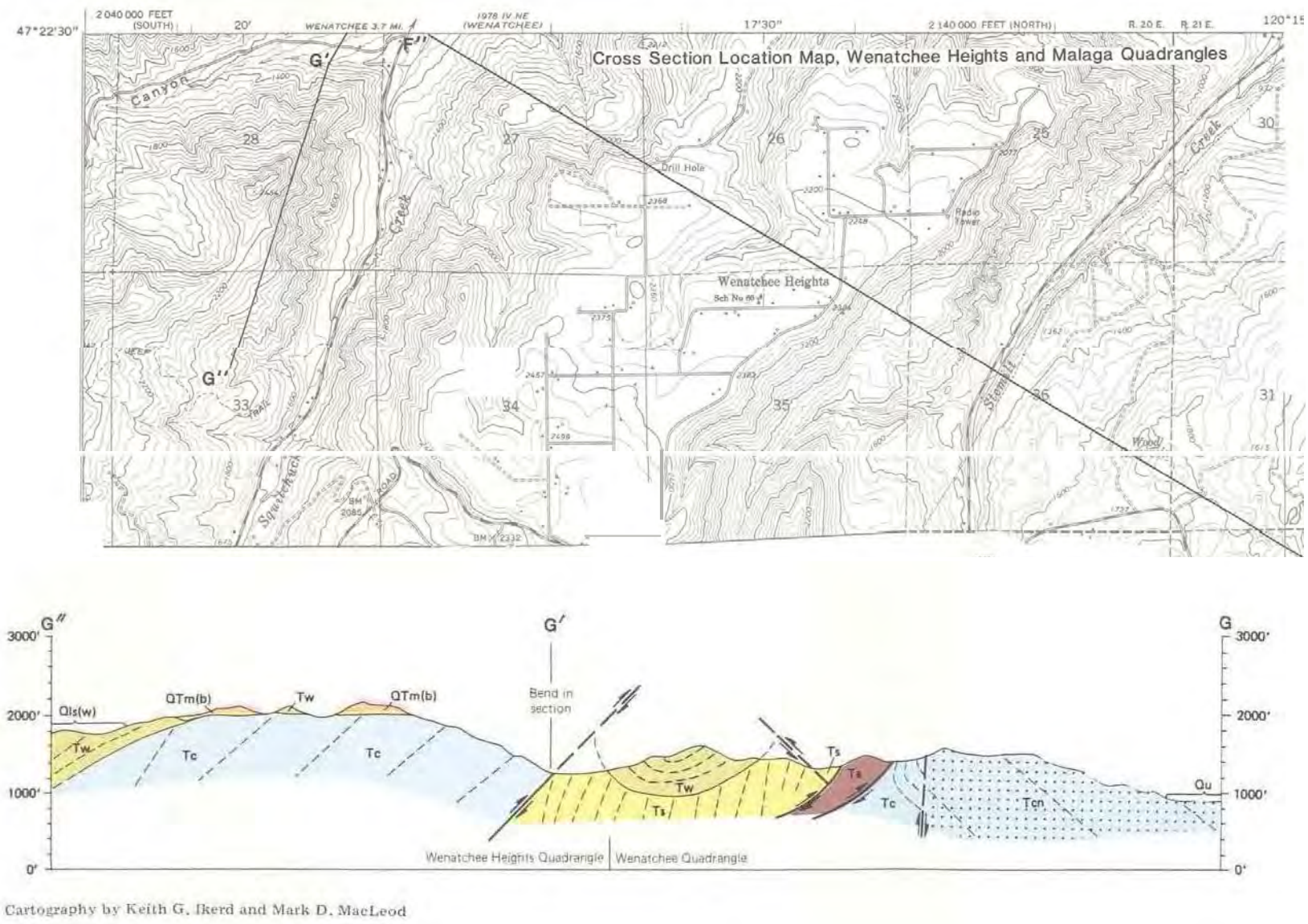


FIGURE 8: GEOLOGIC CROSS SECTION IN THE LOWER SQUICHUCK VALLEY SHOWING TERTIARY ROCK LAYERS AND FAULTING (GRESENS, 1983).

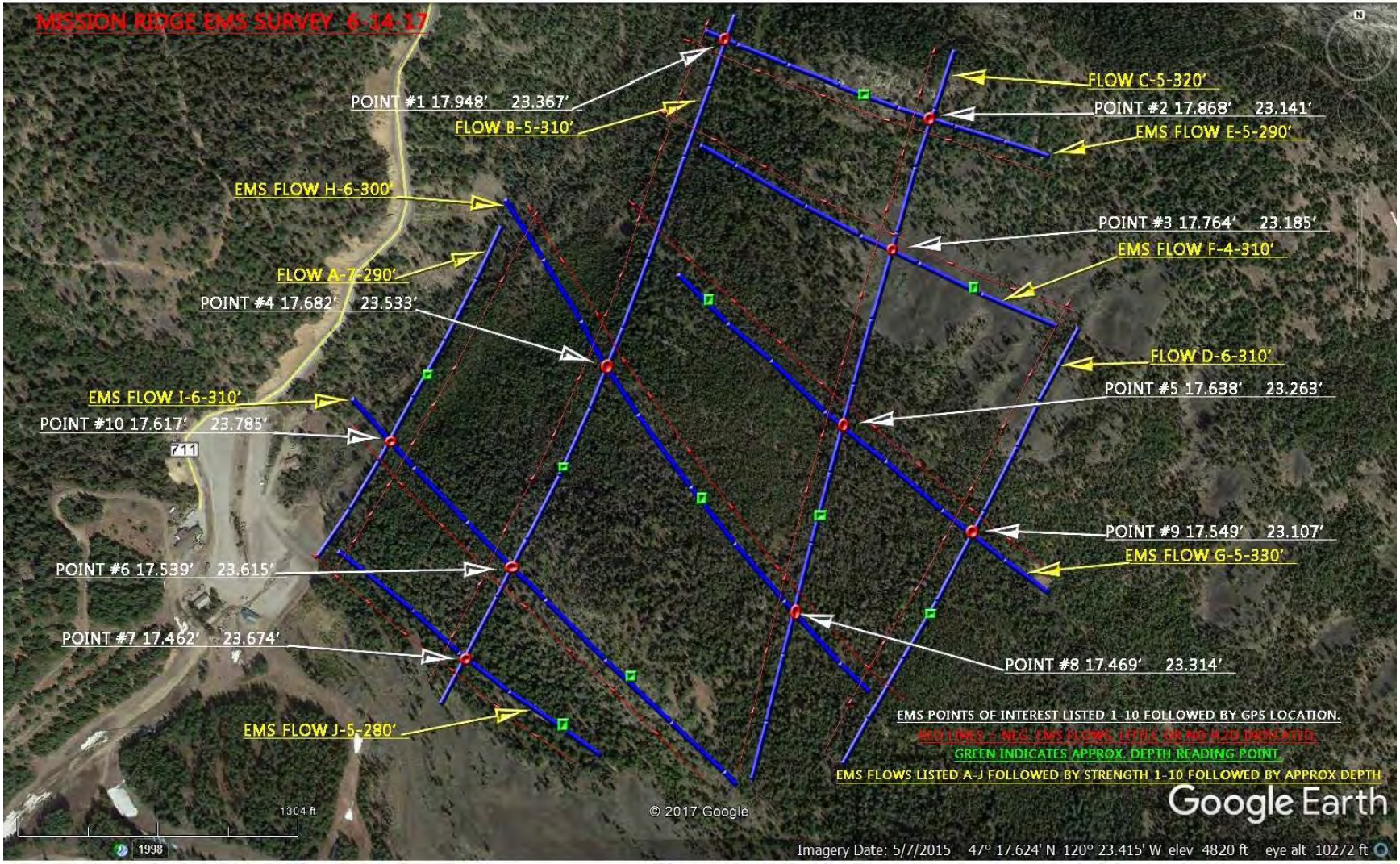


FIGURE 9: EMS SURVEY MAP OF WESTERN AREA SHOWING POTENTIAL RANKING OF DRILLING LOCATIONS.

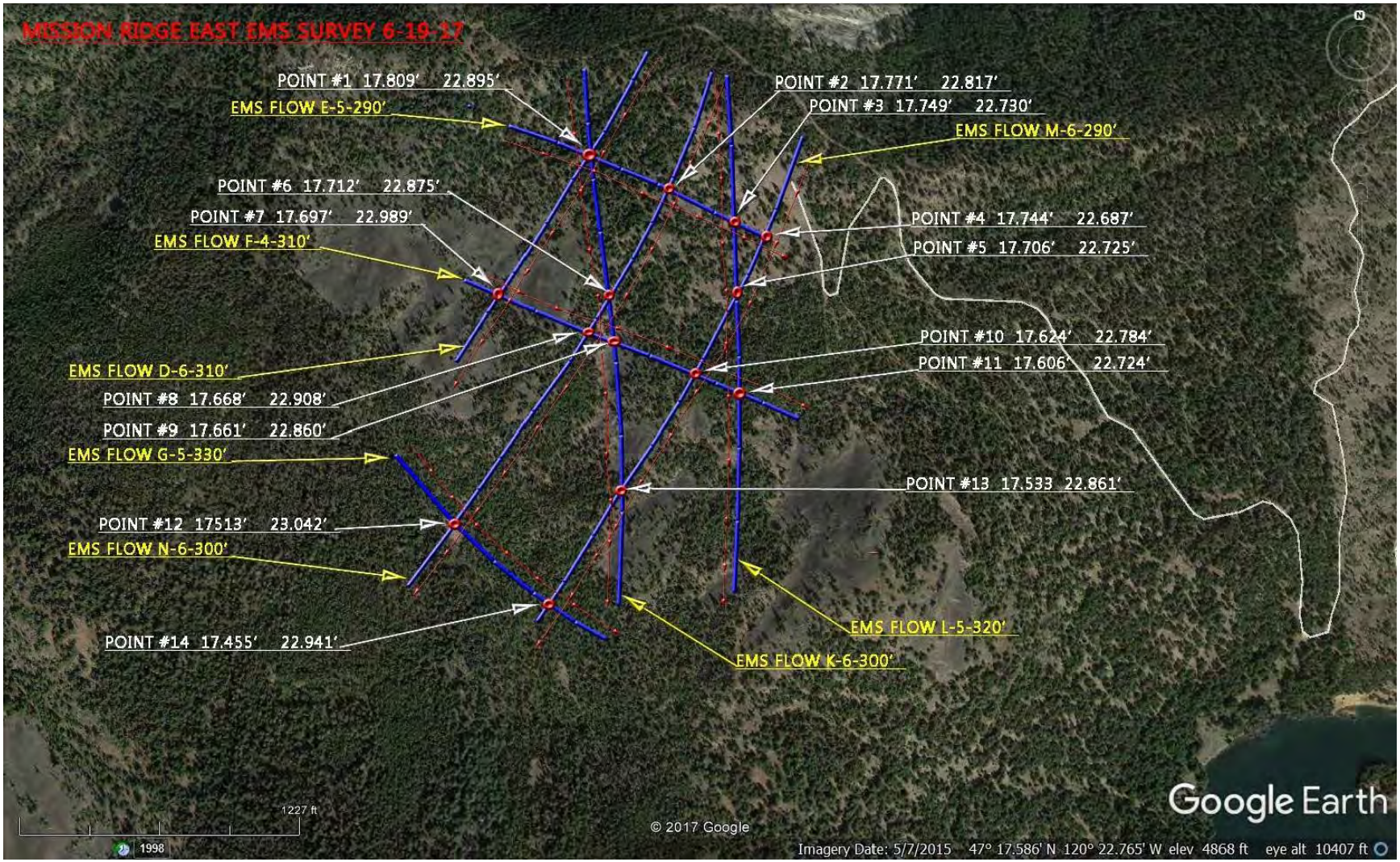


FIGURE 10: EMS SURVEY MAP OF EASTERN AREA SHOWING POTENTIAL RANKING OF DRILLING LOCATIONS.

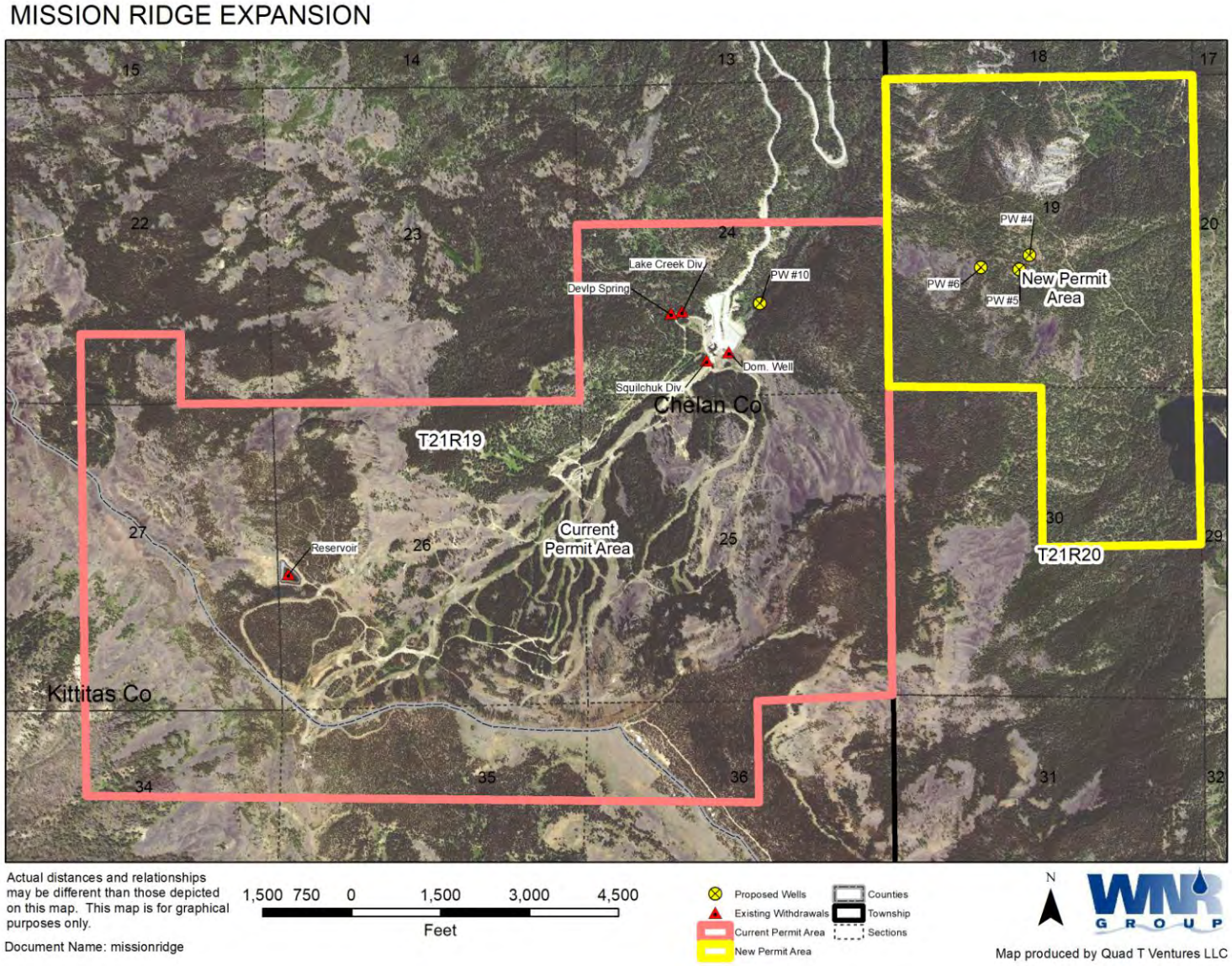


FIGURE 11: LOCATION OF EXISITNG DIVERSIONS AND PROPOSED WELL LOCATIONS ACROSS THE SITE.

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) 7500 mission Ridge. Road Wenachee 98807

(3) PROPOSED USE: ☒ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ Test Well ☐ Municipal ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one)
Abandoned ☐ 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 ☐ Liner installed ☐ Threaded ☐ " Diam. from ft. to ft.
" Diam. from ft. to ft.

Perforations: Yes ☐ No ☒
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 ☒
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal Bentinit Ch. Pl.
Did any strata contain unusable water? Yes ☐ No ☒
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
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 CENTRAL REGION OFFICE Received FEB 22 1999

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) (WELL DRILLER) License No. 2359
Contractor's Registration No. HOLTDI*B606 Date 9-5-98, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329- ⑧ 18

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

FIGURE 12: WELL LOG FOR MISSION RIDGE SKI AREA LODGE WELL.

Attachment A

IDEA4WATER

EMS Survey Report

IDEA4WATER Inc.

Site Survey Report

IDEA4WATER Inc.
121 Iowa Ave. Suite 1K
Whitefish, MT 59937
(208) 290-8811
info@idea4water.com

Results

Introduction
IDEA4WATER Inc. was contracted by Mission Ridge Ski Resort via Gene St. Godard to perform a site survey at 7500 Mission Ridge Rd., Wenatchee, WA. (Township 21N, Range 19/20E, Section 24/19)

Purpose
The objective of the investigation was to identify subsurface fractures that could contain underground water. The investigation consisted of an EMS and/or VLF survey. The investigation was successful in identifying a number of geophysical anomalies thought to be useful in finding water. The survey was conducted on June 24, 2017.

Water Survey
It is a well known fact that fresh water often sits in fracture zones in rock structures. Finding these fractures are the key to obtaining positive results when drilling for water. Finding the best place to drill can radically reduce the costs of drilling.

Geophysical surveying methods were developed in the 1940s, 1950s and 1960s. The methods used since this time have become more sophisticated and with the evolution of digital technologies, geophysicists have had a chance to obtain and analyze information obtained and develop more accurate and meaningful results.

The technologies used in this survey are known for finding useful quantities of underground water that may be trapped in rock fractures and cavities. This enables us to be able to determine the best site for drilling a well. By utilizing the magnetic components of the electromagnetic field generated by VLF (very low frequency) transmitters, it is possible to locate anomalies which provide a view of what structures exist underground. This is done by comparing electrical resistances of structures which are created by using the low frequency waves that are sent out by military radio transmitters around the world.

Survey Design
The EMS survey was conducted first and numerous potential water flows were discovered. The VLF survey area was then conducted. We conducted numerous runs along the flows to be certain that both technologies gave us information showing that we had water flows at those locations.

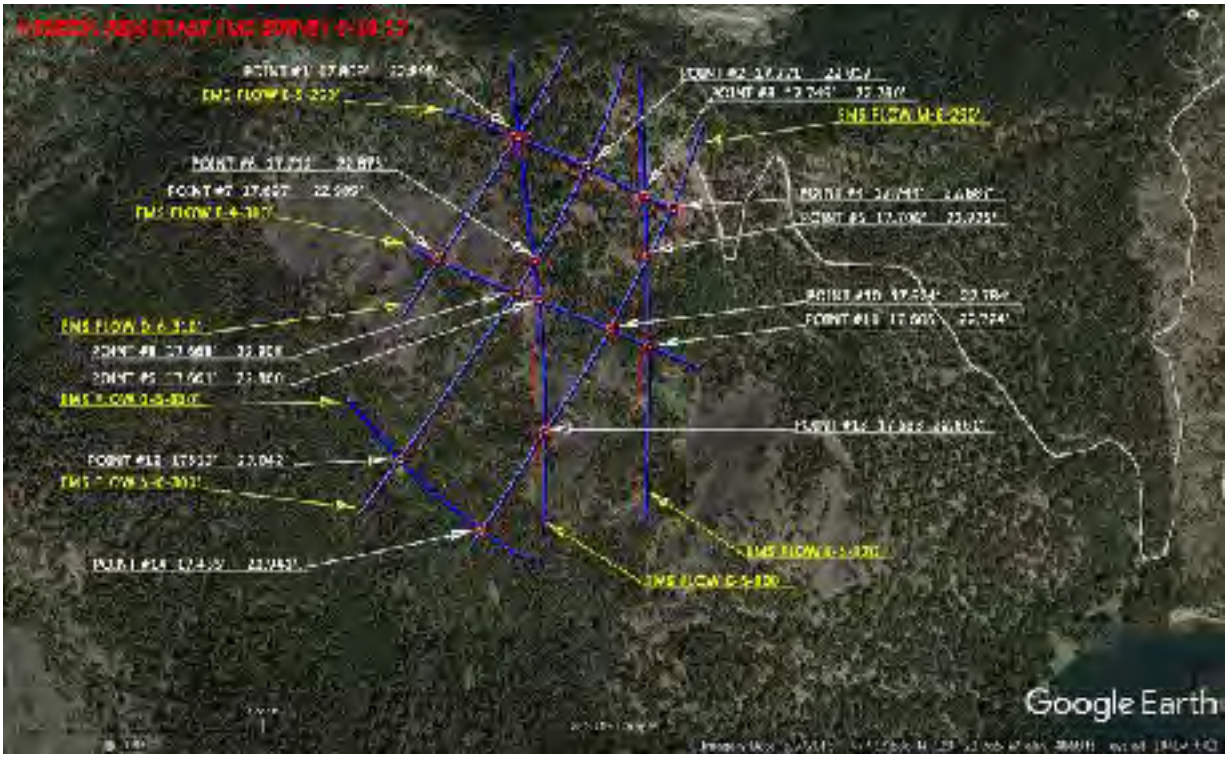
Results
The EMS results are listed below. The blue flow lines indicate good signals which could hold the potential for water. The red flows indicate very little likelihood of containing significant water. The blue crossing points of the lines were of extreme interest as they are most likely to contain the largest volumes of water.

The VLF survey was conducted to pinpoint the location of the crossing points and to verify that water is being indicated by this technology also. The frequency used was 24.7 kHz. The profiles were run at 90/270 degrees.

The EMS and VLF were in total agreement and the points determined to be the most likely to produce the best water were at points #4, #5, #6 from the East Area. We anticipate a maximum drilling depth at this point of about 450 feet*.

West Area

East Area



Interpretations
The EMS and VLF survey was successful in mapping several anomalies. While surveys can give information that can be somewhat ambiguous, there are a number of anomalies thought to be associated with underground water. The confidence in the results of the water prospecting survey are average.

Drilling Recommendations
We recommend drilling at points #4, #5, #6 in the East Area to a depth of 450 feet*. The drilling order should be point #4 (Due to the strong flow of M-6 and the additional fracturing in that area), #6 (Due to Very Good signals in that area), then #5 (Due to the Very Good signals) in the East Area.

The EMS Flows listed below are rated based on the quality of the signals received.

