

Environmental Review:

Draft Master Plan for Expansion Area – 2020

Big White Ski Resort, BC



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Executive Summary

Introduction

Big White Ski Resort retained Cascade Environmental Resource Group Ltd. (Cascade) to conduct an Environmental Review (ER) of the resort lands, as described by the proposed Controlled Recreation Area (CRA) amendment. Big White proposes to increase their CRA. The assessment includes the documentation of existing environmental conditions on the subject property as well as the identification and delineation of environmentally sensitive areas and ecologically significant habitats. As part of the assessment, measures to assist the protection of identified environmentally sensitive areas are outlined, which include but are not limited to riparian retention. This report is based on the initial ER conducted in 2008 (Cascade Environmental Resource Group Ltd., 2008), the 2018 amendment (Cascade Environmental Resource Group Ltd., 2018) and the data analyzed for the CRA expansion and the proposed development.

Existing Environmental Conditions

Hydrology

The subject area is drained by four watercourses and their tributaries; Hallam Creek, Trapping Creek, Whitefoot Creek and Copperkettle Creek (Map 4).

The south facing portion of the existing Big White Mountain ski terrain drains south to Trapping Creek and then into the West Kettle River. The West Kettle River is a tributary of the Kettle River which in turn is a tributary to the Columbia River drainage basin.

The remainder of the existing CRA and the majority of the proposed expanded CRA are drained by Whitefoot Creek and Copperkettle Creek which flows into the Kettle River. A small portion of the proposed CRA is drained to the north via a tributary to Two John Creek, which flows into the West Kettle River just upstream of its confluence with Hallam Creek

Aquatic Environment

Previous studies and search of the provincial fish habitat mapping (BC Ministry Of Environment, 2020a) listed rainbow trout (*Oncorhynchus mykiss*) to be the only documented species of fish in the watercourses found on the subject site.

Vegetation

Forest stands within the subject area were found to consist of pole/sapling (Structural Stage 4) second growth cut blocks, young forest (Structural Stage 5), mature (Structural Stage 6) and old growth (Structural Stage 7a) forest stands from undisturbed sites, all with a coniferous dominated composition

Deciduous tree species are uncommon in this subalpine forest. Understory shrub vegetation is typically dominated by white-flowered rhododendron (*Rhododendrum albiflorum*). Grouseberry (*Vaccinium scoparium*) appears to dominate the herbaceous understory. Wetter sites are likely associated with Sitka valerian (*Valeriana sitchensis*), sedges (*Carex* spp.), and glow moss (*Aulacomnium palustre*)

Conservation Data Centre (CDC) Rare and Endangered Plants

The CDC indicated that there are no recorded observations for red or blue-listed plant species within the immediate study area (Government of British Columbia, 2020). Three Red and three blue listed plants were recorded as a possibility of occurring within the subject area.

CDC Rare and Endangered Communities

The CDC indicated that there are no recorded observations for red or blue-listed Ecological Communities within the immediate study area (Government of British Columbia, 2020).



During the 2018 field survey, one blue listed ecological community was observed in the study area. In addition, five blue listed ecological communities have been confirmed through a desktop analysis. While eight blue and one red listed ecological communities have the potential to be present within the proposed CRA.

Environmental Constraints

Geomorphology

The thin soils that remain on the ski runs once cut are highly susceptible to surface erosion. This condition is exacerbated by summer grooming techniques which may disturb the upper soil layers or remove larger woody material. Prompt revegetation of disturbed soils can mitigate surface erosion.

Hydrology

Four creeks are present in the study area. Cutting and clearing for ski runs could cause surface erosion could potentially deposit sediment in the local stream channels over the first few seasons. Debris flows/torrents in larger creeks are possible