M-6 Excellent/Outstanding
E-5 OK
L-5 Very Good
N-6 Good
K-6 Very Good
F-4 OK

If adequate water is not obtained, we recommend Hydro fracturing the well. We believe that this will give the best volume of water for the money spent.

These results are respectfully submitted this 28th day of June, 2017.

Norman Larson, President

©IDEA4WATER Inc. 2008

* In the event that there is in excess of 50 feet of clay, this depth will increase by 150 feet.

APPENDIX E

2022 Water Resources Memo

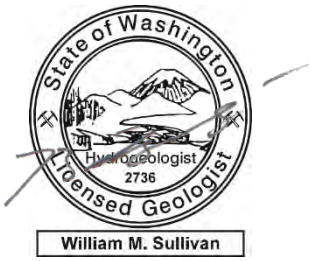
AMERICAN LAND AND WATER CONSULTING

106 N. Columbia Street
Wenatchee, WA 98801
(509) 888-8081

TECHNICAL MEMORANDUM

Date: January 20, 2022
Project: Mission Ridge Expansion
Project No.: 21006
Issued by: Bill Sullivan, LHG | (509) 699-0682 | bill@AmericanLW.com
Subject: Water Resources Existing Conditions and Impacts from Proposed Development

Authored By:



January 20, 2022

Bill Sullivan, LHG
Hydrogeologist

Executive Summary

American Land and Water Consulting (American) completed a planning-level assessment of water resources elements related to the proposed Mission Ridge Ski and Board Resort (Mission Ridge) Master Planned Resort expansion project (Project). This memorandum addresses specific areas for discussion identified by Chelan County in Chapter 3 (Water) of its Mission Ridge Master Planned Resort Expansion Environmental Impact Statement (EIS) Scoping Status Summary Document Revised on September 21, 2020.

The Project is an expansion of the existing Mission Ridge Resort on approximately 502 acres of privately-owned land in Section 19, and a small portion of the NE ¼ of Section 30, T. 21 N., R. 20 E.W.M. (Site) adjacent to the existing resort. The majority of the Site and the entire existing resort lie within the upper Squilchuck Creek watershed.

To complete this planning-level assessment, we reviewed information contained in project proposals, SEPA documents, and reports comprising the known body of work for water resources in the Squilchuck basin including documents developed supporting the approved Watershed Plan for Water Resources Inventory Area (WRIA) 40A (Stemilt-Squilchuck).

This memo:

- summarizes existing water resource conditions in the Squilchuck watershed including at the Site;

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- provides projected demand estimates for the Project's proposed public water system;
- describes alternatives for physical water supply;
- summarizes legal water availability (water rights);
- provides an assessment of potential impacts to water quantity and quality resulting from the Project and identifies mitigation measures; and
- evaluates the Project for consistency with the approved WRIA 40A Watershed Plan.

Based on our assessment, we have determined that:

1. There is adequate water available for the Project. Two water supply alternatives were identified that are both capable of providing sufficient physical and legal water availability to meet projected water supply demands through full buildout. This conclusion is based on:

    - The estimated total demand for the Project's Group A community public water system at full buildout is 241 acre-feet per year (ac-ft/yr) including 231 ac-ft/yr for indoor use and 10 ac-ft/yr for outdoor use. Estimated water demand for the Project is consistent with other recreational/residential developments in the region. The Project's public water system will not be used for snowmaking.

    - Under water supply Alternative 1, a portion of water system demand would be met using water rights currently owned by Mission Ridge and the balance would be supplied by Chelan County PUD (CPUD).

        - Up to 90 ac-ft/yr of demand may be met using existing Mission Ridge water rights that authorize water sources located within the Squilchuck basin. Mission Ridge does not plan to seek a new water right appropriation to supply the Project. It does plan to seek water right changes to align attributes of existing authorizations with Project needs. Any potential impact resulting from these changes will be fully mitigated through Washington's water laws that are established to protect existing instream and out-of-stream rights when water right changes are approved. There will be no enlargement of existing authorized quantities.

        - The balance of water demand of about 151 ac-ft/yr would be supplied by CPUD's Group A community water system using sources located outside of the Squilchuck basin that are in hydraulic continuity with the Columbia River. CPUD's water system currently extends to a reservoir in the Forest Ridge neighborhood located less than 0.5 mile north of the Site (Figure 1).

    - Under water supply Alternative 2, all water system demand (241 ac-ft/yr) would be supplied by CPUD. Based on initial discussions with CPUD, it appears the utility has sufficient physical and legal water availability to supply the Project under Alternative 2.

    - Initial discussions with CPUD indicate its Group A water system has adequate physical and legal availability to supply the Project. The State's Municipal Water Law authorizes CPUD to exercise its existing municipal water rights anywhere within the boundaries of its service area.

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- CPUD routinely extends water service to supply new developments. Expansion of CPUD's water system will be subject to all applicable permitting processes.
- Mission Ridge is currently coordinating with CPUD to initiate an engineering study to further investigate the feasibility of expanding its service area to supply the Project under a wholesale agreement and to identify needed improvements to its existing system. Locations for the service extension pipeline and pump stations will be determined through subsequent engineering study.

2. The Project is not expected to negatively impact water supplies and instead is expected to increase overall water availability in the Squilchuck basin throughout the year and especially during low flow periods benefitting instream and out-of-stream uses including irrigation. The conclusion is based on:
   - The maximum quantity of water consumptively used (lost from Squilchuck basin) will be small and well within authorized water rights. Consumptive use losses from supplying 90 ac-ft/yr of demand from sources in the Squilchuck basin under Alternative 1 are estimated to be no more than about 18 ac-ft/yr, or a continuous rate of about 0.02 cubic feet per second (9 gallons per minute). By comparison, mean annual flow in Squilchuck Creek estimated at 7.5 cubic cfs.
   - Importing water for the Project from CPUD under Alternatives 1 and 2 will negate all consumptive losses and will provide substantial net water supply benefit to the Squilchuck basin via return flows. Assuming CPUD supplies 151 ac-ft/yr for indoor water use having a 90 percent return flow rate (Ecology, 2018), water augmentation to the Squilchuck basin under Alternative 1 is estimated to be about 136 ac-ft/yr, or an average continuous rate of about 0.2 cfs. If all water for the Project's water system is supplied by CPUD under Alternative 2, water augmentation increases to 208 ac-ft/yr and 0.3 cfs continuously.
   - Additionally, Mission Ridge plans to expand its artificial snowmaking operation to the Project site using existing water right authorizations. The WRIA 40A Watershed Plan specifically recognized benefits of snowmaking to water supplies in Squilchuck Creek. Snowmaking prolongs the spring freshet period by increasing water storage. It also increases the quantity of cold water infiltrating to groundwater. Prolonging the freshet period benefits aquatic habitat, delays mandatory cuts to downstream irrigation rights, and delays the need to release cool water from high-elevation reservoirs in the Squilchuck basin until later in the season. Increased infiltration results in additional inflow of cool groundwater to sustain baseflows during late season low flows.
3. Potential water quantity and quality impacts resulting from erosion and sedimentation, stormwater runoff, and wastewater discharge will be fully mitigated through existing required permitting processes that are established to be protective of surface and groundwater resources.
4. The Project was assessed for consistency with the WRIA 40A Watershed Plan and supporting documents. The Planning Unit approved the Watershed Plan in 2007 consistent with RCW 90.82.

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- The Project would not be in conflict with desired future conditions, opportunities, and recommendations identified by the Planning Unit.
- The Project is expected to result in a substantial increase of water supplied to the Squilchuck basin on a continuous basis fulfilling several major objectives listed the Watershed Plan including:
    - Providing domestic water from regional (out-of-basin) water supply sources;
    - Enhancing groundwater recharge and baseflow;
    - Creating domestic water interties to increase reliability of the drinking water supply; and
    - Using artificial snowmaking at Mission Ridge to enhance stream flows in Squilchuck Creek by retiming water delivery;

5. Our planning-level assessment did not identify any water elements that would limit development of the proposed Project or impacts to water resources that cannot be fully mitigated through compliance with applicable regulations and standard permitting processes (See Section 4 of this report). Suggested conditions to mitigate potential impacts from the Project include:
    - The development shall comply with all applicable local, state, and federal rules and regulations, and must obtain all appropriate approvals and permits.
    - If existing water rights will be utilized for development which requires water right transfers, transfer should be approved by the Department of Ecology prior to preliminary plat approval.
    - Prior to preliminary plat or building permit approvals, proof of potable water must be provided to Chelan County. For domestic water supplied by expansion of the CPUD's public water system, the utility must provide written confirmation agreeing to provide water for the proposed development. All water system improvements must be designed, constructed, and placed in accordance with CPUD's standards and requirements. Completion of the improvements, including necessary easements, must be accepted in writing by CPUD. Expansion of CPUD's water system will be subject to applicable permitting processes including an update to its Group A water system plan to be approved by Washington Department of Health (DOH).
    - Discharge of wastewater to groundwater will require approval from Chelan-Douglas Health District (CDHD) and DOH to comply with Washington State antidegradation policies under WAC 173-200. Discharge of wastewater to surface water will require compliance with the federal Clean Water Act and state antidegradation policies under WAC 173-201A including a National Pollutant Discharge Elimination System (NPDES) wastewater discharge permit administered by Ecology.
    - A final site-specific stormwater plan and report prepared by a Professional Engineer licensed in the State of Washington that conforms to Ecology's 2019 Stormwater Management Manual for Eastern Washington (SWMMEW) and Chelan County's

Stormwater Management Code (SMC, Chapter 13.16) shall be submitted and accepted by Chelan County prior to construction.

- The Project will result in greater than 1-acre of disturbed ground requiring coverage under the NPDES Construction Stormwater General Permit (CSWGP). As part of the CSWGP, a Stormwater Pollution Prevention Plan (SWPPP) and a Temporary Erosion and Sediment Control Plan (TESC Plan) shall be submitted to and accepted by Chelan County prior to grading. The SWPPP and TESC Plan shall be maintained on-site and updated as needed to address and prevent any sediment or sediment-laden water from leaving the Project Site.

1.0 Introduction

American Land and Water Consulting (American) drafted this technical memorandum to support planning and permitting for the proposed Mission Ridge Ski and Board Resort (Mission Ridge) Master Planned Resort expansion project (Project). Chelan County is the lead agency for State Environmental Policy Act (SEPA) review for the Project. This memo provides a planning-level assessment of water resources elements related to the Project and addresses specific areas for discussion identified by Chelan County in Chapter 3 (Water) of its Mission Ridge Master Planned Resort Expansion Environmental Impact Statement (EIS) Scoping Status Summary Document Revised on September 21, 2020.

This memo addresses the following specific areas for discussion presented by Chelan County:

a. Groundwater and surface water movement/quantity/quality

i. *Further analysis of the water requirements for the project, availability of sufficient ground water for resort uses, and of the potential adverse impacts resulting from the use of groundwater on stream flow and irrigation water downstream of the site.*
ii. *Alteration of the absorption characteristics of the site.*
iii. *Contamination of runoff water with trace amounts of petroleum residues, heavy metals, phosphorus, nitrogen and other pollutants associated with vehicle traffic and property maintenance.*

b. Public water supplies

i. *Feasibility and impact of extending the Chelan PUD public water system to the project site, which may require improvements to the existing water system.*
ii. *WRIA 40A Watershed Plan.*
iii. *WRIA 40A Water Quantity Analysis*.

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The Project comprises approximately 502 acres of privately-owned land adjacent to the current Mission Ridge Ski and Board Resort (ski resort) in southwestern Chelan County, Washington (Figure 1). Most of the planned development will occur in Section 19 and a small portion of the NE ¼ of Section 30, T. 21 N., R. 20 E.W.M. (Site).

The current ski resort consists of ski lifts and runs, a lodge, support facilities, and parking lot located on over 2,000 acres of leased federal and state land.

The Project is proposed to be constructed as a Master Planned Resort offering year-round recreational, commercial, and residential uses. Based on information in the Mission Ridge Expansion Project Narrative (Mission Ridge, 2020), the Project at full buildout will consist of 275 single family units (later revised to 265), 621 condominiums/townhouses/duplexes, a 57-room hotel/lodge, housing for 80 employees, and services for 110,000 annual visitors. Infrastructure required to support planned the Project includes roadways, sidewalks, a public water system, and wastewater treatment.

2.0 Background

This section summarizes water resources in the Squilchuck watershed and at the Project Site.

2.1 Related Studies

The body of work relating to water resources in the Squilchuck basin and at the Site is summarized below and listed in the References section of this memo.

The Watershed Plan for Water Resources Inventory Area (WRIA) 40A (Stemilt-Squilchuck) was approved by the Planning Unit in 2007 in accordance with the Watershed Planning Act (RCW 90.82; Chelan County, 2007a). The Planning Unit elected to complete the required water quantity assessment (Chelan County, 2007b) and optional multi-purpose water storage assessment (Chelan County, 2010). The Planning Unit elected to not complete optional water quality, instream flow, and habitat assessments.

Hydrologic studies preceding the watershed plan include reports by Woolridge (1972) assessing Squilchuck Creek in the context of other nearby watersheds, Woodridge (1994) addressing upper Squilchuck Creek at the Mission Ridge Ski Resort, and a watershed assessment completed by the U.S. Forest Service (1998). WNR Group (2019) completed a survey-level evaluation of hydrogeologic conditions at the Site supporting planning for the Mission Ridge expansion project.

Washington State Department of Ecology (Ecology) operated a continuous recording stream flow gaging station near the mouth of Squilchuck Creek from 2008 through 2012. Other stream flow data are limited to spot flow measurements collected over decades as summarized in Chelan County (2007b).

Potential impacts to aquatics, wildlife, and botany were assessed supporting SEPA compliance for the Project (Washington Conservation Science Institute, 2020) and it was concluded there will be no population impacts for a properly mitigated Project.

The Washington State Conservation Commission completed an evaluation of limiting factors to migration of anadromous fish in the creek (Andonaegui, 2001) and the Washington Department of Fish and Wildlife inventoried fish passage barriers and irrigation diversions in the creek (2006).

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The Stemilt Partnership, formed by Chelan County in 2007, represents agriculture, wildlife, recreation, development, and conservation interests within WRIA 40A. Its priorities, vision, and landscape strategies for these watersheds are documented in the Stemilt-Squilchuck Community Vision (Chelan County, 2008).

Two geotechnical studies completed supporting the Project include a reconnaissance-level geologic hazards assessment primarily focused on Section 19 (GN Northern, 2017) and a site evaluation report for the proposed access roadway (GN Northern, 2020). The Site was determined to be suitable for the intended development subject to recommendations in these reports.

2.2 Existing Watershed Conditions

The Project is located within the upper reaches of the Squilchuck Creek watershed (watershed, basin) in southeastern Chelan County. Squilchuck Creek comprises approximately half the area of WRIA 40A along with Stemilt Creek adjacent to the south. This summary of existing water resources conditions in the Squilchuck basin and at the Site is based on information from sources listed in the References section of this memo.

Squilchuck Creek is a 10.6-mile long perennial stream forming a direct tributary to the Columbia River. It drains approximately 17,600 acres of the eastern slope of the Cascade Mountains southwest of Wenatchee. The Squilchuck watershed is bounded to the west by Naneum Ridge and to the east by the Columbia River. The watershed forms a canyon bounded to the north by foothills of the Wenatchee Mountains and to the south by Wheeler Ridge and Wenatchee Heights. Major perennial tributaries to Squilchuck Creek include Miners Run and Lake Creeks that empty to Squichuck Creek downstream and upstream from the Site, respectively.

Anadromous fish passage in Squilchuck Creek is limited by a natural gradient barrier to the lowermost reach within about 1 mile upstream from the confluence with the Columbia River. No water bodies within the Squilchuck Creek watershed are listed by Ecology as impaired on its 303(d) list under The Clean Water Act.

Land surface elevations range from about 640 feet asl near the Columbia River to greater than 6,800 feet above sea level (asl) at Naneum Ridge. The Site lies several hundred feet above Squilchuck Creek at elevations between about 4,500 and 5,000 feet asl. Most of the Site lies in a northwest-sloping bowl draining toward Squilchuck Creek. A portion of the Project in the east half of Section 19 and Section 30 will be situated on an east-sloping hillside draining toward the Stemilt Creek basin.

Vegetation communities in the watershed range from shrub-steppe in low and middle elevations to mixed coniferous and subalpine forest in high elevations. Irrigated commercial tree-fruit orchard covers much of the land surface on gentle slopes in lower and middle elevation areas. Land cover in the upper elevations is predominantly bare rock (basalt rubble). Land cover at the Site is primarily mixed coniferous forest. Up to about 50 acres of the Site is covered by basalt rubble.

Mean annual precipitation in the watershed ranges from 8 inches near the Columbia River to 32 inches at Naneum Ridge and is about 27 inches at the Site. Approximately 70 percent of annual precipitation falls as snow between October and April. As a result, the hydrology of Squilchuck Creek is characterized by snowmelt with peak flows occurring between April and July. About 65 percent of annual water flow occurs during these months. Baseflow from groundwater storage

sustains stream flows during later summer and mid-winter months when rainfall is scarce. Mean annual flow is estimated to be 7.5 cubic feet per second (cfs; Chelan County, 2007b). Low stream flows are typically less than 2 cfs. High stream flows are typically 20-30 cfs and can exceed 50 cfs for brief periods.

About 13 percent of annual precipitation goes to runoff and about 35 percent goes to groundwater recharge. An unknown quantity of recharge returns to the creek as baseflow. The balance of 52 percent of annual precipitation is attributed to evapotranspiration.

Geology of the watershed is characterized by steeply-dipping continental sedimentary rocks of the Tertiary Chumstick formation overlain by gently-dipping Tertiary Grande Ronde basalt of the Columbia River Basalt Group and Quaternary mass wasting deposits. The Chumstick Formation is comprised of siltstone, shale, sandstone, and conglomerate. It underlies the entire watershed and crops out at all but the highest elevations. Basalt occurs primarily in the upper elevations of the watershed above about 4,500 feet asl. Mass wasting deposits are primarily present along ridges, canyon walls, and in the upper elevations of the watershed. Alluvial deposits consisting of sand, gravel, silt, and clay line the bottoms of drainages. All four major geologic units described above are present at the Site.

Ecology's well database indicates about 100 wells are present in the watershed. Nearly all are used for domestic supply. Wells are concentrated along canyon bottoms and on hillsides in the lower and middle elevations of the watershed east of the Site. Few wells are present in the upper elevations and no wells are present at the Site. The nearest wells to the Site are located 0.5 mile to the southwest near Squilchuck Creek at the existing ski resort base in Section 24, T. 21 N., R. 19 E.W.M (Ecology IDs AGJ-097 and BJB-131). These wells supply the existing Mission Ridge Ski Resort Group A transient non-community (TNC) water system (No. 55335) approved for 5 connections supplying the lodge and support facilities.

Wells are completed throughout the watershed in all four of the major geologic units. Groundwater occurrence is generally localized and unpredictable. Groundwater occurs in the Chumstick Formation in open fractures along discontinuous, moderately permeable layers. Well yields in the Chumstick range from 1 to 30 gallons per minute (gpm) and average less than 10 gpm. Groundwater in basalt likely occurs within the basal unit. The few wells completed in basalt in WRIA 40A yield between 10 and 100 gpm. Groundwater in mass wasting deposits is highly localized and occurs where permeable basalt rubble overlies less permeable Chumstick Formation. Wells completed in mass wasting deposits typically yield between 5 and 30 gpm. Alluvium occupying drainage bottoms comprises the most productive groundwater unit in the watershed due to relatively high permeability and connection with surface water bodies. Wells completed in alluvium yield between 10 and 100 gpm. Existing Mission Ridge wells AGJ-097 and BJB-131 are completed in unconsolidated deposits (basaltic alluvium or mass wasting deposits) at depths of 100 feet bgs or less with reported yields between 40 and 100 gpm.

Groundwater is recharged by infiltration of precipitation. In general, relatively flat lying areas and areas comprised of basalt rubble and mass wasting deposits promote recharge. Additional artificial recharge comes from seepage associated with irrigation return flow, onsite sewage systems (OSS), and unlined irrigation ditches and reservoirs. Groundwater flow direction is primarily controlled by topography. Shallow groundwater generally flows perpendicular to local drainages while deep

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groundwater flows northeasterly toward the Columbia River. Shallow groundwater discharges to the surface in springs along canyon walls and to streams along drainage bottoms. Deep groundwater discharges to the lower reaches of Squilchuck Creek and the Columbia River.

Surface water features at the Site consist a northwest-flowing intermittent stream in the western half of Section 19, and several small ponds. Squilchuck Creek lies about 1,000 feet to the northeast of the Site. Infiltration at the Site discharges to the intermittent stream in Section 19 and to Squilchuck Creek.

About half of mapped surface soils in Section 19 are classified as bedrock outcrop. The other half, where most project development will occur, are classified as having moderately low to moderately high drainage capacities ranging from 0.06 to 0.2 inches/hour. Stemilt silt loam, comprising about one-quarter of the land surface at the Site is classified as presenting a severe erosion hazard. All others are classified as moderate or lower.

The primary irrigation source in the watershed is surface water from Squilchuck Creek. Surface water is also conveyed via gravity from adjacent Mission and Stemilt Creek watersheds. In recent decades, surface water pumped from the Columbia River has become an important irrigation water source.

Major irrigation water purveyors include Beehive Irrigation District and Lower Squilchuck Irrigation District. Wenatchee Heights Reclamation District and Lower Stemilt Irrigation District also supply irrigation to portions of the Squilchuck basin.

A portion of irrigation water is stored in artificial reservoirs including high-elevation Beehive and H&H reservoirs and The Great Depression. Two small lakes near the ski resort comprise the only natural surface water storage. Mission Ridge operates a reservoir to store water diverted from Squilchuck Creek for artificial snowmaking.

Water rights and claims within the Squilchuck watershed are primarily for irrigation use. Over 200 permits and certificates and 100 claims are listed in Ecology's water right database. The basin underwent a Superior Court Adjudication completed in 1926 that validated then-existing surface water rights and claims of beneficial use predating the 1917 Water Code (RCW 90.03). Claims filed after 1926 have not been adjudicated. A substantial portion of water rights are subject to annual mandatory curtailment of diversion rates based on priority date or class of the rights as stream flows decrease following the spring freshet period.

3.0 Project Water Requirements

This section presents a planning-level assessment of water demand and supply alternatives.

3.1 Public Water System Demand Estimates

A Group A community public water system will be developed to support the Project. This section provides a projected water demand estimate for the Project considering indoor and outdoor uses based on development plans listed in the Project Narrative (Mission Ridge, 2020).

Planning assumptions for types and numbers of connections and population at full buildout are shown in Table 1. These assumptions and the resulting water demand estimates shown below are consistent with other recreational/residential developments in the region. Water for artificial

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snowmaking was not considered in the demand estimate because it will not be supplied by the public water system.

Results of this water demand estimate were used to evaluate legal and physical water availability for water sources and to evaluate potential water resources impacts from the Project (see Section 4 of this report). Additionally, water demand estimates can be used to guide planning for water system and wastewater treatment facilities recognizing that estimates will be refined as the Project progresses.

The equivalent residential unit (ERU), based on a typical full-time single-family residence, was used to evaluate water system consumptive demand for two demand scenarios described below (ADD and MDD). Approximately 913 ERUs are expected at full project buildout (Table 1).

Average Day Demand (ADD)

ADD is the total annual consumptive demand per ERU averaged over 365 days. ADD is used to estimate water supply safe annual yield and required water right annual quantity.

Estimates for ADD are based on indoor use for 1 ERU of 200 gallons per day (gpd), distribution system leakage (DSL) of 10 percent, and factor of safety (FS) of 15 percent as recommended in the Washington State Department of Health (DOH) *Water System Design Manual* (DOH, 2019). ADD is estimated to be 250 gpd:

ADD = indoor use (200 gpd) + DSL (20 gpd) + FS (30 gpd) = 250 gpd

Facilities differing from the ERU criterion were accounted by applying a factor. An ERU factor of 0.8 was applied to multi-family units as recommended in *Water System Design Manual*. ERU values for water usage for the hotel and employee housing were adjusted based on the guidance in Table 3-2 in the *Water System Design Manual*. Estimates for visitors and employees are based on 5 gpd per person.

Outdoor water use is assumed to be primarily for irrigation of drought-resistant native shrub vegetation to compliment the natural alpine setting and will use low flow application methods to minimize water consumption. Landscaping requirements will be established by the development's covenants, conditions, and restrictions.

Outdoor water use was estimated assuming a total of 8 acres of landscaping will be irrigated. This irrigated area is apportioned among residential and commercial facilities assuming 500 square feet (sf) per single-family unit, 250 sf per condo/townhouse, and 22,000 sf each for the hotel/lodge and employee housing. Numbers of ERUs assigned to irrigation water use were determined by dividing the annual total irrigation requirement (TIR) of the facility by the ERU value:

ERUs = TIR x number of irrigated acres/1 ERU rate

The TIR for shrubbery was determined based on the annual crop irrigation requirement (CIR) in excess of rainfall for the index crop grapes contained in the US Department of Agriculture Natural Resources Conservation Service *Washington Irrigation Guide* (WIG) at Winthrop, Washington. Winthrop was selected because it has a similar climate to the Site. According to the WIG, the CIR for grapes is 1.11 feet. The TIR assuming a sprinkler application efficiency (Ea) of 85 percent is 1.31 feet:

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TIR = CIR/Ea = 1.11 feet/0.85 = 1.31 feet (15.7 inches)

Based on a TIR 1.31 feet and irrigated area of 8 acres, the total irrigation demand is estimated to be 10.5 ac-ft/yr. This volume averaged over an assumed 153-day irrigation season (nominally May through September) is about 22,000 gpd or 15 gpm. Outdoor water use from October through April is assumed to be zero. The water system will not be used to supply snowmaking.

The total annual quantity (Qa) needed to meet ADD at full project buildout is estimated to be 241 ac-ft (Table 1).

Maximum Day Demand (MDD)

The MDD for an ERU is the highest volume of water an ERU is expected to consume over a 24-hour period excluding emergencies. MDD is used to guide water system source and storage design and assess adequacy of water right instantaneous quantity.

MDD per ERU was estimated by applying a peaking factor of 2.0 times ADD which falls in the range of values recommended by the *Water System Design Manual*. MDD is estimated to be 500 gpd:

MDD = ADD (250 gpd) x Peaking Factor (2.0) = 500 gpd

The total instantaneous quantity (Qi) needed to meet MDD at full project buildout is about 302 gpm (Table 1).

Table 1. Mission Ridge Expansion Water Demand Estimate

Water Use	No.	Unit	ADD/ ERU (gpd)	Total ADD (gpd)	Annual (ac-ft)	Factor (x ADD)	MDD/ ERU (gpd)	Total MDD (gpd)
Single Family	265	units	250	62,250	74.0	2	500	132,500
Condo/townhome	621	units	200	124,200	138.8	2	400	248,400
Hotel / lodge	57	rooms	100	5,700	6.4	2	200	11,400
Employee housing	80	ea	50	4,000	4.5	2	100	8,000
Daily visitors	1,000	ea	5	5,000	5.6	2	10	10,000
Employees	150	ea	5	750	0.8	2	10	1,500
Irrigation	8	acres		22,318	10.5			22,318
TOTAL				***228,218***	***240.5***			***434,118***
			Total ERUs = 913		**Qa = 241**			**Qi = 302 gpm**

ADD = Average Day Demand = 250 gpd/ERU
MDD = Maximum Day Demand - 500 gpd/ERU
ERU = Equivalent Residential Unit. Total number of ERUs = Total ADD/ ADD per ERU = 913 ERUs.
Qa = Annual Quantity (ac-ft)
Qi = Instantaneous Quantity (gpm)

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3.2 Public Water Supply Alternatives

Two alternatives were identified to supply water to the Project's public water system. Both appear to be capable of providing sufficient physical and legal water availability to meet projected water system demand through full buildout of 241 ac-ft/yr .

Under water supply Alternative 1, a portion of water system demand would be met using water sources located within the Squilchuck basin under water rights currently owned by Mission Ridge with the balance supplied by Chelan County Public Utility District (CPUD) through extension of its Group A community water system service area. As described below, up to 90 ac-ft/yr could be supplied under existing Mission Ridge water rights. CPUD would supply the balance of 151 ac-ft/yr through wholesale water service to the Project's water system.

Under water supply Alternative 2, all water system demand would be supplied by CPUD.

CPUD currently supplies domestic water to the Forest Ridge development located within 0.5 mile north of the Site (Figure 1). Connecting to CPUD's Group A community water system would require construction of a new pipeline and pump station(s) to convey water from CPUD's Forest Ridge reservoir to the Site.

Mission Ridge has consulted CPUD and is coordinating to initiate an engineering study to investigate the feasibility of expanding its service area to supply the Project and to identify needed improvements to its existing system. Based on initial discussions with CPUD, it appears that the utility has sufficient physical and legal water availability to supply the Project. The exact location of an offsite pipeline and pumping station(s) to connect the Project with CPUD's water system is currently not known and will be determined through subsequent engineering study.

3.3 Physical Water Availability

Water supply Alternative 1 involves using water sources located within the Squilchuck basin consisting of groundwater and/or surface water to meet a portion of water system demand. New sources supplying the Project's Group A water system (e.g. new wells) must receive source approval from Washington State Department of Health (DOH) under WAC 246-290-130 including testing to demonstrate safe yield and source reliability.

Groundwater sources within the Squilchuck basin would include new wells in Section 19 and adjacent Section 24. Based on yields in nearby wells including existing Mission Ridge wells AGJ-097 and BJB-131 with reported yields up to 40 to 100 gpm, it appears that multiple wells might be needed to meet estimated MDD for the water system. WNR Group (2019) identified three prospective well locations in Section 19 and one in the vicinity of the existing ski area base in Section 24.

Diverting surface water for domestic supply is also an option; however, this would require construction of a water treatment plant. The primary surface water source within the watershed is Squilchuck Creek and its tributaries. Squilchuck and Lake Creeks are perennial streams currently used to supply water for snowmaking within the existing ski resort boundary and will also supply water for snowmaking at the Site under existing Mission Ridge water right authorizations. Surface water could also be used to supply irrigation water for the Project without the need for treatment if separate systems are constructed for irrigation and domestic water uses.

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Water supply Alternatives 1 and 2 involve using an out-of-basin source to supply a portion or all the Project's water system demand. Water supplied by CPUD would come from groundwater wells in hydraulic continuity with the Columbia River.

3.4 Legal Water Availability

In addition to physical water availability, water supply alternatives for the Project must consider legal water availability. Mission Ridge does not plan to seek a new water right appropriation to supply the Project and instead plans to use quantities authorized under water rights in its existing portfolio. There will be no enlargement of existing authorized quantities.

The Mission Ridge water right portfolio includes several water rights having places of use appurtenant to the existing ski resort and Section 19. Attributes of water rights in the Mission Ridge portfolio are summarized in Table 2. Under water supply Alternative 1, these water rights would be used to supply a portion of projected water demand for the Project's public water system estimated at up to 302 gpm (0.67 cfs) instantaneously and 241 ac-ft annually. Mission Ridge estimates that about 90 ac-ft/yr of water system demand may be available using existing water right authorizations in its portfolio authorizing domestic use and by changing some water rights. The balance of water for the Project's public water system demand (about 151 ac-ft/yr) would be supplied by CPUD.

Table 2. Mission Ridge Water Rights and Applications

Document No.	Document Type	Name	Priority Date	Source	Qi (cfs)	Qa (ac-ft/yr)	Purpose
S4-25295C	Certificate	Wenatchee Mountain Inc.	5/23/1977	Squilchuck Crk, Lake Crk, Unnamed Spring	0.45 cfs	11	Commercial (snowmaking)
S4-31615P	Permit	New Mission, LLC	8/25/1993	Squilchuck Crk, Lake Crk, Unnamed Spring	1.4 / 0.1	348 / 10	Commercial (snowmaking)/ Domestic
CS4-CCVOL3P1030	Change ROE	Mission Ridge Mountain Corporation	1/8/1993	Lake Crk	0.1 cfs	2/ 2/ 23	Community Domestic/ Irrigation of 1 acre/Snowmaking
S4-*22348J	Adjudicated Certificate	Landreth Brothers and Inland Timber Co.	1/1/1901	Stemilt Crk	70.14	-	Domestic, Stockwater
S4-*25001JC	Change Certificate	Peshastin Forest Products Corporation	1/1/1870	Unnamed Crk Sect. 19	0.1	-	Irrigation of 5 acres
R4-31616P	Reservoir Permit	Mission Ridge Mountain Corporation	8/25/1993	Squilchuck Crk, Lake Crk, Unnamed Spring	-	300 ac-ft	Storage for Snowmaking
R4-33189	Application	New Mission, LLC	5/24/2017	Squilchuck Crk, Lake Crk, Unnamed Spring	-	300 ac-ft	Storage for Snowmaking

Using the water rights shown in Table 2 to supply the Project's municipal and snowmaking demand will require some attributes to be changed to align legal water availability with Project needs. Mission Ridge intends to seek several changes to water rights. Examples of changes to water right attributes could include adding a purpose of use, changing the season of use, expanding the place of use, and adding wells as authorized points of withdrawal. In Washington State, potential impacts from every proposed water right change are evaluated and mitigated by subjecting the proposal to legal tests demonstrating that the change:

- will not result in enlargement of authorized quantities;
- will not impair any existing water rights;
- is not detrimental to the public interest; and
- will not result in a change of the water source.

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Legal availability for water supplied by CPUD is established under existing water rights authorizing its Group A community water system. Extending CPUD water service to Mission Ridge would involve expanding CPUD's water service area. Under the State's Municipal Water Law, Group A water systems may use their municipal use water rights to serve connections anywhere within an approved water service area.

Expanding artificial snowmaking to within the boundaries of the Project will not result in enlargement of existing authorized quantities.

4.0 Potential Impacts of the Proposed Development and Mitigation

This section provides a discussion of potential short-term and long-term impacts to water quantity and quality resulting from the Project and mitigation. Potential impacts can be fully mitigated through compliance with applicable regulations and standard permitting. Additional analysis will be required to meet project-specific permitting and design requirements for stormwater and wastewater facilities.

4.1 Changes to Landcover

Changes to landcover from the proposed development will consist of removal of vegetation exposing bare soil, replanting vegetation, changes to topography (cut and fill slopes), and increased impervious surfaces. With proper mitigation, these changes are not expected to result in decreased groundwater recharge, increased erosion, increased runoff, or mobilization of sediments or contaminants that could impact water resources. Proper mitigation will result in developed conditions that are expected to be consistent with pre-development conditions.

Erosion and Sediments

About one-quarter of Section 19 contains soils classified as having severe erosion hazard. The greatest potential for erosion is in areas cleared of vegetation and where bare soils are exposed during construction and during the first 1-2 years following land clearing prior to groundcover vegetation becoming fully established. Long-term erosion potential is low for areas where soils are fully stabilized following construction. Potential for onsite erosion and transport of sediments off-site during all project phases will be mitigated by:

- Minimizing ground disturbances;
- Avoiding development on steep slopes;
- Implementing Best Management Practices (BMPs) outlined Ecology's *Eastern Washington Stormwater Management Manual* (SMMEW; Ecology, 2019); and
- Complying with conditions of Ecology's Construction Stormwater General Permit (CSWGP) and Chelan County's Stormwater Management Code (SMC; Chapter 13.16).

Runoff and Recharge

About half of land surface in Section 19 is classified as soil having moderately low to moderately high drainage capacities and the balance is classified as rock outcrop having limited drainage capacity (NRCS, 2021). With proper mitigation, impacts to runoff and groundwater recharge resulting from replacement of permeable native soils with impervious surfaces including sidewalks, rooftops, and roadways are expected to be *de minimis*.

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Short-term and long-term runoff impacts will be mitigated by designing and constructing stormwater facilities in accordance with the SMMEW and SMC. These require stormwater volumes generated from new impervious surfaces during design storm events to be retained onsite. Proper implementation of flow control BMPs will limit surface water runoff volumes to pre-development levels. Implementation of stormwater infiltration BMPs will minimize impacts to groundwater recharge because stormwater runoff will be infiltrated onsite consistent with pre-development conditions.

Stormwater Quality

Long-term cumulative impacts from trace contaminants have potential to degrade surface water and groundwater quality. Stormwater runoff from new impervious pollution-generating surfaces and landscaping has potential to contain trace amounts of contaminants including heavy metals (roadways and metal roofs); petroleum hydrocarbons, polycyclic aromatic hydrocarbons, pathogens, and road salts (roadways); and phosphorous and nitrogen (runoff from landscaping).

Potential long-term water quality impacts will be mitigated by implementing stormwater treatment BMPs including properly designed and constructed stormwater infiltration facilities in accordance with the SMMEW and SMC. Proper implementation of applicable BMPs will remove target pollutants or reduce their concentrations to levels that will not adversely affect public health, beneficial uses of surface water and groundwater resources, and will not cause a violation of groundwater quality standards.

Potential short-term impacts to water quality from the Project include an unlikely worst-case scenario, such as a spill, that could result in localized release of contaminants into the environment. These impacts will be mitigated during all project phases by implementing BMPs in the SMMEW, complying with the CSWGP and SMC, and through spill response planning and coordination with local emergency management agencies.

4.2 Water Use

The projected annual total demand for the Project's public water system of 241 ac-ft/yr will be supplied by a combination of sources located within the Squilchuck basin and outside of the basin under Alternative 1. Only sources located outside of the basin would be used under Alternative 2. Because substantial water will be imported, both water supply alternatives will result in increased water availability in the Squilchuck basin for instream and out-of-stream uses including irrigation.

Most projected annual water system demand (about 231 ac-ft/yr) is expected be for indoor use at residential and commercial facilities (Table 1). Ecology has established an indoor consumptive use rate of 10 percent (Ecology, 2018). The balance of 90 percent of indoor water use (about 208 ac-ft/yr) will be processed as wastewater that will become return flow to the hydrologic system.

Return flow will consist of groundwater or surface water depending on the wastewater processing systems that will be used (see wastewater discussion below). Most return flow is expected to occur within the Squilchuck basin because most of the Project lies within that basin. A minor portion of the Project's return flow volume could enter the adjacent Stemilt Creek basin if residences planned for that area use individual OSSs.

Assuming up to 90 ac-ft/yr of the Project's water system demand will be supplied from sources located within the Squilchuck basin under water supply Alternative 1, the quantity of water

consumptively used (not returned to the Squilchuck basin) will be no more than about 18 ac-ft/yr (10 ac-ft for outdoor use + 8 ac-ft for indoor use). This quantity is equal to a continuous rate of about 0.02 cfs. By comparison, mean annual flow in Squilchuck Creek estimated at 7.5 cfs. The quantity of water that would be consumptively used is within water right authorizations owned by Mission Ridge.

Importing water from outside the Squilchuck basin will negate any consumptive use losses and augment natural water supplies. Supplying the balance of the Project's water system demand from sources located outside of the basin will result in substantial net water gain from return flows.

Under Alternative 1, CPUD would supply 151 ac-ft/yr (241 ac-ft – 90 ac-ft) for indoor water use resulting in water augmentation of about 136 ac-ft/yr (151 ac-ft x 0.90) or an average continuous rate of about 0.2 cfs. If all water for the Project's water system is supplied by CPUD under Alternative 2, water augmentation to the Squilchuck basin would increase to about 208 ac-ft/yr or 0.3 cfs continuously.

Mission Ridge is coordinating with CPUD to commission an engineering study to determine the feasibility of extending the utility's water service to the Project and identify needed improvements to mitigate any potential impacts to CPUD's water system.

Mission Ridge also plans to expand its artificial snowmaking operation to the Project site using existing water right authorizations. Benefits of snowmaking to water supplies in Squilchuck Creek are specifically recognized by the WRIA 40A Watershed Plan (Chelan County, 2007a). Snowmaking prolongs the spring freshet period by increasing water storage and increasing quantities of cold water infiltrating to groundwater. These effects benefit aquatic habitat, delay mandatory cuts to downstream irrigation rights, delay the need to release cool water from high-elevation reservoirs in the Squilchuck basin until later in the season, and result in additional inflow of cool groundwater to sustain baseflows during late season low flows.

4.3 Wastewater

As mentioned above, the volume of domestic wastewater from indoor residential and commercial uses at full buildout is estimated to total about 208 ac-ft/yr or an average rate of about 190,000 gpd. There is no existing sanitary sewer utility available to serve the Project. The preferred method of wastewater disposal will be determined through engineering study.

Alternatives for conveying, storing, treating, and disposing of wastewater include multiple individual residential OSSs discharging to groundwater, one or more Large OSS (LOSS) discharging to groundwater, and a centralized municipal wastewater treatment plant (WWTP) discharging treated effluent to surface water in Squilchuck Creek.

Contaminants in sewage effluent can include pathogens, nitrate, metals, salts, and other trace quantities of toxic materials. The alternatives listed above for disposing of wastewater from the Project are regulated by state agencies and will require permitting. When properly designed and permitted, these wastewater disposal alternatives will conform to Washington State's water quality standards and antidegradation policies for protecting groundwater and surface water under WAC 173-200 and WAC 173-201A, respectively.

Wastewater disposal alternatives involving discharge of effluent to groundwater will require permitting through DOH in coordination with Chelan-Douglas Health District (CDHD). Analysis will be required to determine minimum lot size for wastewater disposal alternatives involving multiple individual OSSs to avoid loading groundwater with contaminants. Because the estimated effluent rate for the Project exceeds 100,000 gpd, several LOSSs or a combination of a single LOSS and multiple individual OSSs would be needed.

Construction of a WWTP discharging treated effluent to Squilchuck Creek will require a National Pollutant Discharge Elimination System (NPDES) permit administered by Ecology. NPDES permits are required for all discharges to surface water bodies to set discharge limits for pollutants and monitoring and reporting requirements.

5.0 Consistency with WRIA 40A Watershed Plan

Review of the WRIA 40A Watershed Plan indicates that the proposed Project would not be in conflict with desired future conditions, opportunities, and recommendations identified by the Planning Unit. The Project is expected to result in a substantial increase of water supplied to the Squilchuck basin on a continuous basis fulfilling several objectives of the Watershed Plan.

Examples of consistency between the proposed Project and watershed planning documents include:

- The WRIA 40A Water Quantity Assessment found that much of the water used for domestic use returns as groundwater storage and baseflow and that water imported for domestic use increases water availability;
- Watershed Plan Desired Future Condition No. 7 that states “Where feasible, provide domestic water from regional water supply to support future domestic and industrial development in WRIA 40A”;
- Watershed Plan Principal Recommendation Opportunity A-6 that states “Enhance groundwater recharge and baseflow”;
- Watershed Plan Principal Recommendation Opportunity A-8 that states “Evaluate the feasibility of creating domestic water interties to increase the reliability of the drinking water supply”; and
- Watershed Plan Desired Future Condition No. 5 that states “Evaluate artificial snowmaking and reservoir construction at the Mission Ridge Winter Sports Area to determine opportunities for enhancing water delivery in terms of timing and flow in the Squilchuck Creek watershed.”

While the Planning Unit did not address water quality, the Project will be properly permitted and designed to comply with Washington State’s water quality standards and antidegradation policies for protecting groundwater and surface water.

6.0 References

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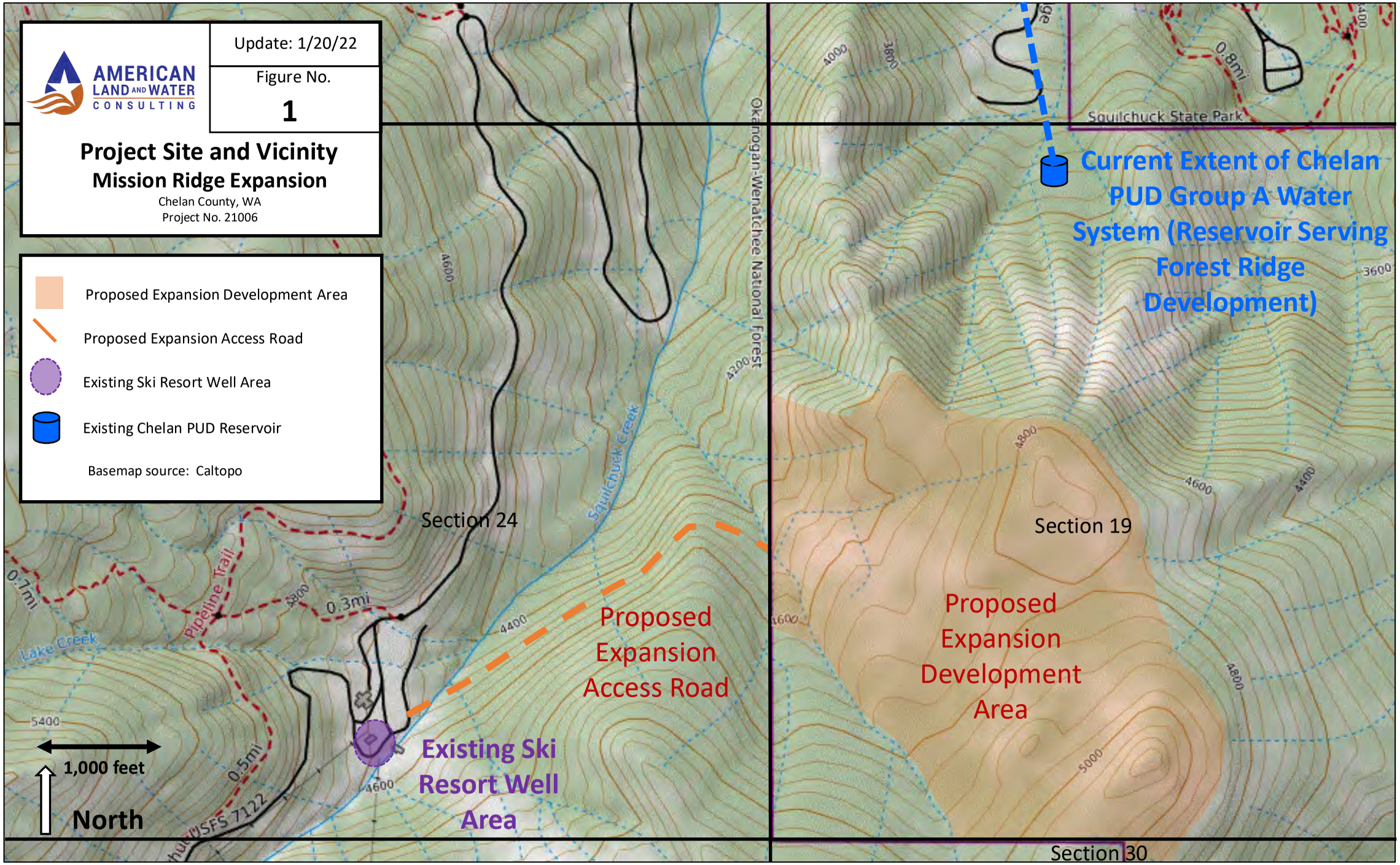
Limitations

Work for this project was performed for Mission Ridge, LLC and this report was prepared consistent with recognized standards of professionals in the project vicinity and involving similar conditions, at the time the work was performed. No other warranty, expressed or implied, is made by American Land and Water Consulting, LLC.

We appreciate the opportunity to work with you. If you have any questions, please contact Bill Sullivan at (509) 699-0682 or Bill@AmericanLW.com.


AMERICAN LAND AND WATER CONSULTING
Update: 1/20/22
Figure No.
1
Project Site and Vicinity
Mission Ridge Expansion
Chelan County, WA
Project No. 21006
Proposed Expansion Development Area
Proposed Expansion Access Road
Existing Ski Resort Well Area
Existing Chelan PUD Reservoir
Basemap source: Caltopo
Okanogan-Wenatchee National Forest
Squilchuck Creek
Squilchuck State Park
Pipeline Trail
Lake Creek
0.7mi
0.3mi
0.5mi
0.8mi
Section 24
Section 19
Section 30
Proposed Expansion Access Road
Proposed Expansion Development Area
Existing Ski Resort Well Area
Current Extent of Chelan PUD Group A Water System (Reservoir Serving Forest Ridge Development)
1,000 feet
North

APPENDIX F - WETLAND REPORTS

Wetland Reports
2023 Verification of Wetland Boundaries Memo

2024 Wetland Delineation and Stream Typing Report for Mission Ridge

2025 Mission Ridge Alternative Utility Route

ECOSYSTEMS NORTH WEST

Phone (509) 670-9918
Rriver2b@hotmail.com

October 18, 2023

MEMO: Verification of wetland boundaries

On October 17, 2023, Professional Wetland Scientists (PWS) Dennis Beich of Ecosystems North West and Suzanne Tomassi of Avia Environmental visited specific sites within the property owned by Mission Ridge in Section 9 of Township 21N, Range 20E in Chelan County. Both ecologists had visited the same area previously to document and delineate two small wetlands. The wetlands were described and rated in the Mission Ridge Wetland Delineation Report submitted to Mission Ridge and dated September 2017. Findings of the October 17th visit are described in this document.

Both of the previously delineated wetlands, referred to as Wetlands 1 and 2 in the 2017 report, were located and plants, soils, and hydrology were observed. In both wetlands, vegetative communities were consistent with those observed and reported in 2017. Soil chroma varied between the inner areas of the wetlands and in the wetland margins, but were again found to show wetland characteristics, including those of low chroma and value (mainly black (10YR 2/1)). Wetland hydrologic indicators were present in both wetlands; these include ponding marks and the presence of oxidized rhizospheres along living roots.

Flags from the 2017 delineation were no longer present, and GPS or survey points of the boundaries were not available, as they had not been collected at the time of the 2017 study. As a result, existing wetland boundaries could not be directly compared to the previously delineation. However, no indicators that the wetland boundaries have shifted measurably were noted. As well, wetland edges most often show a gradient as the features transition to upland, particularly in soil characteristics. Such transitional zones were observed in both Wetland 1 and Wetland 2 in both 2017 and during the recent site visit.

The conclusion of the October 17, 2023 site investigation is that Wetlands 1 and 2 are not substantially different presently in location, size, configuration, structure, or quality from the conditions and characteristics noted and reported in September 2017.

Dennis Beich PWS emeritus

2024 Wetland Delineation and Stream Typing Report for Mission Ridge (Ecosystems Northwest)

ECOSYSTEMS NORTH WEST

Wetland Delineation and Stream Typing Report for Mission Ridge

September 2024

Prepared for:

Josh Jorgensen, Mission Ridge

Prepared by:

Dennis Beich, PWS, Ecosystems Northwest

Project location:

Address: 7500 Mission Ridge Rd, Wenatchee, WA 98801

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1 INTRODUCTION

Ecosystems North West was contracted by Mission Ridge Ski and Board Resort to conduct a critical areas assessment within 100 feet of centerline of Chelan PUD's existing powerline (corridor) from the Forest Ridge neighborhood to the Mission Ridge parking lot. The survey area also included three locations identified for booster pump station placement. The assessment included determining the locations and ratings/types of streams and wetlands within this area, and identifying the approximate edge of the Squilchuck Creek and or the Ordinary High Water Mark (OHWM) of Squilchuck Creek in areas where it enters the 150-foot boundary. The primary purpose of the work was to identify and quantify regulatory requirements that would apply to development within the corridor, specifically installation of a buried water line and fiberoptic line to serve the proposed Mission Ridge Expansion Master Planned Resort.

The project is located on forested parcels owned by the U.S. Forest Service, Sawyer Industries LLC, Noyd, and Friends of Scout-A-Vista. All easement areas were investigated on the ground during site visits with the exception of the northernmost extent of the Noyd easement, which enters a residential area. Aerial photographs were used to assess the residential area.

Work was conducted in compliance with Chelan County Code (CCC) Chapter 11.78.

2 METHODS

2.1 Documentation

A documentation search was conducted and included local (County) inventories, the Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species (PHS) database, the National Wetland Inventory (NWI), WDFW's SalmonScape database, the Washington Department of Natural Resources (DNR) Forest Practices Application Mapping Tool (FPAMT), and Natural Resources Conservation Service (NRCS) maps.

2.2 Field Investigation

Work was performed by Professional Wetland Scientists (PWS) trained in conducting OHWM determinations by the Department of Ecology (DOE) through the WA Coastal Training Program. A reconnaissance visit was performed on June 22, 2024 and the majority of the field work was completed on June 28, 2024.

Methodology used for wetland determination was that of the U.S. Army Corps of Engineers *Wetland Identification and Delineation Manual* (Manual) and *Arid West Supplement*. Soil, hydrology, and vegetation were examined throughout the property to determine whether they fit criteria set forth in the Manual. Soils baseline information was obtained through the NRCS Web Soil Survey, and on-site investigation employed the ESDA/NRCS guidance *Field Indictors of Hydric Soils in the US: A Guide for*

Identifying and Delineating Hydric Soils, Version 8.2, 2018). Plant communities were classified in accordance with the U.S. Fish and Wildlife Service (USFWS) Cowardin classification system.

Wetland data plots were evaluated at numerous points throughout the property; data forms were completed at two of these points. The determination of the on-site portions of the OHWM of Squilchuck Creek was conducted following guidance outlined in the 2016 DOE publication: *Determining the Ordinary High Water Mark for Shoreline Management Act Compliance in Washington State: Publication No*. 16-06-029 for Points 2-5 and 8 and 15 (Appendix A). All other points were estimated using GPS and a range finder. Those points are the estimated edge of Squilchuck Creek. Since all the other points are 100 feet or over and the topography of the site is such that the OHWM would be within 2 to 3 feet of the actual OHWM. In addition, the topography of the site made it very difficult to actually reach Squilchuck Creek.

According to the DNR FPARS mapping tool, there are numerous stream segments located throughout the easement area. As this project involved a linear easement, we modified the stream typing protocol to only assess those drainages that crossed the easement or were within 150' of the easement corridor. If a drainage did cross the easement corridor or was within 150' of the easement corridor, the drainage was walked 300' upstream and 100' downstream from the centerline of the utility easement. The stream type was based on that assessment. Using this methodology and incorporating the DNR stream typing protocol there was one type "F" (Squilchuck Creek) and one type Np stream (unnamed stream labeled as stream "A" in this report). There were four "dry drainages" encountered during the survey. These drainages did not exhibit any characteristics of a stream and would not qualify as streams in the DNR typing system.

The small stream at the north end of the project site averaged 3 feet in width and due to the narrow width, it did not seem practical nor necessary to locate the left and right OHWM. This stream will need additional survey work to precisely locate its relationship to the easement and proposed work as a large portion of this stream and its buffers will be impacted by any excavation to install utilities. Chelan County uses DNR stream type maps (CCC 11.78.010.2.E), amended where needed by field investigation, conducted per the Washington Administrative Code (WAC). Stream type depends largely on fish use and flow (Table 1). Fish presence in the streams within the project area was determined per the criteria set forth in WAC 222-16-031, which consist of bankfull width, gradient, and seasonal or perennial flow. In addition, public databases of fish records and known fish barriers were considered.

Wetland boundaries and stream OHWMs were recorded using OnX GPS navigation app. The GPS unit is accurate to within 4 feet to 8 feet depending on signal strength at the time and overhead cover (forest). Wetlands were rated using the Washington State Department of Ecology (Ecology) 2014 update of the Washington State Wetland Rating System for Eastern Washington and the Chelan County Critical Area Ordinance (CCC 11.80).

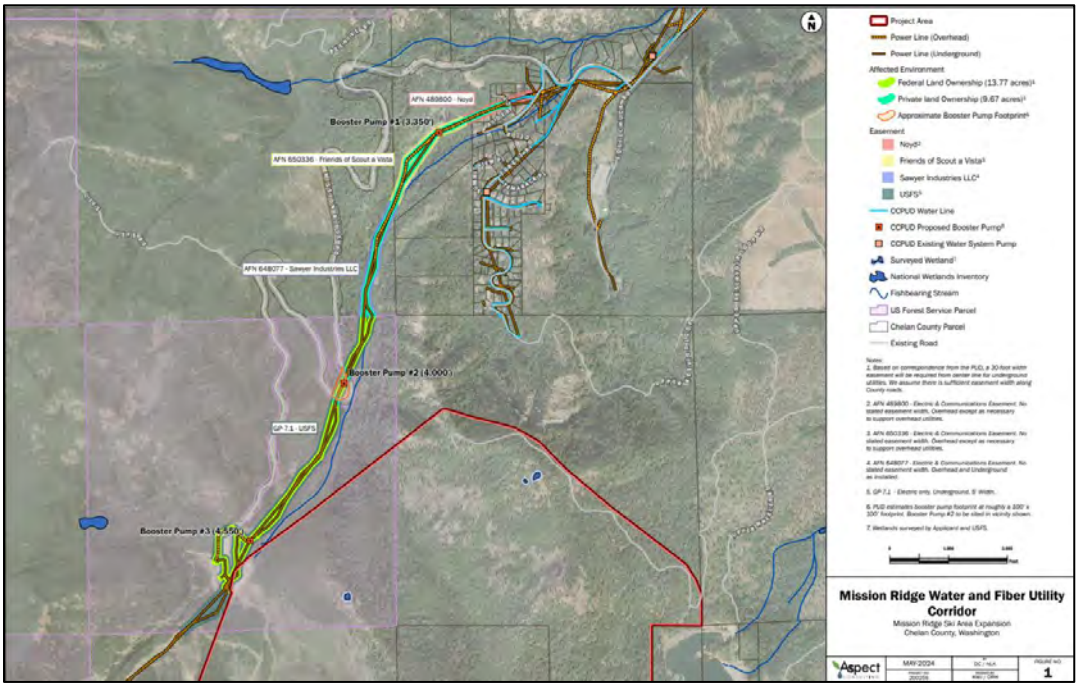
Table 1. DNR water type classifications.

Water Type	Description
Type S - Shoreline	Streams and waterbodies that are designated “shorelines of the state” as defined in chapter 90.58.030 RCW.
Type F - Fish	Streams and waterbodies that are known to be used by fish, or meet the physical criteria to be potentially used by fish. Fish streams may or may not have flowing water all year; they may be perennial or seasonal.
Type Np – Non-fish perennial	Streams that have flow year-round and may have spatially intermittent dry reaches downstream of perennial flow. Type Np streams do not meet the physical criteria of a Type F stream. This also includes streams that have been proven not to contain fish using methods described in the Forest Practices Board Manual.
Type Ns – Non-fish seasonal	Streams that do not have surface flow during at least some portion of the year, and do not meet the physical criteria of a Type F stream.

3 PROPERTY DESCRIPTION

The subject property is zoned for commercial forest and rural residential/resource. Present development with the investigation area includes underline power lines, overhead power lines, poles, and associated booster pumps, which are accessed by an informal trail. Approximately 75% of the lines are underground, with the remaining overhead lines located at the north end of the corridor. The Scout-A-Vista boy scout camp is located partially within the corridor near the north end. The north and south ends of the corridor are bordered by Mission Ridge Road and a gravel parking lot associated with the Mission Ridge Ski report to the north and south, respectively. Figure 1 depicts the corridor and its features.

Figure 1. Study area (Source: Chelan County).



The south end of the corridor is at approximately 4,600 feet elevation and declines to 3,300 feet at the north end. Topography of the surrounding area is steep, rising to 6,853 feet at Mission Peak, located approximately 2.1 miles southwest of the south end of the corridor. The area of investigation runs generally downslope, west of and parallel to Squilchuck Creek. Squilchuck Creek is within a very steep ravine; it is not designated as a Shoreline of Statewide Significance by the Chelan County Shoreline Management Program. The creek and other critical features of the site are presented in detail in the following sections of this report.

The greater vicinity is primarily zoned for commercial forestland, rural residential/resource, and rural public; the Forest Ridge Subdivision is about 0.2 miles east of the corridor and is zoned rural recreational/residential. The property is accessed via Mission Ridge Road.

4 FINDINGS

The entire study area except for the boy scout camp, wetland, and small booster pump and trail footprint is densely vegetated. Conifer dominated forest and the riparian zone of Squilchuck Creek make up the habitat adjacent to both sides of the central corridor. Dominant species are ponderosa pine (*Pinus ponderosa*), Douglas fir (*Pseudotsuga menziesii*), and western larch (*Larix occidentalis*). The riparian zone of Squilchuck Creek supports a dense community of native shrubs, including vine maple (*Acer circinatum*), mountain ash (*Sorbus* sp.), Scouler's willow (*Salix scouleriana*), and serviceberry (*Amelanchier alnifolia*). The corridor was previously cleared to install the below-ground powerlines and is presently maintained in a dense shrub and herbaceous community dominated by thimbleberry (*Rubus*

parviflorus), oceanspray (*Holodiscus discolor*), mountain-lover (*Paxistima* sp.), giant red Indian paintbrush (*Castilleja miniata*), and angelica (*Angelica* sp.) below the above-ground lines. All plant species observed in the study area are listed in Table 2.

Table 2. Plant species observed on the study property.

Common name	**Scientific name**
Ponderosa pine	*Pinus ponderosa*
Douglas fir	*Pseudotsuga menziesii*
Western larch	*Larix occidentalis*
Vine maple	*Acer circinatum*
Mountain ash	*Sorbus* sp.
Bitter cherry	*Prunus emarginata*
Scouler's willow	*Salix scoulriana*
Coyote willow	*Salix exigua*
Serviceberry	*Amelanchier alnifolia*
Nootka rose	*Rosa nutkana*
Oceanspray	*Holodiscus discolor*
Nootka rose	*Rosa nutkana*
Mountain-lover	*Paxistima* sp.
Thimbleberry	*Rubus parviflorus*
Bitter cherry	*Prunus emarginata*
Meadowsweet	*Spiraea* sp.
Currant	*Ribes* sp.
Giant red Indian paintbrush	*Castilleja miniata*
Lupine	*Lupinus* sp.
Showy aster	*Euybia conspicua*
Angelica	*Angelica* sp.
Field horsetail	*Equisetum arvense*
Columbian monkshood	*Aconitum columbianum*
Panicled bulrush	*Scirpus microcarpus*
Bigleaf sedge	*Carex amplifolia*
Large-leaved avens	*Geum macrophyllum*
Common spikerush	*Eleocharis palustris*
Cinquefoil	*Potentilla* sp.
Cattail	*Typha latifolia*
Duckweed	*Lemna minor*
Grasses	*Poa* spp.

4.1 Streams

4.1.1 Squilchuck Creek

The field form used to establish and describe the OHWM of Squilchuck Creek is included as Appendix B of this report. The creek runs in a very steep ravine with dense riparian vegetation and abundant downed trees and woody debris (Figure 2). Two gabion baskets are present in the creek near the south end of the study area, approximately 25 feet from one another (See Appendix A, Map 1, Point 3). The upstream basket has two corrugated plastic pipes, but water was flowing over the structure and not through the pipes (Figure 3). The WDFW SalmonScape database depicts these as "total fish passages barriers." Two additional total fish barriers occur downstream of the study area before the creek drains to Miners Run Creek. No other instream structures were observed. The OHWM of Squilchuck Creek is clearly delineated throughout the study area by channel scour, clean boulders and cobble, bank erosion, exposed roots, and debris.

Figure 2. Squilchuck Creek.

Squilchuck Creek is not a designated shoreline by Chelan County. It is a Type F stream where it flows within the study area. The State DNR hydrography database designates the on-site creek reaches as fish-bearing. The WDFW PHS database reports the occurrence/migration of rainbow trout (*Oncorhynchus mykiss*) in Squilchuck Creek. Salmonscape reports only an unspecified "all Salmonscape species" occurrence but does not indicate the presence of any individual salmon runs or species. The entire area is within the Evolutionarily Significant Unit (ESU) for Chinook and the Distinct Population Segment (DPS) for steelhead, although neither of these species actually occur in Squilchuck Creek.

Figure 3. Gabion basket with corrugated plastic pipes in Squilchuck Creek.

Notably, most sources, including SalmonScape, PHS, NWI, the DNR Forest Practices Application Mapping Tool, and Chelan County GIS mapping depict Squilchuck Creek incorrectly throughout the study area. These sources show Squilchuck Creek draining directly into the wetland described in Section 4.2 (see, for example, Figures 6 and 8). This is in contrast to what was observed in the field as, depicted in Map 4, Appendix A. Squilchuck Creek is east of the wetland and no above-ground hydrologic connection was observed, despite high flows.

4.1.2 Stream A

A second, unnamed stream is present in the study area and is referred to in this report as Stream A. It originates in a seep west of the corridor near Point 15 (see Appendix A, Map 2) approximately 1 mile north of the south corridor end and runs adjacent to or within the corridor for approximately 2,400 feet. The Stream A data points are labeled A through Q on Map 3 in Appendix A. The stream was flowing at the time of the June 28, 2004 site visit (Figure 4). The complete OHWM field form is included as Appendix C of this report. The OHWM is easily discernable by the lack of accumulation of sediment within the channel, the distinct bank along the channel, and the change in vegetation at OHWM. While the DNR and NWI databases depict tributary streams in topographic drainages along the Squilchuck, it is

unclear whether this Stream A is included. These sources are not accurate at the scale of the corridor and most tributary lines are simply located in topographic drainages.

In addition to Stream A, four dry drainages were observed, none of which showed any evidence of flow this year or in recent history.

Figure 4. Stream A.

Stream A splits just before entering a ponded wetland at the Scout-A-Vista camp near the north end of the corridor (see Section 4.2). A portion of the stream flows directly into the wetland and another portion runs north along a dirt road and then enters the wetland via a small culvert beneath a dirt road and what appears to be a manmade ditch lined by small boulders direct the water toward the pond (Figure 5). Aerial photographs spanning from 1998 to 2024 and taken from spring through autumn months show a largely consistent water level in the wetland pond. This, along with the NWI classification of Permanently Flooded (Section 4.2), implies that Stream A is permanently flowing and would be categorized as a type Np stream.

Figure 5. Stream A channeled to wetland.

4.2 Wetlands

The NWI database depicts one ponded wetland and several riverine wetlands within the study area (Figure 2). However, wetland characteristics were not present outside of the OHWM of the streams. Thus, one wetland was identified, rated, and located by GPS (Appendix A, Map 5). The Cowardin classification assigned by NWI for the wetland is Palustrine Unconsolidated Bottom, Permanently Flooded, Diked/Impounded (PUB Hh) (Figure 6). The designation given to the wetland is consistent with what was observed in the field. NWI depicts Squilchuck Creek (inaccurately, as described in Section 4.1.1) and a tributary that appears to be Stream A (Section 4.1.2) as riverine wetlands.

The on-site wetland is approximately 0.5 ac, the majority of which was ponded during the June 28 site visit (Figure 7); soils in the remainder of the area were saturated to the surface and the water table visible at 4-12 inches. Other Cowardin *et al.* (1979) classes in the wetland are shrub-scrub, emergent plants, and aquatic vegetation. The dominant woody species is coyote willow (Salix exigua), and herbaceous species include panicled bulrush (*Scipus microcarpus*), cattail (*Typha latifolia*), and common spikerush (*Eleocharis palustris*). Duckweed (*Lemna minor*) is the predominant aquatic species.

Figure 6. National Wetlands Inventory map of onsite wetland.

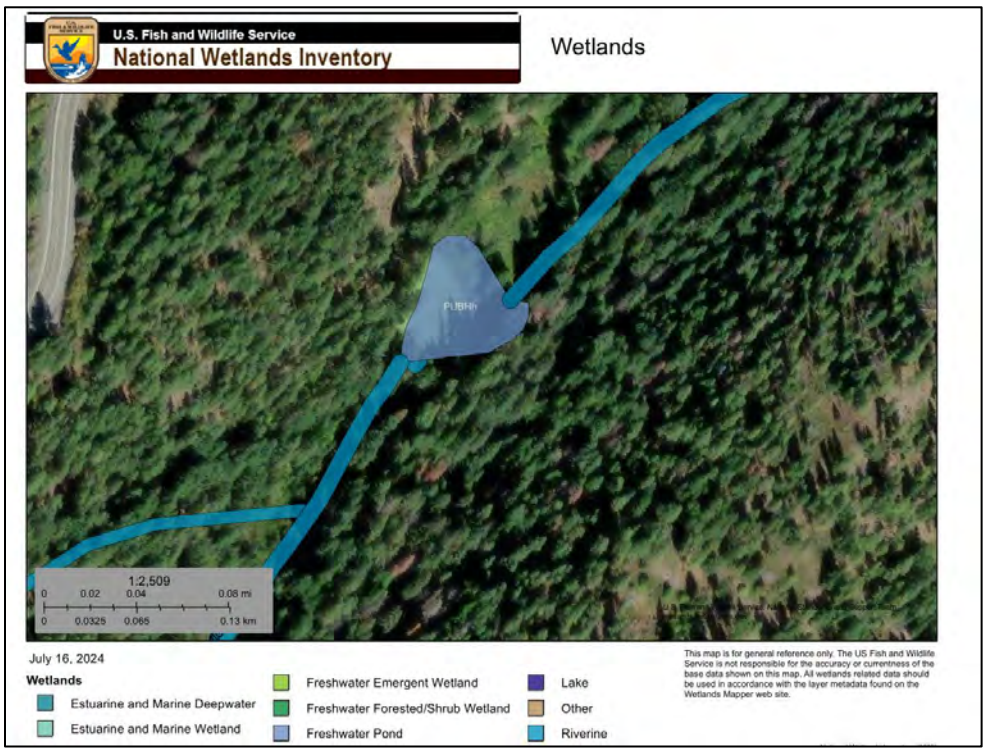
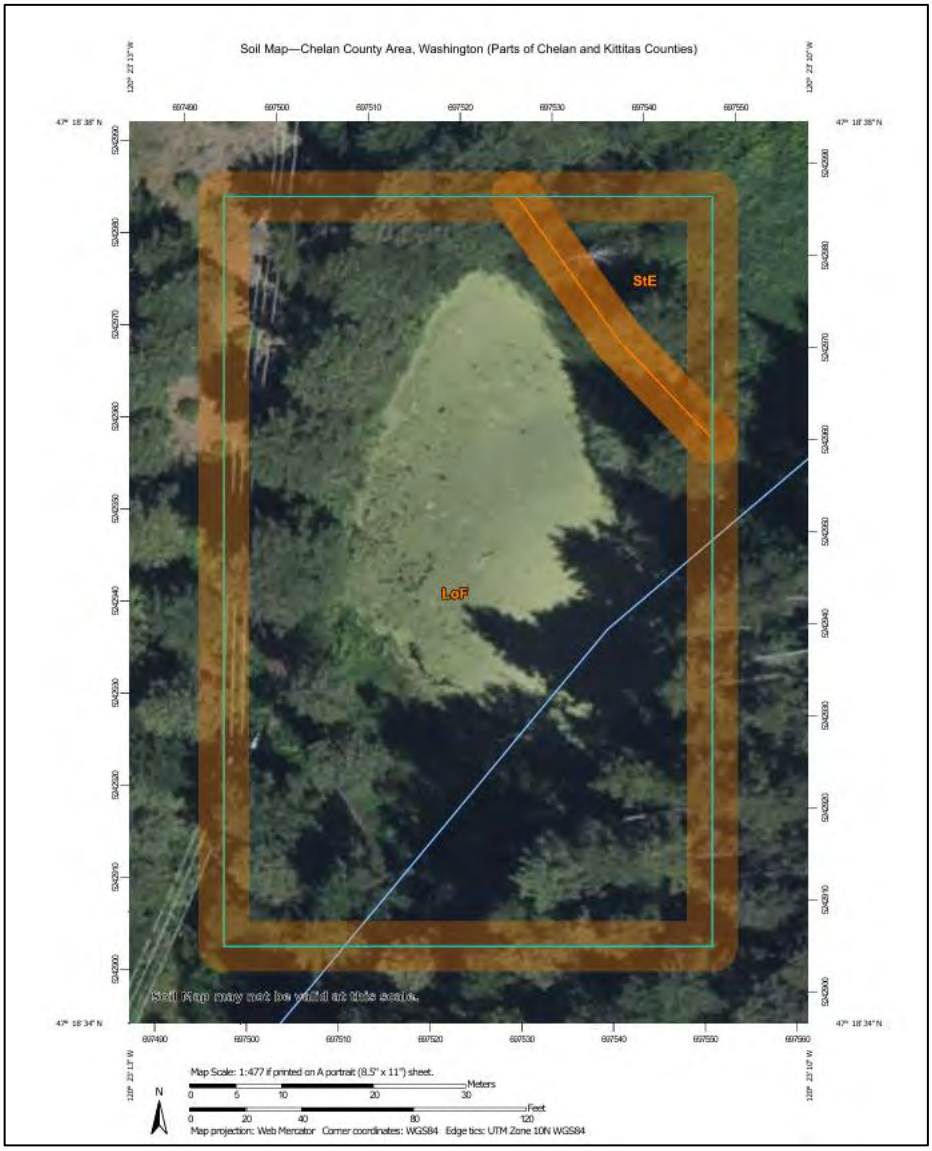


Figure 7. On-site wetland.

Soils in the wetland ranged from very dark gray (10YR 3/1) in the upper 4-inch stratum to black (10YR 2/1) silt loam with distinct yellowish brown (10YR 5/6) redoximorphic features. The USDA Soil Survey for the area indicates the possible presence of two soil units in and immediately adjacent to the wetland. The unit attributed to the wetland is Loneridge very stony loam, 25 to 65 percent slopes (LoF); along the northeast edge of the wetland may include Stemilt silt loam, 25 to 45 percent slopes (StE) (Figure 8).

Figure 8. NRCS map of onsite wetland.



Wetland hydrology is supported mainly by input from Stream A and groundwater. As described in previous sections, an above-ground hydrologic connection to Squilchuck Creek was not observed. There appears to be a man-made berm at the north end of the wetland and water drains to the north through a highly constricted outlet. Wetland Determination Data Forms are included as Appendix D.

The wetland rates as Category III with a high (8 points) habitat score on the wetland rating form for Eastern Washington (Appendix E). The undeveloped nature of the buffer and landscape limit the

wetland's potential to improve water quality; hydrologic function is limited by the same features, although significant ponding provides both water quality and storage value. Habitat function is enhanced by the condition of the buffer and surrounding area, which is largely intact forest. While the wetland itself is small and only moderately diverse in plant communities and species, it supports native species including emergent vegetation, is adjacent to a permanently flowing stream, has permanent ponding, and has at least one large snag and downed wood.

4.3 Upland

Habitat outside of the described wetland and streams is, as previously stated, mostly intact mid-age coniferous forest. Evidence of deer, bear, coyote, and woodpeckers and many other birds were noted during site visits. Snags and downed logs are numerous. Disturbance is limited to the previously cleared corridor and informal access trail, adjacent stretches of Mission Ridge Road, Mission Ridge Ski Resort off-site to the south, and the seasonally occupied Scout-A-Visit Camp.

Approximately one mile at the north end of the right-of-way (where power poles carry the electric utility line) is maintained in low woody and herbaceous vegetation (Figure 9). The remainder of the easement where the power utility line is buried is not maintained. See Table 2 for a full list of species observed during site visits.

Figure 9. Maintained right-of-way beneath power poles.

4.4 Priority Habitats and Species

The WDFW PHS database depicts shrub-steppe occurrences in the area around Mission Ridge Ski Resort, and one on the Scout-A-Vista property. The PHS database does not indicate the presence of wetlands along the streams, nor does it include the onsite wetland. Rainbow trout occurrence/migration is documented in Squilchuck Creek, as noted in Section 4.1.1.

Other PHS occurrences are "masked," meaning that precise locations are not made available publicly. These occurrences are northern spotted owl and gray wolf. One or more spotted owl records are noted for the greater area, including the study site, and one or more gray wolf records are depicted in the township/range/sections from the study area westwards. Cornell University's "eBird.org" database of public contributions also masks data, collected from both professionals and casual bird enthusiasts; these data indicate sightings of spotted owls beginning approximately 5 miles west of the study area. None of the four Chelan County wolf packs formally documented by WDFW have been observed in or proximate to the study area. Table 3 summarizes all PHS occurrences.

Table 3. PHS occurrences in the project vicinity.

Common name (stock)	Scientific name	Stock status	Federal status	State status
Rainbow Trout	*O. mykiss*	Resident	N/A	N/A
Northern Spotted Owl (masked)	*Strix occidentalis*	N/A	Threatened	Endangered
Gray wolf (masked)	*Canis lupus*	N/A	Endangered	Endangered
Shrub-steppe (general locations)		N/A	N/A	N/A

None of the sensitive species listed or those typically associated with forested and riparian habitat were observed during the site visits. In addition, there was no shrub steppe associated with any portion of the easement.

5 REGULATORY IMPLICATIONS

5.1 Local Regulations

5.1.1 Wetlands

Chelan County regulates wetlands through CCC 11.80, Wetland Areas Overlay District. Wetland buffers are determined based on the wetland category associated with the wetland. Buffer widths also vary depending on the intensity of planned land use. Some exemptions apply to standards regulations, including some passive, educational, maintenance, and noxious species control uses (CCC 11.80.020).

The wetland's rating of Category III with 8 habitat points requires a standard buffer of 100, 150, 200 feet, depending on whether the proposed adjacent action is low, moderate, or high impact, respectively

(CCC 11.80.060(4)Table 1). Utility facilities would likely be considered a low impact use (CCC 14.98.1920).

Regulatory buffers are required to be maintained in their natural condition. Buffer widths may be modified only when approved by the County and pursuant to the conditions in CCC 80.11.070. Under this code provision, the applicant must demonstrate:

"(1) That width averaging will not degrade the wetland structure, function and values; and

(2) The total area contained within the wetland buffer after averaging is no less than that contained within the wetland buffer, outlined by the requirements of this chapter, prior to averaging. The revised wetland buffer width shall not be less than seventy-five percent of the wetland buffer widths outlined within this chapter, or be less than twenty-five feet, whichever is greater; and

(3) Failure to adjust the buffer would result in a hardship to the property owner; and

(4) The need for buffer averaging is not due to the landowner's own actions; and

(5) That low-intensity land uses would be located adjacent to areas where buffer width is reduced, and that such low-intensity land uses are guaranteed in perpetuity by covenant, deed restriction, easement, or other legally binding mechanism; and

(6) A wetland report pursuant to CCC 11.80.100, if required by the administrative authority, supporting the newly delineated wetland buffer, has been prepared and submitted."

The County administrator may increase the required buffer if it is determined that a wider buffer is needed to protect a wetland (CCC 80.11.090). Buffer widths may be varied by the County on lots, tracts, and parcels legally created prior to January 5, 1999, provided the applicant can demonstrate that standard requirements significantly interferes with reasonable use of the property, the need for variance is not the result of the applicants own actions, the shoreline environment (if applicable) will not be impacted, the project is compatible with the Chelan County Comprehensive Plan and Shoreline Master Program, and the public will not be negatively impacted (CCC 11.80.090).

Buffer reduction may be no greater than 50% of the standard, and may not be less than 25 feet for Category III wetlands. The County administrator may require a mitigation plan to be implemented to avoid or compensate for any buffer impacts.

Wetlands are also regulated by the U.S. Army Corps of Engineers (Corps) under section 404 of the Clean Water Act. Any filling of Waters of the State, including wetlands (except isolated wetlands), would likely require notification and permits from the Corps. The on-site wetland would likely not be considered isolated by the Corps. Federally permitted actions that could affect endangered species may also require consultation with the U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service.

5.1.2 Streams

Squilchuck Creek

Squilchuck Creek does not fall within the Chelan County Shoreline jurisdiction and therefore does not have a shoreline designation. It's categorization as a Type F water requires a regulatory buffer of 150 or 200 feet, depending on whether planned use is low intensity or high intensity (Table 4). High intensity land uses include, but are not limited to, medium and high density residential, multifamily residential, active recreation, and commercial and industrial uses; low intensity uses include single-family residential and related accessory structures and home occupational uses, agriculture uses, and forest management uses.

Table 4. Chelan County required standard riparian buffer widths.

Stream Type	High Intensity Land Use (feet)	Low Intensity Land Use (feet)
Type S Waters	*Depends on shoreline designation	*Depends on shoreline designation
Type F Waters	200	150
Type Np Waters	150	100
Type Ns Waters	50	50

*See Chelan County Shoreline Master Program

Stream A

Type Np waters require 100- or 150-foot buffers for low intensity and high intensity land uses, respectively.

Per CCC 11.78.040, all structures and activities must be located outside of riparian buffers unless specifically permitted. Permitted activities include access and view corridors with specific conditions applied, and some modifications to existing structures. Other activities and structures require a habitat management and mitigation plan (CCC 11.78.060).

Buffer modifications in the form of a reduction by no more than 25% of the standard width may be permitted in legally created lots, tracts, and parcels, subject to the provisions in CCC 11.78.040(3)C. Provisions require that adherence to the standard buffer would create a hardship to reasonable use of the lot; no detrimental impacts to habitat functions or the public interest would result; and no feasible alternatives exist. Buffer widths may be increased on a case-by-case basis as determined by the administrator when a larger buffer is necessary to protect habitat functions and values.

Please note that the findings of this report are subject to the verification and agreement of local, State and/or federal regulatory authorities.

6 REFERENCES

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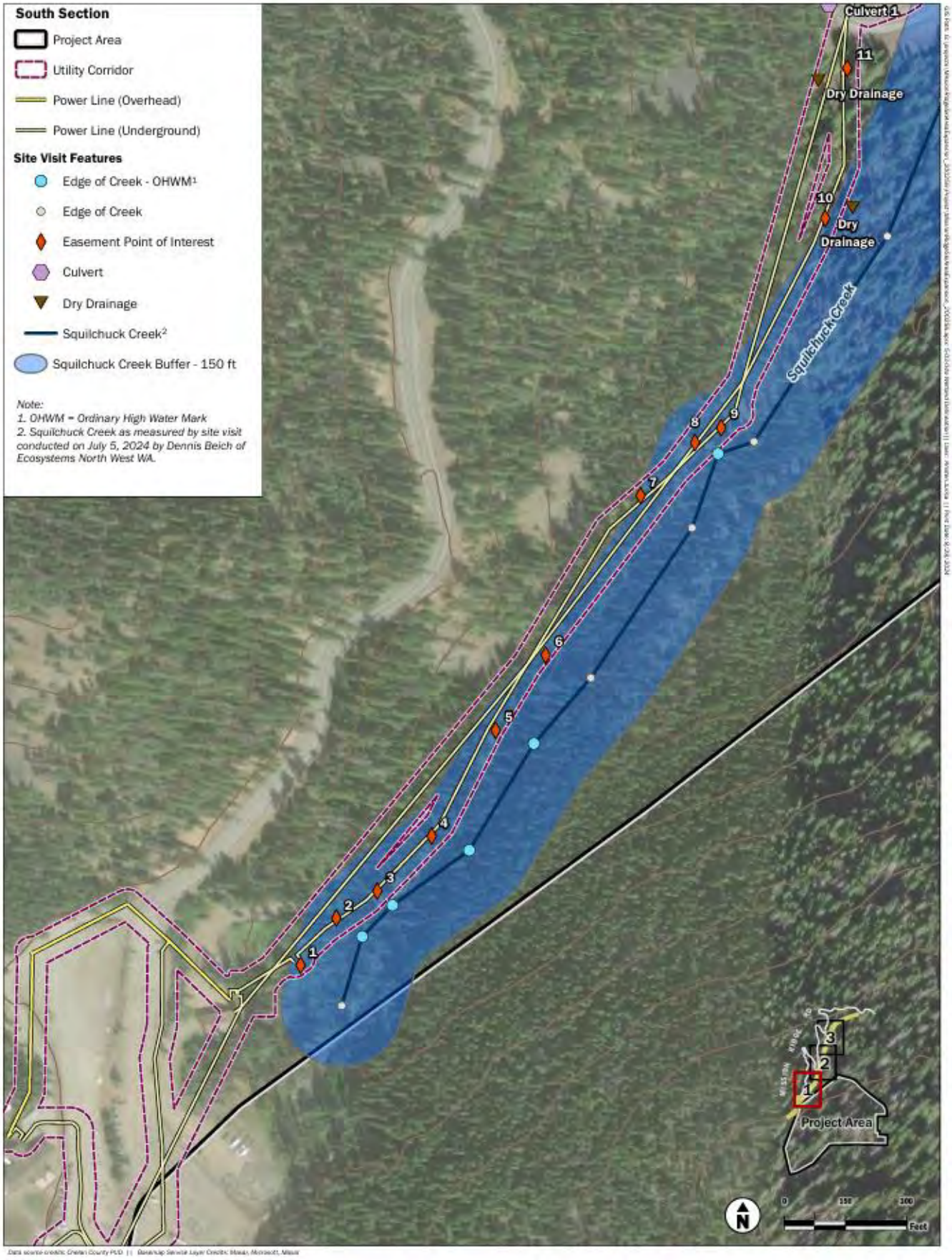
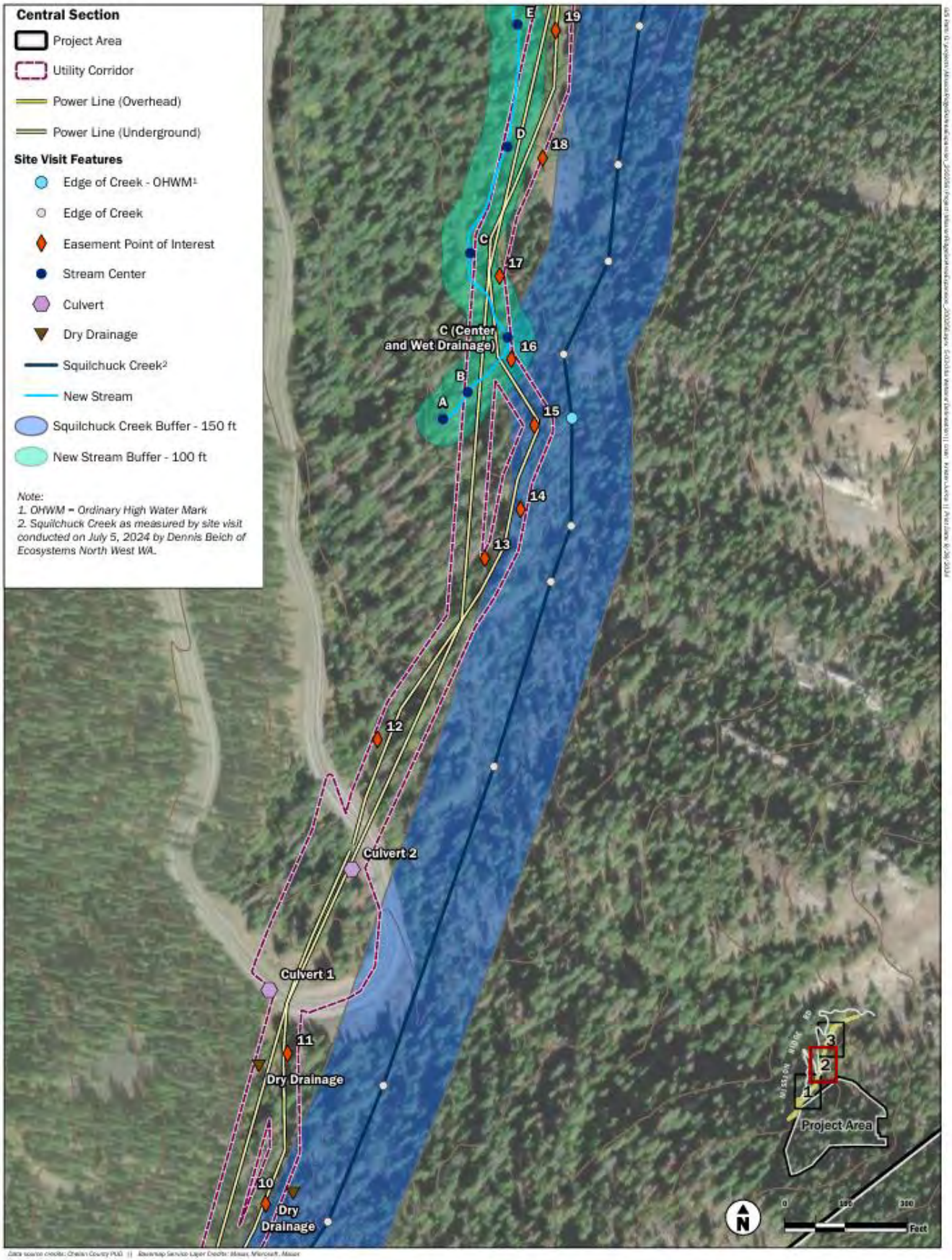
APPENDIX A

Wetland and Streams Maps

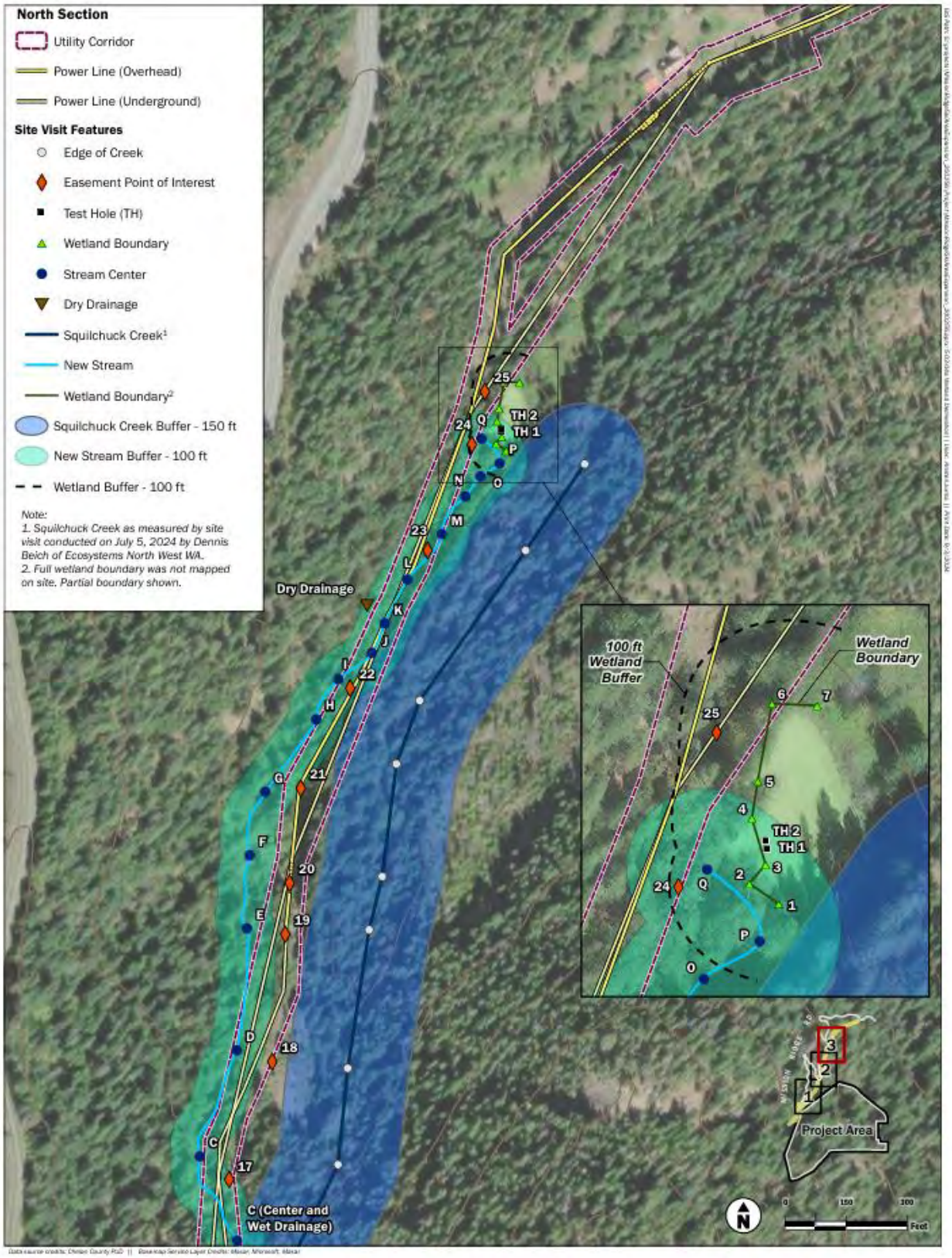
Map 1


South Section
Project Area
Utility Corridor
Power Line (Overhead)
Power Line (Underground)
Site Visit Features
Edge of Creek - OHWM1
Edge of Creek
Easement Point of Interest
Culvert
Dry Drainage
Squilchuck Creek2
Squilchuck Creek Buffer - 150 ft
Note:
1. OHWM = Ordinary High Water Mark
2. Squilchuck Creek as measured by site visit conducted on July 5, 2024 by Dennis Beich of Ecosystems North West WA.
Culvert 1
11
Dry Drainage
10
Dry Drainage
Squilchuck Creek
1
2
3
4
5
6
7
8
9
Project Area
N
0
150
300
Feet

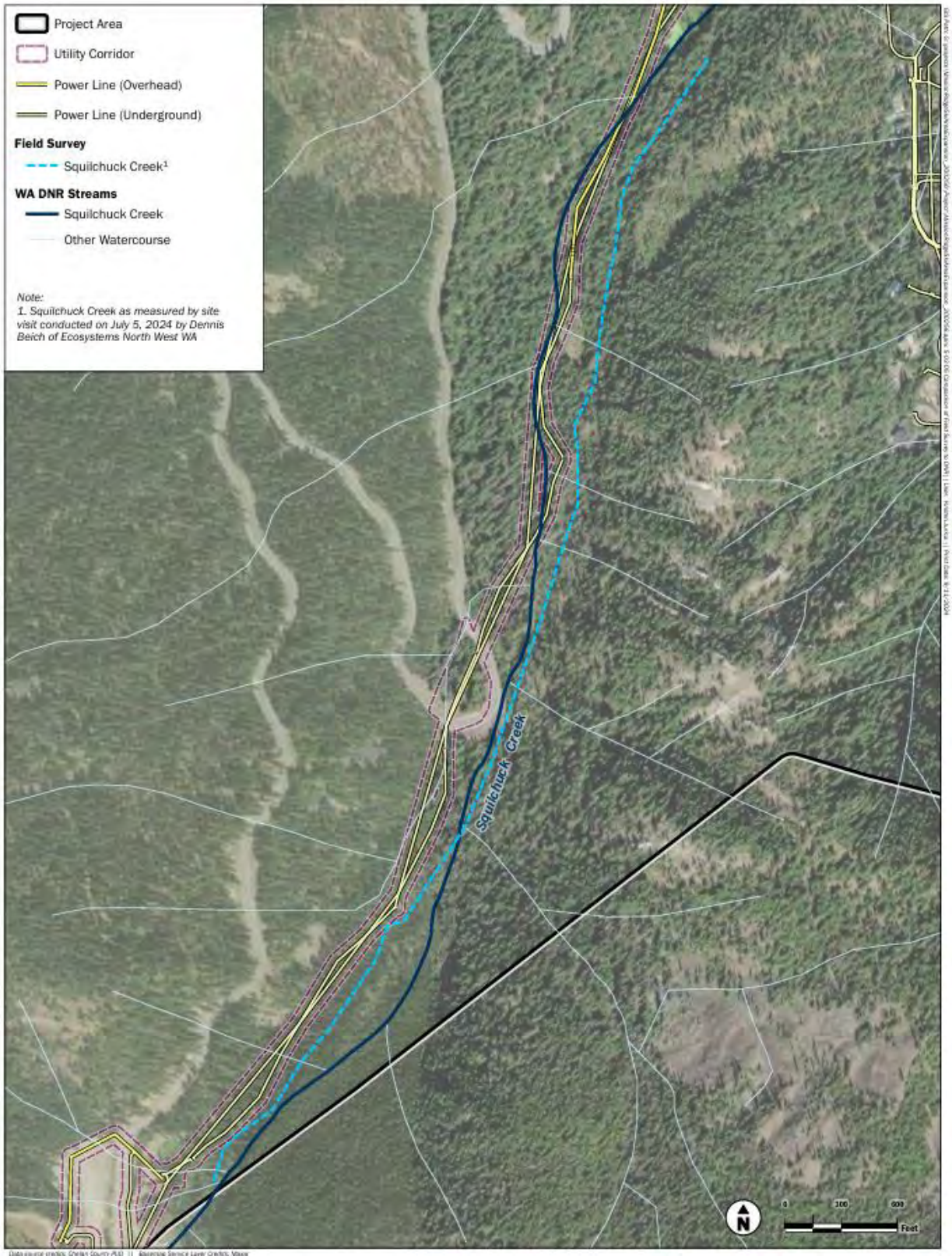
Map 2


Central Section
Project Area
Utility Corridor
Power Line (Overhead)
Power Line (Underground)
Site Visit Features
Edge of Creek - OHWM[1]
Edge of Creek
Easement Point of Interest
Stream Center
Culvert
Dry Drainage
Squilchuck Creek[2]
New Stream
Squilchuck Creek Buffer - 150 ft
New Stream Buffer - 100 ft
Note:
1. OHWM = Ordinary High Water Mark
2. Squilchuck Creek as measured by site visit conducted on July 5, 2024 by Dennis Beich of Ecosystems North West WA.
E
19
D
18
C
17
C (Center and Wet Drainage)
16
B
A
15
14
13
12
Culvert 2
Culvert 1
11
Dry Drainage
10
Dry Drainage
3
2
1
Project Area
N
0
150
300
Feet

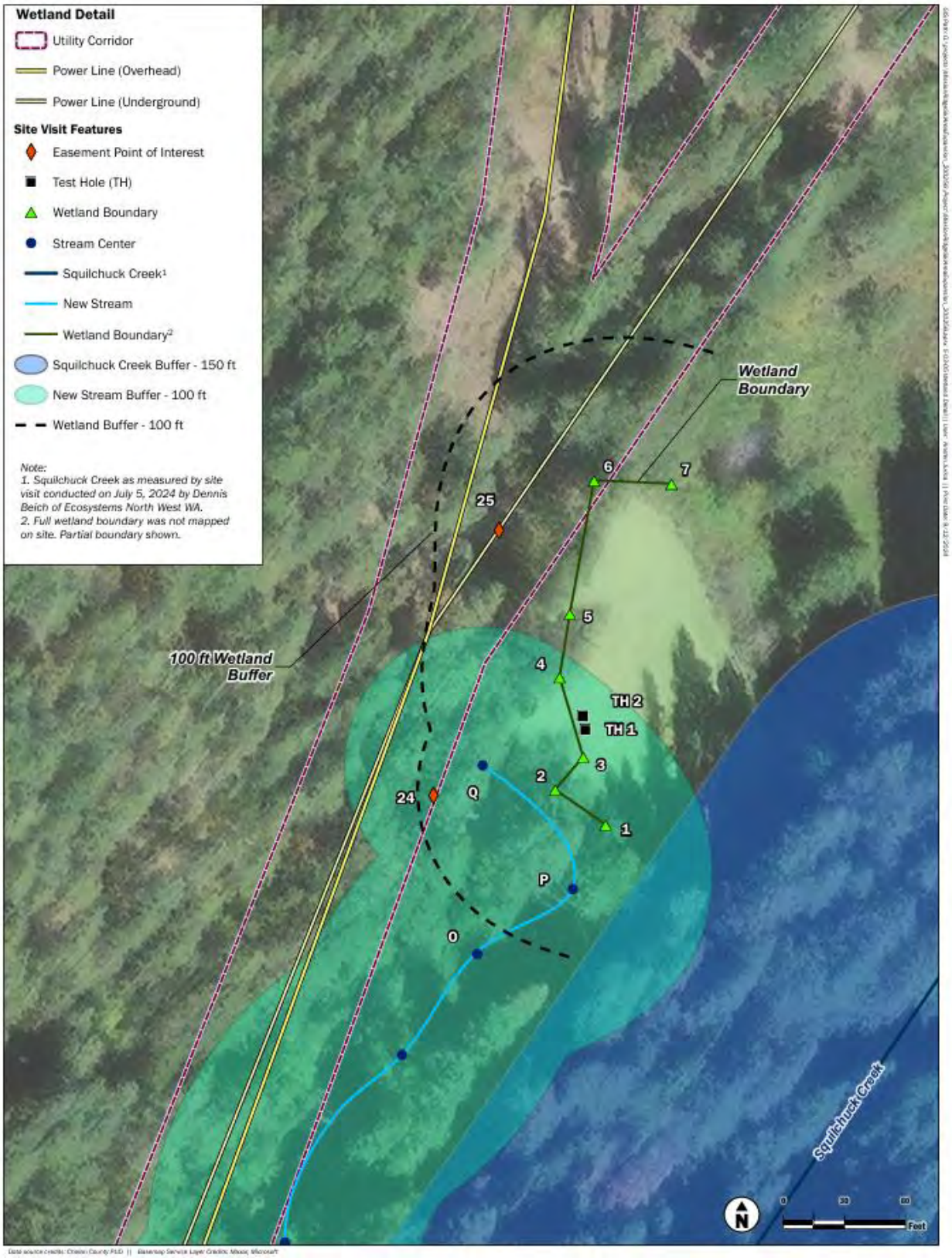
Map 3


North Section
Utility Corridor
Power Line (Overhead)
Power Line (Underground)
Site Visit Features
Edge of Creek
Easement Point of Interest
Test Hole (TH)
Wetland Boundary
Stream Center
Dry Drainage
Squilchuck Creek[1]
New Stream
Wetland Boundary[2]
Squilchuck Creek Buffer - 150 ft
New Stream Buffer - 100 ft
Wetland Buffer - 100 ft
Note:
1. Squilchuck Creek as measured by site visit conducted on July 5, 2024 by Dennis Beich of Ecosystems North West WA.
2. Full wetland boundary was not mapped on site. Partial boundary shown.
Dry Drainage
C (Center and Wet Drainage)
100 ft Wetland Buffer
Wetland Boundary
TH 2
TH 1
Project Area
Feet

Map 4


Project Area
Utility Corridor
Power Line (Overhead)
Power Line (Underground)
Field Survey
Squilchuck Creek[1]
WA DNR Streams
Squilchuck Creek
Other Watercourse
Note:
1. Squilchuck Creek as measured by site visit conducted on July 5, 2024 by Dennis Beich of Ecosystems North West WA
Squilchuck Creek
N
0
300
600
Feet

Map 5


Wetland Detail
Utility Corridor
Power Line (Overhead)
Power Line (Underground)
Site Visit Features
Easement Point of Interest
Test Hole (TH)
Wetland Boundary
Stream Center
Squilchuck Creek[1]
New Stream
Wetland Boundary[2]
Squilchuck Creek Buffer - 150 ft
New Stream Buffer - 100 ft
Wetland Buffer - 100 ft
Note:
1. Squilchuck Creek as measured by site visit conducted on July 5, 2024 by Dennis Beich of Ecosystems North West WA.
2. Full wetland boundary was not mapped on site. Partial boundary shown.
Wetland Boundary
100 ft Wetland Buffer
25
24
6
7
5
4
TH 2
TH 1
3
2
1
Q
P
O
Squilchuck Creek
N
0
30
60
Feet

APPENDIX B

Squilchuck Creek OHWM Data Form

Field Data Form

General Information

Site/Project Name/Owner:
Mission Ridge Ski Resort

Location: Parcel 211924000000

Description: OWHM of Sqilchuck Creek

The following field form is for use in the field to help in making ordinary high water mark delineations on streams. The form should be used as a guide. A team consisting of a hydrologist/ geomorphologist and a biologist may be needed to accurately determine the ordinary high water mark.

General Observations: Day of Site Visit

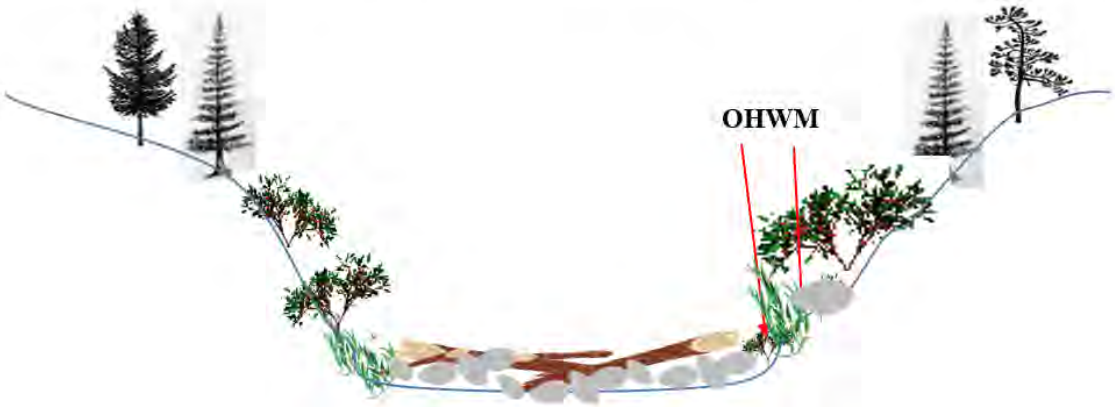
Date of site visit:	June 26, 2024			
Time of site visit:	9:00			
Weather conditions:	Hot (90F), sunny			
Watershed development:	Highly developed ❍		Mod. Developed ❍	Undeveloped ●
Reach development:	Highly developed ❍		Mod. Developed ❍	Undeveloped ●
Recent site disturbance?	No ●	Yes ❍	Describe:	
Upstream flow control devices?	No ●	Yes ❍	Describe:	
Bank armoring at the site?	No ●	Yes ❍	Describe:	
Bank armoring up or downstream?	No ●	Yes ❍	Describe:	
Observable tidal backwater?	No ●	Yes ❍		
In-water structures? (i.e. bridge pilings, railroad embankments)	No ❍	Yes ●	Describe: 2 gabion baskets	
Animals grazing in riparian zone?	No ●	Yes ❍	Describe:	
Observable beaver activity?	No ●	Yes ❍	Describe:	

Complete Vegetation Transects

- Use guidelines in Chapter 4 to complete vegetation transects.
- Determine upper and lower bounds of the OHWM from vegetation transects.
- After completing vegetation transects, look for more field indicators near the upper and lower bounds of the OHWM. Use the checklist as guidance.

Sketch

If a simple site, sketch a cross-sectional diagram of the site below. Include location of the waterway and upper and lower bounds of the OHWM defined by the vegetation communities or other OHWM indicators. Page 3 of the data form can be used for more complex sketches.



Additional Indicators

Check the indicators that are observable at the site that provide rationale for establishing the OHWM at this location. The rationale should be described in detail in the report and should be supported with photographs taken during the site visit.

	Soil and geomorphic indicators [1]	Vegetative indicators [2]	Other indicators
Below OHWM	○ Sediment bars ○ Scour line ○ Clean cobbles/boulders ○ Bank erosion/scour ○ Lack of soil horizons	Vegetation tolerant of inundation or high flow disturbances such as: ○ Willows ○ Black cottonwood ○ Japanese knotweed ○ Skunk cabbage ○ Aquatic plants	○ Exposed roots/root scour ○ Drainage patterns, as shown by flattened vegetation ○ Aquatic animals ○ Algal mats ○ Iron staining

[1] Refer to Chapter 4 for a more complete description of indicators.

[2] Species are provided as examples. Refer to Appendix B for a more complete listing of plant species and their distribution across the OHWM gradient. Some species occur in more than one category depending on site conditions. For example Indian plum and red alder may straddle the OHWM where soil drainage is high. They may occur above OHWM were soil drainage is low to moderate.

	Soil and geomorphic indicators [1]	Vegetative indicators [2]	Other indicators
At or straddling OHWM	☒ Top of bank ○ Toe of lowest terrace (if terrace has developed horizons which may include a duff layer and A and B horizons versus freshly deposited alluvium) ○ Benches	○ Willows ○ Western red cedar ☒ Vine maple (streams) ○ Black cottonwood ☒ Red alder ○ Salmonberry ○ Nootka rose ○ Maidenhair and lady fern ○ Blackberries ○ Dunegrasses	○ Sediment lines on vegetation or other fixed objects ○ Change from channel deposits to older alluvium. ☒ Darker stain lines on fixed objects ☒ Exposed roots/root scour. ○ Drainage patterns, as evidenced by flattened vegetation ○ Weathered and buried driftwood
Above OHWM	☒ Hillslope toe ○ Terraces or alluvium with an organic horizon or other developed soil horizons ○ Relic floodplain surface ☒ Well developed soil A andB horizons/duff layer	☒ Indian plum ☒ Red alder ○ Western red cedar ☒ Douglas fir ○ Western hemlock ☒ Ponderosa pine ○ Oregon white oak ○ Coast pine ○ Quaking aspen ○ Vine maple (lakes) ○ Blackberries	○ Lighter or no staining on fixed objects ○ Overbank deposits

Notes

OHWM defined by scour, topographic break, cobbles/boulders, and root scour.

At or near OHWM: Horsetail (*Equisetum* sp.), angelica (*Angelica* sp.)

Above OHWM: Douglas fir (*Pseudotsuga menziesii*), vine maple (*Acer circinatum*), thimbleberry (*Rubus parviflorus*), Nootka rose (*Rosa nootkana*), oceanspray (*Holodiscus discolor*)

APPENDIX C

Stream A OHWM Data Form

Field Data Form

General Information

Site/Project Name/Owner:
Mission Ridge Ski Resort

Location: Parcel 211924000000

Description: OWHM of Unnamed Stream

The following field form is for use in the field to help in making ordinary high water mark delineations on streams. The form should be used as a guide. A team consisting of a hydrologist/ geomorphologist and a biologist may be needed to accurately determine the ordinary high water mark.

General Observations: Day of Site Visit

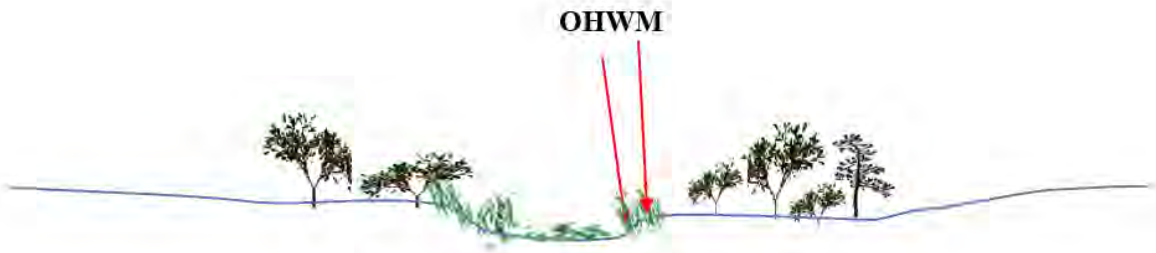
Date of site visit:	June 26, 2024			
Time of site visit:	9:00			
Weather conditions:	Hot (90F), sunny			
Watershed development:	Highly developed ❍		Mod. Developed ❍	Undeveloped ●
Reach development:	Highly developed ❍		Mod. Developed ❍	Undeveloped ●
Recent site disturbance?	No ●	Yes ❍	Describe: past vegetation maintenance	
Upstream flow control devices?	No ●	Yes ❍	Describe:	
Bank armoring at the site?	No ❍	Yes ●	Describe: diversion is lined by rocks	
Bank armoring up or downstream?	No ●	Yes ❍	Describe:	
Observable tidal backwater?	No ●	Yes ❍		
In-water structures? (i.e. bridge pilings, railroad embankments)	No ●	Yes ❍	Describe:	
Animals grazing in riparian zone?	No ●	Yes ❍	Describe:	
Observable beaver activity?	No ●	Yes ❍	Describe:	

Complete Vegetation Transects

- Use guidelines in Chapter 4 to complete vegetation transects.
- Determine upper and lower bounds of the OHWM from vegetation transects.
- After completing vegetation transects, look for more field indicators near the upper and lower bounds of the OHWM. Use the checklist as guidance.

Sketch

Draw a simple site, sketch a cross-sectional diagram of the site below. Include location of the waterway and upper and lower bounds of the OHWM defined by the vegetation communities or other OHWM indicators. Page 3 of the data form can be used for more complex sketches.



Additional Indicators

Check the indicators that are observable at the site that provide rationale for establishing the OHWM at this location. The rationale should be described in detail in the report and should be supported with photographs taken during the site visit.

	Soil and geomorphic indicators [1]	Vegetative indicators [2]	Other indicators
Below OHWM	○ Sediment bars ○ Scour line ○ Clean cobbles/boulders. ○ Bank erosion/scour ○ Lack of soil horizons	Vegetation tolerant of inundation or high flow disturbances such as: ○ Willows ○ Black cottonwood ○ Japanese knotweed ○ Skunk cabbage ○ Aquatic plants	○ Exposed roots/root scour ○ Drainage patterns, as shown by flattened vegetation ○ Aquatic animals ○ Algal mats ○ Iron staining

[1] Refer to Chapter 4 for a more complete description of indicators.

[2] Species are provided as examples. Refer to Appendix [redacted] for a more complete listing of plant species and their distribution across the OHWM gradient. Some species occur in more than one category depending on site conditions. For example Indian plum and red alder may straddle the OHWM where soil drainage is high. They may occur above OHWM were soil drainage is low to moderate.

	Soil and geomorphic indicators [1]	Vegetative indicators [2]	Other indicators
At or straddling OHWM	○ Top of bank ○ Toe of lowest terrace (if terrace has developed horizons which may include a duff layer and A and B horizons versus freshly deposited alluvium) ○ Benches	○ Willows ○ Western red cedar ○ Vine maple (streams) ○ Black cottonwood ○ Red alder ○ Salmonberry ■ Nootka rose ○ Maidenhair and lady fern ○ Blackberries ○ Dunegrasses	○ Sediment lines on vegetation or other fixed objects ○ Change from channel deposits to older alluvium. ○ Darker stain lines on fixed objects ■ Exposed roots/root scour. ■ Drainage patterns, as evidenced by flattened vegetation ○ Weathered and buried driftwood
Above OHWM	■ Hillslope toe ○ Terraces or alluvium with an organic horizon or other developed soil horizons ○ Relic floodplain surface ○ Well developed soil A andB horizons/duff layer	○ Indian plum ■ Red alder ○ Western red cedar ○ Douglas fir ○ Western hemlock ○ Ponderosa pine ○ Oregon white oak ○ Coast pine ○ Quaking aspen ○ Vine maple (lakes) ○ Blackberries	○ Lighter or no staining on fixed objects ○ Overbank deposits

Notes

OHWM defined by scour, erosion, and root scour.

At or near OHWM: Horsetail (*Equisetum* sp.), angelica (*Angelica* sp.), Columbian monkshood (*Aconitum columbianum)*

Above OHWM: thimbleberry (*Rubus parviflorus*), Nootka rose (*Rosa nootkana*), oceanspray (*Holodiscus discolor*)

APPENDIX D

Wetland Determination Data Forms

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Mission Ridge | City/County: Chelan | Sampling Date: 6/28/2024
Applicant/Owner: Mission Ridge Ski & Snowboard Resort | State: WA | Sampling Poir: DP1
Investigator(s): D Beich | Section, Township, Rang: T21N R19E Sec 13
Landform (hillslope, terrace, e: toeslope | Local relief (concave, convex, nor: none | ope (%): 0
Subregion (LRR: B | Lat: 47.3088 | Long: -120.3894 | Datum: NAD83HARN
Soil Map Unit Nam: Loneridge very stony loam, 25 to 65 percent slopes | NWI Classificatior: PUB Hh
Are climatic / hydrologic conditions on the site typical for this time of y: (●) Yes ( ) No (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present: (●) Yes ( ) No
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Presen	(●) Yes	( ) No	**Is the Sampled Area within a Wetland?** (●) Yes ( ) No
Hydric Soil Present?	(●) Yes	( ) No	
Wetland Hydrology Present?	(●) Yes	( ) No	

Remarks:
Although vegetation is heavilty grazed, determination was not affected because dominant plant species were identifiable.

VEGETATION – Use scientific names of plants.

		Absolute % Cover	Dom. Sp.?	Relative % Cover	Indicator Status
Tree Stratum (Plot size: 15ft x 15ft)					
1.	Lookup				
2.	Lookup				
3.	Lookup				
4.	Lookup				
		= Total Cover			
Sapling/Shrub Stratu (Plot size: 15ft x 15ft)					
1. *Salix scouleriana*	Lookup	5	Y	50.0	
2. *Cornus nuttallii*	Lookup	5	Y	50.0	FACU
3.	Lookup				
4.	Lookup				
5.	Lookup				
		10 = Total Cover			
Herb Stratum (Plot size: 5ft x 5ft)					
1. *Equisetum arvense*	Lookup	90	Y	90.0	FAC
2. *Scirpus microcarpus*	Lookup	10	N	10.0	OBL
3.	Lookup				
4.	Lookup				
5.	Lookup				
6.	Lookup				
7.	Lookup				
8.	Lookup				
		100 = Total Cover			
Woody Vine Stratu (Plot size:)					
1.	Lookup				
2.	Lookup				
		= Total Cover			

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	10	x 1 =	10
FACW species	0	x 2 =	0
FAC species	90	x 3 =	270
FACU species	5	x 4 =	20
UPL species	0	x 5 =	0
Column Totals	105 (A)		300 (B)

Prevalence Index = B/A = 2.857

Hydrophytic Vegetation Indicators:
- ☐ Dominance Test is >50%
- ☑ Prevalence Index is ≤3.0¹
- ☐ Morphological Adaptations¹ (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation¹ (Explain)

¹Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? (●) Yes ( ) No

Remarks:

SOIL

Sampling Point: DP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR	3/1	90	10YR	5/6	10	C	M	Silt Loam	
4-16	10YR	2/1	95	10YR	5/6	5	C	M	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (LRR C)
- ☐ 1 cm Muck (A9) (LRR D)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☑ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]

- ☐ 1 cm Muck (A9) (LRR C)
- ☐ 2 cm Muck (A10) (LRR B)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? ◉ Yes ○ No

Remarks:
area is extremely compacted

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1) (Nonriverine)
- ☐ Sediment Deposits (B2) (Nonriverine)
- ☐ Drift Deposits (B3) (Nonriverine)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thick Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (Riverine)
- ☐ Sediment Deposits (B2) (Riverine)
- ☐ Drift Deposits (B3) (Riverine)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? ○ Yes ◉ No Depth (inches):

Water Table Present? ◉ Yes ○ No Depth (inches): 4

Saturation Present? ◉ Yes ○ No Depth (inches):
(includes capillary fringe)

Wetland Hydrology Present? ◉ Yes ○ No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Mission Ridge | City/County: Chelan | Sampling Date: 6/28/2024

Applicant/Owner: Mission Ridge Ski & Snowboard Resort | State: WA | Sampling Point: DP2

Investigator(s): D Beich | Section, Township, Range: T21N R19E Sec 13

Landform (hillslope, terrace, etc.): toeslope | Local relief (concave, convex, none): none | Slope (%): 5

Subregion (LRR): B | Lat: 47.3088 | Long: -120.3894 | Datum: NAD83HARN

Soil Map Unit Name: Loneridge very stony loam, 25 to 65 percent slopes | NWI Classification: PUB Hh

Are climatic / hydrologic conditions on the site typical for this time of year? (●) Yes ( ) No (If no, explain in Remarks.)

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? (●) Yes ( ) No

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	( ) Yes	(●) No	**Is the Sampled Area within a Wetland?** ( ) Yes (●) No
Hydric Soil Present?	( ) Yes	(●) No	
Wetland Hydrology Present?	( ) Yes	(●) No	

Remarks:
Although vegetation is heavilty grazed, determination was not affected because dominant plant species were identifiable.

VEGETATION – Use scientific names of plants.

		Absolute % Cover	Dom. Sp.?	Relative % Cover	Indicator Status
Tree Stratum (Plot size 15ft x 15ft)					
1. *Pseudotsuga menziesii*	Lookup	90	Y	100.0	
2.	Lookup				
3.	Lookup				
4.	Lookup				
		90	= Total Cover		
Sapling/Shrub Stratum (Plot size 15ft x 15ft)					
1. *Acer circinatum*	Lookup	5	Y	50.0	FAC
2. *Holodiscus discolor*	Lookup	5	Y	50.0	FACU
3.	Lookup				
4.	Lookup				
5.	Lookup				
		10	= Total Cover		
Herb Stratum (Plot size 5ft x 5ft)					
1.	Lookup				
2.	Lookup				
3.	Lookup				
4.	Lookup				
5.	Lookup				
6.	Lookup				
7.	Lookup				
8.	Lookup				
			= Total Cover		
Woody Vine Stratum (Plot size:)					
1.	Lookup				
2.	Lookup				
			= Total Cover		

% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	5	x 3 =	15
FACU species	5	x 4 =	20
UPL species	0	x 5 =	0
Column Totals:	10 (A)		35 (B)

Prevalence Index = B/A = 3.500

Hydrophytic Vegetation Indicators:

- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0¹
- ☐ Morphological Adaptations¹ (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation¹ (Explain)

¹Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? ( ) Yes (●) No

Remarks:

SOIL

Sampling Point: DP2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
1-12	10YR	5/4	30					Silt Loam	
1-12	10YR	3/1	20						
1-12	10YR	4/2	50						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (LRR C)
- ☐ 1 cm Muck (A9) (LRR D)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]

- ☐ 1 cm Muck (A9) (LRR C)
- ☐ 2 cm Muck (A10) (LRR B)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? ○ Yes ◉ No

Remarks:
area is extremely compacted

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required: check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (Nonriverine)
- ☐ Sediment Deposits (B2) (Nonriverine)
- ☐ Drift Deposits (B3) (Nonriverine)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thick Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (Riverine)
- ☐ Sediment Deposits (B2) (Riverine)
- ☐ Drift Deposits (B3) (Riverine)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? ○ Yes ◉ No Depth (inches): _____

Water Table Present? ○ Yes ◉ No Depth (inches): _____

Saturation Present? (includes capillary fringe) ○ Yes ◉ No Depth (inches): _____

Wetland Hydrology Present? ○ Yes ◉ No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

APPENDIX E

Wetland Rating Form

Wetland name or number: Boy Scout Camp

RATING SUMMARY - Eastern Washington

Name of wetland (or ID#): Boy Scout Camp **Date of site visit:** 06/28/2024
Rated By: Suzanne Tomassi **Trained by Ecology? Yes** [X] **No** [ ] **Date of Training:** 06/03/2006
HGM Class used for rating: Depressional
Wetland has multiple HGM classes? Yes [ ] **No** [X]

NOTE: Form is not complete without the figures requested *(figures can be combined).*
Source of base aerial photo/map: BING IMAGERY

OVERALL WETLAND CATEGORY: [**Category III**] (based on functions [X] or special characteristics [ ])

1. Category of wetland based on FUNCTIONS

[ ] **Category I** - Total score = 22 - 27
[ ] **Category II** - Total score = 19 - 21
[X] **Category III** - Total score = 16 - 18
[ ] **Category IV** - Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
Site Potential	**M**	**M**	**M**	
Landscape Potential	**L**	**L**	**H**	
Value	**H**	**L**	**H**	**Total**
Score Based on Ratings	**6**	**4**	**8**	**18**

Score for each function based on three ratings (order of ratings is not important)
9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	CATEGORY
Vernal Pool	
Alkali	
Wetland of High Conservation Value	
Bog	
Calcareous Fen	
Forested	
None of the above	**Not Applicable**

Wetland name or number: Boy Scout Camp

Maps and figures required to answer questions correctly for Eastern Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes and classes of emergents	D 1.3, H 1.1, H 1.5	1
Hydroperiods (including area of open water for H 1.3)	D 1.4, H 1.2, H 1.3	2
Location of outlet *(can be added to map of hydroperiods)*	D 1.1, D 4.1	2
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	D 2.2, D 5.2	3
Map of the contributing basin	D 5.3	4
1km Polygon: Area that extends 1km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	5
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	6
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	7

Wetland name or number: Boy Scout Camp

DEPRESSIONAL WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

D 1.0 Does the site have the potential to improve water quality?		
D 1.1 What are the characteristics of surface water outflows from the wetland?		
Wetland has no surface water outlet	points = 5	
Wetland has an intermittently flowing outlet	points = 3	
Wetland has a highly constricted permanently flowing outlet	points = 3	
Wetland has a permanently flowing, unconstricted surface outlet	points = 1	**Score: 3**
D 1.2 Is the soil 2 in. below the surface a true clay or organic soil?		
Mapped as true clay or organic	points = 3	
Soil texture identified as clay or organic in field	points = 3	
Soil texture identified as clay or organic by laboratory test	points = 3	
None of the above	points = 0	**Score: 0**
D 1.3 What are the characteristics and distribution of persistent plants?		
Wetland has persistent, ungrazed, vegetation for >66% of the wetland area	points = 5	
Wetland has persistent, ungrazed, vegetation from 33%-66% of the wetland area	points = 3	
Wetland has persistent, ungrazed vegetation from 10%-33% of the wetland area	points = 1	
Wetland has persistent, ungrazed vegetation <10% of the wetland area	points = 0	**Score: 3**
D 1.4 What are the characteristics of seasonal ponding or inundation in the wetland area?		
Area seasonally ponded is >50% total area of wetland	points = 3	
Area seasonally ponded is 25%-50% total area of wetland	points = 1	
Area seasonally ponded is <25% total area of wetland	points = 0	**Score: 0**
	Total for D 1:	**6**

Rating of Site Potential [ ] **12-16 = H** [X] **6-11 = M** [ ] **0-5 = L** *Record the rating on the first page*

D 2.0 Does the landscape have the potential to support the water quality function of the site?		
D 2.1 Does the wetland unit receive stormwater discharges?		
Yes	points = 1	
No	points = 0	**Score: 0**
D 2.2 Is >10% of the area within 150ft of the wetland in land uses that generate pollutants?		
Yes	points = 1	
No	points = 0	**Score: 0**
D 2.3 Are there septic systems within 250ft of the wetland?		
Yes	points = 1	
No	points = 0	**Score: 0**
D 2.4 Are the other sources of pollutants coming into the wetland that are not listed in questions D 2.1-D 2.3?		
Yes	points = 1	
No	points = 0	**Score: 0**

Wetland name or number: Boy Scout Camp

D 2.5 What are the other sources of pollutants coming into the wetland?	
Total for D 2:	**0**

Rating of Landscape Potential [ ] **3-4 = H** [ ] **1-2 = M** [X] **0 = L** *Record the rating on the first page*

D 3.0 Is the water quality improvement provided by the site valuable to society?		
D 3.1 Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, or lake that is on the 303(d) list?		
Yes	points = 1	
No	points = 0	**Score:**
D 3.2 Is the wetland in a basin or sub-basin where water quality is an issue in some aquatic resource [303(d) list, eutrophic lakes, problems with nuisance and toxic algae]?		
Yes	points = 1	
No	points = 0	**Score: 0**
D 3.3 Has the site been identified in a watershed or local plan as important for maintaining water quality?		
Yes	points = 2	
No	points = 0	**Score: 2**
Total for D 3:		**2**

Rating of Value [X] **2-4 = H** [ ] **1 = M** [ ] **0 = L** *Record the rating on the first page*

DEPRESSIONAL WETLANDS

Hydrologic Functions - Indicators that the site functions to reduce flooding and stream degradtion

D 4.0 Does the site have the potential to reduce flooding and erosion?		
D 4.1 What are the characteristics of surface water outflows from the wetland?		
Wetland has no surface water outlet	points = 8	
Wetland has an intermittently flowing outlet	points = 4	
Wetland has a highly constricted permanently flowing outlet	points = 4	
Wetland has a permanently flowing unconstricted surface outlet	points = 0	**Score: 4**

Wetland name or number: Boy Scout Camp

D 4.2 What is the depth of storage during the wet periods?		
Seasonal ponding: 3ft or more above the lowest point in the wetland or the surface of permanent ponding	points = 8	
Seasonal ponding: 2ft-<3ft above the lowest point in the wetland or the surface of permanent ponding	points = 6	
The wetland is a headwater wetland	points = 4	
Seasonal ponding: 1ft - <2ft	points = 4	
Seasonal ponding: 0.5ft - <1ft	points = 2	
Seasonal ponding: <0.5ft (6in) or only saturated soils	points = 0	**Score: 6**
	Total for D 4:	**10**

Rating of Site Potential [ ] **12-16 = H** [X] **6-11 = M** [ ] **0-5 = L** *Record the rating on the first page*

D 5.0 Does the landscape have the potential to support hydrologic functions of the site?		
D 5.1 Does the wetland unit receive stormwater discharges?		
Yes	points = 1	
No	points = 0	**Score: 0**
D 5.2 Is >10% of the area within 150ft of the wetland in a land use that generates runoff?		
Yes	points = 1	
No	points = 0	**Score: 0**
D 5.3 Is more than 25% of the contributing basin of the wetland covered with intensive human land uses?		
Yes	points = 1	
No	points = 0	**Score: 0**
	Total for D 5:	**0**

Rating of Landscape Potential [ ] **3 = H** [ ] **1-2 = M** [X] **0 = L** *Record the rating on the first page*

D 6.0 Are the hydrologic functions provided by the site valuable to society?		
D 6.1 Is the wetland in a landscape that has flooding problems?		
Flooding occus in a sub-basin that is immediately down-gradient of the wetland	points = 2	
Surface flooding problems are in a sub-basin farther down-gradient	points = 1	
the existing or potential outflow from the wetland is so constrained that water cannot reach areas that flood	points = 0	
There are no problems with flooding downstream of the wetland	points = 0	**Score: 0**
D 6.2 Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan?		
Yes	points = 2	
No	points = 0	**Score: 0**
	Total for D 6:	**0**

Rating of Value [ ] **2-4 = H** [ ] **1 = M** [X] **0 = L** *Record the rating on the first page*

Wetland name or number: Boy Scout Camp

HABITAT FUNCTIONS

These questions apply to wetlands of all HGM classes - Indicators that the site functions to provide important habitat

H 1.0 Does the wetland have the potential to provide habitat for many species?

H 1.1 What is the structure of the plant community?

- [x] Aquatic Bed
- [ ] Emergent plants 0-12in (0-30cm) high are the highest layer and have >30% cover
- [x] Emergent plants >12-40in (>30-100cm) high are the highest layer with >30% cover
- [ ] Emergent plants >40in (>100cm) high are the highest layer with >30% cover
- [x] Scrub-shrub (areas where shrubs have >30% cover)
- [ ] Forested (areas where trees have >30% cover)

4 structures or more	points = 3	
3 structures	points = 2	
2 structures	points = 1	
1 structure	points = 0	
No structures	points = 0	**Score: 2**

H 1.2 Is one of the vegetation types Aquatic Bed?

Yes	points = 1	
No	points = 0	**Score: 1**

H 1.3 What is the surface water potential?

- [ ] The wetland has areas of open water (without emergent or shrub plants) that meet the scoring threshold during March to early June OR in August to the end of September
- [x] The wetland has an intermittent or permanent, and unvegetated stream within its boundaries, or along one side
- [ ] The wetland is along the side of a stream or river with an unvegetated area that is at least 16ft (5m) wide
- [ ] The wetland is a Lake Fringe wetland

The wetland meets at least one of these criteria	points = 3	
No surface water that meets criteria	points = 0	**Score: 3**

H 1.4 What is the richness of plant species in the wetland?

>9 species	points = 2	
4-9 species	points = 1	
<4 species	points = 0	**Score: 1**

Wetland name or number: Boy Scout Camp

H 1.5 What is the interspersion of habitats within the wetland?

High	points = 3	
Moderate	points = 2	
Low	points = 1	
None	points = 0	**Score: 2**

H 1.6 What are the special habitat features within the wetland?

- [ ] Loose rocks larger than 4in OR large, downed, woody debris (>4in in diameter) within the area of surface ponding or in a stream.
- [✓] Cattails or bulrushes are present within the wetland.
- [✓] Standing snags (diameter at the bottom >4in) in the wetland or within 30m (100ft) of the edge.
- [✓] Emergent or shrub vegetation in areas that are permanently inundated/ponded
- [ ] Stable steep banks of fine material that might be used by beaver or muskrat for denning (>45 degree slope) or signs of recent beaver activity.
- [✓] Invasive species cover less than 20% in each stratum of vegetation (canopy, sub-canopy, shrubs, herbaceous, moss/ground cover)

6 habitat features selected	points = 6	
5 habitat features selected	points = 5	
4 habitat features selected	points = 4	
3 habitat features selected	points = 3	
2 habitat features selected	points = 2	
1 habitat feature selected	points = 1	
No habitat features selected	points = 0	**Score: 4**

Total for H 1: 13

Rating of Site Potential [ ] **15-18 = H** [X] **7-14 = M** [ ] **0-6 = L** *Record the rating on the first page*

H 2.0 Does the landscape have the potential to support the habitat functions of the site?

H 2.1 What is the percentage of accessible habitat within 1km of the wetland?

>33% of 1km Polygon is accessible habitat	points = 3	
20-30% of 1km Polygon is accessible habitat	points = 2	
10-19% of 1km Polygon is accessible habitat	points = 1	
<10% of 1km Polygon is accessible habitat	points = 0	**Score: 3**

H 2.2 What is the total habitat in a 1km polygon around the wetland?

Total habitat is >50% of the 1km polygon	points = 3	
Total habitat is 10-50% of the 1km polygon and in 1-3 patches	points = 2	
Total habitat is 10-50% of the 1km polygon and in >3 patches	points = 1	
Total habitat is <10% of the 1km polygon	points = 0	**Score: 3**

Wetland name or number: Boy Scout Camp

H 2.3 What is the land use intensity in a 1km polygon within the wetland?

>50% of the polygon is high intensity land use	points = -2	
<50% of the polygon is high intensity land use	points = 0	**Score: 0**

H 2.4 Is the wetland is in an area where annual rainfall is less than 12in, and its water regime is not influenced by irrigation practices, dams, or water control structures?

Yes	points = 3	
No	points = 0	**Score: 0**

Total for H 2: 6

Rating of Landscape Potential [X] **4-9 = H** [ ] **1-3 = M** [ ] **0 = L** *Record the rating on the first page*

H 3.0 Is the habitat provided by the site valuable to society?

H 3.1 Does the site provide habitat for species valued in laws, regulations, or policies?

- [ ] Aspen Stands
- [ ] Biodiversity Areas and Corridors
- [ ] Eastside Steppe
- [ ] Inland Dunes
- [ ] Juniper Savannah
- [ ] Old-growth/Mature Forests
- [ ] Oregon White Oak
- [x] Riparian
- [ ] Shrubsteppe
- [ ] Fresh Deepwater
- [x] Instream
- [ ] Caves
- [ ] Cliffs
- [x] Snags and Logs
- [ ] Talus

The following criteria automatically score 2 points:

- [ ] The wetland provides habitat for Threatened or Endangered species
- [ ] The wetland is mapped as a location for an individual WDFW priority species
- [ ] The wetland is a Wetland of High Conservation Value (WHCV)
- [ ] The wetland has been categorized as an important habitat site in a local plan

The wetland has 3 or more WDFW priority habitats within 100m, or meets the criteria for societal value	points = 2	
The site has 1 or 2 WDFW priority habitats within 100m	points = 1	
The site does not meet any of the criteria for societal value	points = 0	**Score: 2**

Total for H 3: 2

Rating of Value [X] **2 = H** [ ] **1 = M** [ ] **0 = L** *Record the rating on the first page*

Wetland name or number: Boy Scout Camp

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

SC 1.0 Vernal Pools

SC 1.1 Is the wetland less than 4000sqft and it meets at least two of the follow criteria?

☐ It's only source of water is rainfall or snowmelt from a small contributing basin and has no groundwater input.

☐ Wetland plants are typically present only in the spring; the summer vegetation is typically upland annuals (if you find perennial, obligate, wetland plants, the wetland is probably NOT a vernal pool.)

☐ The soil in the wetland is shallow [<1ft (30cm) deep] and is underlain by an impermeable layer such as basalt or clay

☐ Surface water is present for less than 120 days during the wet season.

Yes - Go to SC 1.2

No - Not a Special Characteristic Vernal Pool — **Result: Not a Special Characteristic Vernal Pool**

SC 1.2 Is the vernal pool relatively undisturbed in February and March?

Yes - Go to SC 1.3

No - Not a Special Characteristic Vernal Pool — **Result:**

SC 1.3 Is the vernal pool in an area where there are at least 3 separate aquatic resources (other wetlands, rivers, lakes, etc.) within 0.5 mi?

Yes - Category II Vernal Pool

No - Category III Vernal Pool — **Result:**

SC 2.0 Alkali Wetlands

SC 2.1 Does the wetland meet any of the following criteria for Alkali Wetlands?

☐ The wetland has a conductivity >3.0 mS/cm

☐ The wetland has a conductivity between 2.0 and 3.0 mS, and more than 50% of the plant cover is the wetland can be classified as "alkali" species

☐ If the wetland is dry at the time of your field visit, the central part of the area is covered with a layer of salt.

Yes - Category I Alkali Wetland

No - Go to SC 2.2 — **Result: Go to SC 2.2**

SC 2.2 Does the wetland meet two of the following criteria for Alkali Wetlands?

☐ Salt encrustations around more than 75% of the edge of the wetland

☐ more than 75% of the plant cover consists of alkali (salt tolerant) species

☐ A pH above 9.0

Yes - Category I Alkali Wetland

No - Not a Special Characteristic Alkali Wetland — **Result: Not a Special Characteristic Alkali Wetland**

Wetland name or number: Boy Scout Camp

SC 3.0 Wetlands of High Conservation Value

SC 3.1 Is the wetland listed by Washington Natural Heritage Program (WNHP) as a Wetland of High Conservation Value (WHVC)? Yes - Category I Wetland of High Conservation Value No - Go to SC 3.2	**Result: Go to SC 3.2**
SC 3.2 Does the wetland have a rare plant species, rare plant community, or high-quality plant community that may qualify the site as a WHCV? Yes - Category I Wetland of High Conservation Value No - Not a Special Characteristic Wetland of High Conservation Value	**Result: Not a Special Characteristic Wetland of High Conservation Value**

SC 4.0 Bogs and Calcareous Fens

SC 4.1 Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16in or more of the first 32in of the soil profile? Yes - Go to SC 4.3 No - Go to SC 4.2	**Result: Go to SC 4.2**
SC 4.2 Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16in deep over debrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pong? Yes - Go to SC 4.3 No - Not a Special Characteristic Bog	**Result: Not a Special Characteristic Bog**
SC 4.3 Does an area with peats or mucks have more than 70% cover of mosses at gorund level, AND at least 30% cover of plant species listed? Yes - Category I Bog No - Go to SC 4.4	**Result:**
SC 4.4 Is an area with peats or mucks forested (>30% cover) with subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine AND any of the species (or combination of species) listed provide more than 30% of the cover under the canopy? Yes - Category I Bog No - Go to SC 4.5	**Result:**
SC 4.5 Do the species listed comprise at least 20% of the total plant cover within an area of peats and mucks? Yes - Category I Calcareous Fen No - Go to SC 4.6	**Result:**

Wetland name or number: Boy Scout Camp

SC 4.6 Do the species listed comprise at least 10% of the total plant cover in an area of peats and mucks, AND one of the two following conditions is met?

☐ Marl deposits [calcium carbonate ($CaCO_3$) precipitate] occur on the soil surface or plant stems

☐ The pH of free water is >= 6.8 AND electrical conductivity is >= 200 uS/cm at multiple locations within the wetland

Yes - Category I Calcareous Fen

No - Not a Special Characteristic Calcareous Fen **Result:**

SC 5.0 Forested Wetlands

SC 5.1 Does the wetland have an area of forest rooted within its boundary that meets at least one of the following criteria?

☐ The wetland is within the 100 year floodplain of a river or stream

☐ Aspen (Populus tremuloides) represents at least 20% of the total cover of woody species

☐ There is at least 0.25ac of trees (even in wetlands smaller than 2.5ac) that are "mature" or "old-growth" according to the definitions for these priority habitats developed by WDFW

Yes - Go to SC 5.2

No - Not a Special Characteristic Forested Wetland **Result: Not a Special Characteristic Forested Wetland**

SC 5.2 Does the wetland have a forest canopy where more than 50% of the tree species (by cover) are slow growing native trees?

Yes - Category I Forested Wetland

No - Go to SC 5.3 **Result:**

SC 5.3 Does the wetland have areas where aspen (Populus tremuloides) represents at least 20% of the total cover of woody species?

Yes - Category I Forested Wetland

No - Go to SC 5.4 **Result:**

SC 5.4 Does the wetland have at least 0.25ac with a forest canopy where more than 50% of the tree species (by cover) are fast growing species?

Yes - Category II Forested Wetland

No - Go to SC 5.5 **Result:**

SC 5.5 Is the forested component of the wetland within the 100 year floodplain of a river or stream?

Yes - Category II Forested Wetland

No - Not a Special Characteristic Forested Wetland **Result:**

Category of wetland based on Special Characteristics

If you answered No for all types, enter "Not Applicable" on Summary Form **Final Category: Not Applicable**

Figure 1: Cowardin plant classes

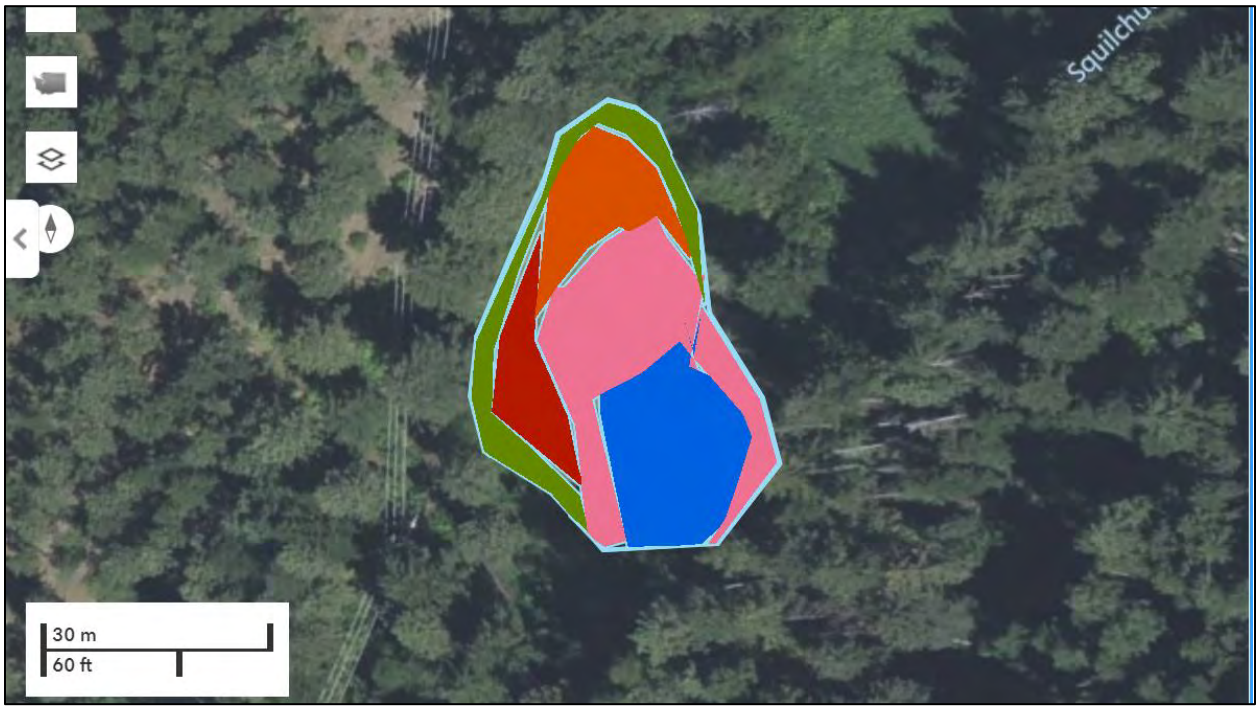


Figure 2: Hydroperiods and outlet

Figure 3: Boundary of area within 150’ of wetland

Figure 4: Contributing basin

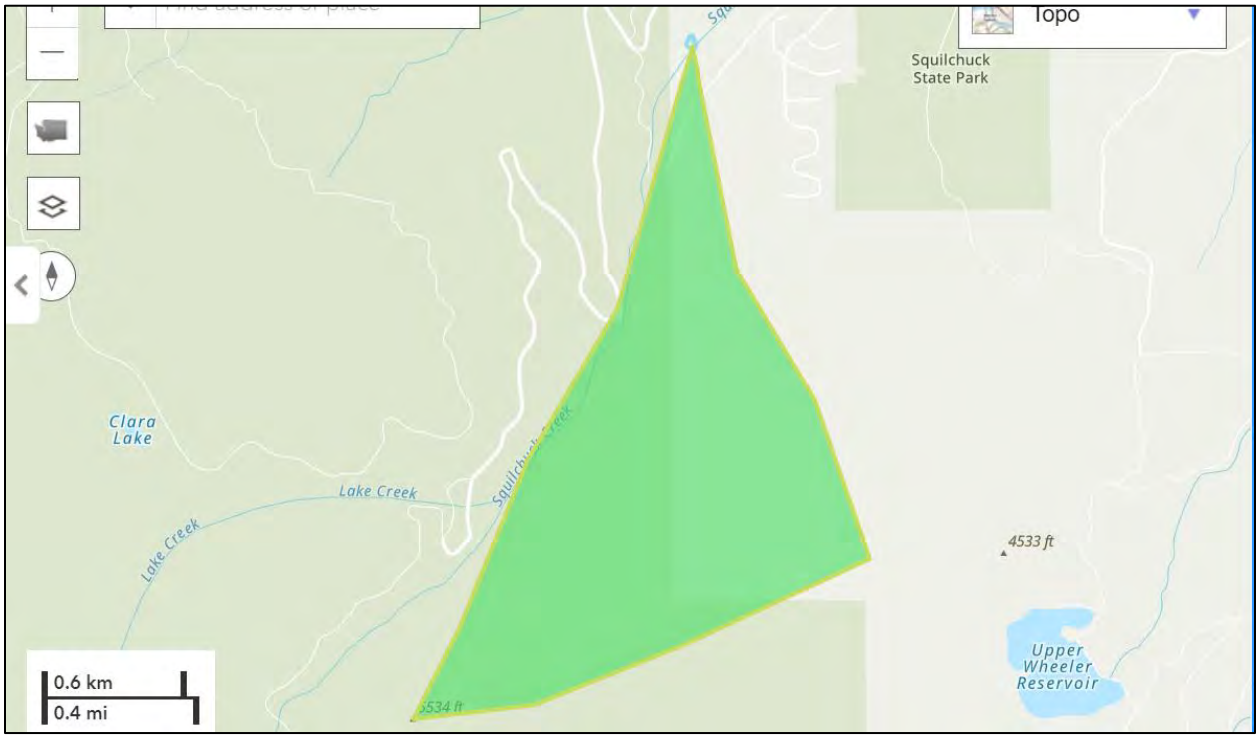
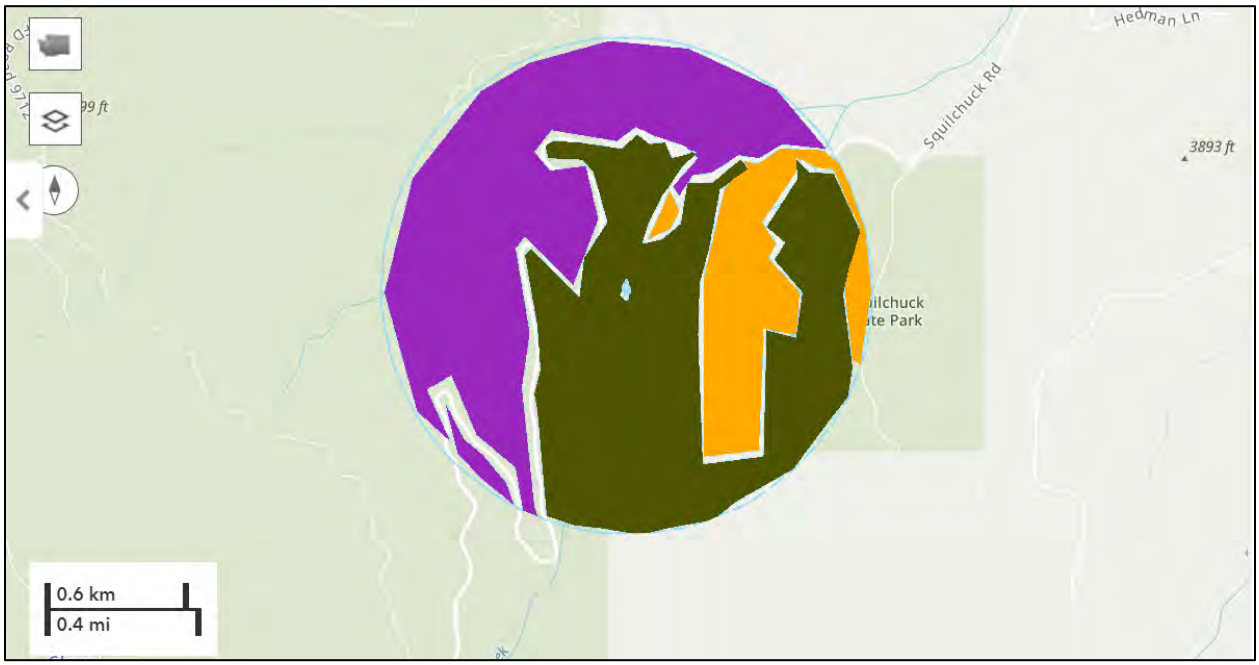


Figure 5: 1-km polygon



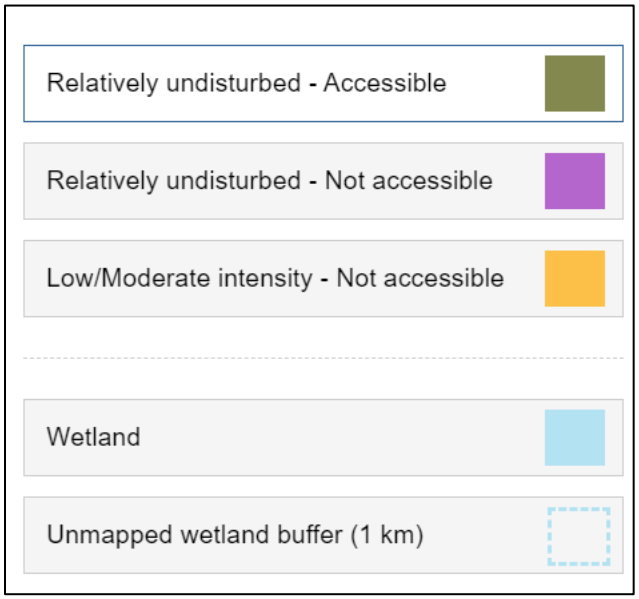


Figure 6: Screen capture of 303(d)-listed waters

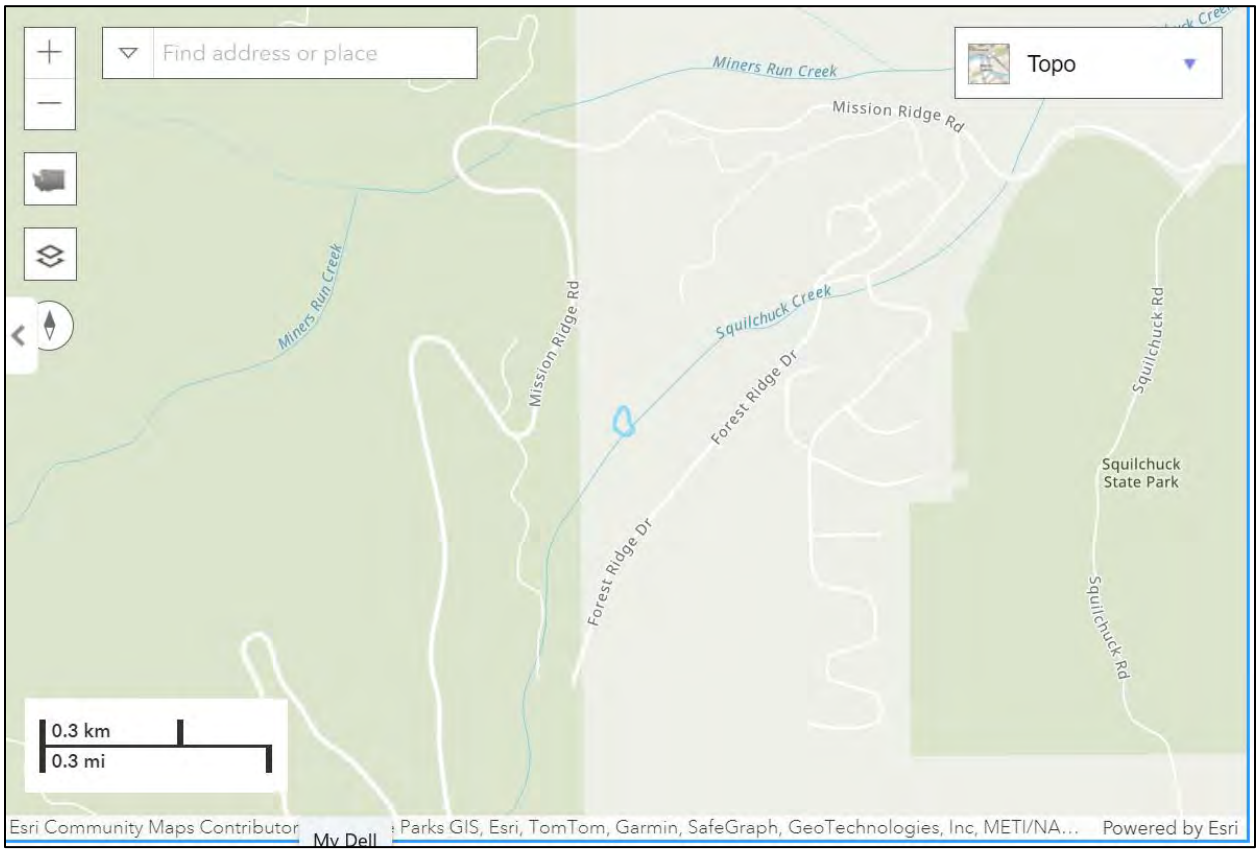


Figure 7: Screen capture of list od TMDLs in WRIA

Water quality improvement projects

Select the waterbody or pollutant name to find more information about the specific project.

Waterbody Name(s)	Pollutant(s)	Status	Project Lead(s)
Lake Chelan	DDT PCB	EPA approved and Has an implementation plan	Mark Peterschmidt 509-454-7843
Lake Chelan	Total Phosphorus	EPA approved.	Mark Peterschmidt 509-454-7843
Mission Creek	DDE DDT	EPA approved.	Mark Peterschmidt 509-454-7843
Wenatchee River Watershed	Dissolved Oxygen and pH	EPA approved.	Mark Peterschmidt 509-454-7843
Wenatchee River Watershed	Fecal Coliform	EPA approved.	Mark Peterschmidt 509-454-7843
Wenatchee River Watershed	Temperature	EPA approved.	Mark Peterschmidt 509-454-7843

2025 Mission Ridge Alternative Utility Route (Ecosystems Northwest)

ECOSYSTEMS NORTH WEST

Phone (509) 670-9918
Rriver2b@hotmail.com

05/19/2025

To: Mission Ridge

RE: Alternative Utility Route

INTRODUCTION

Ecosystems North West Prepared a Wetland Delineation and Stream Typing Report dated September 2024, for the construction of a proposed utility line (figure 1). This letter is an addendum to the September report that addresses a critical habitat review of an alternative utility corridor route at the north (lower) end of the proposed utility corridor (figure 2). An alternative utility route is being considered to avoid impacting the residential neighborhood of Forest Ridge.

Methods

Documentation

A documentation search was conducted and included local (County) inventories, the Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species (PHS) database, the National Wetland Inventory (NWI), and the Washington Department of Natural Resources (DNR) Forest Practices Application Mapping Tool (FPAMT).

Field Investigation

An on site assessment was conducted by Dennis Beich on May 6, 2025. Several potential routes were walked to determine if any of the routes would impact critical habitat with a focus on wetlands and streams.

There are two drainages in the area that any proposed route would cross (figure 2). The drainages have been labeled “X” and “Y”. Drainage “X” is a DNR type Np stream using criteria noted in the original report. Drainage “X” would appear to be a year-round stream, and water was flowing in it at the time of the site visit. Drainage “Y” is a dry

drainage and there was no evidence of water flow in that drainage in recent history. Where these drainages are crossed by existing roads there are 18" culverts.

Findings

Several different route options were explored that would avoid or minimize impacts to residential areas and critical habitats. The preferred alternative route would be as shown on figures 2 and 3. On this preferred route the entire water line would be located on already disturbed existing roads and consequently minimize impacts on existing vegetation. This route would also avoid existing residential areas. The route does cross both "X" and "Y" drainages but in areas where a road already exists. The water line will be located within the existing prism of the private gravel roads as well as the county Mission Ridge Road. In placing the utility line within the existing footprint of the roads there will be no impact to either of the drainage areas. This route would not impact any wetlands.

Conclusion

The preferred alternative route, although longer, would have minimal environmental impacts associated with construction and no impact to existing residential home sites.

Dennis Beich

Ecosystems North West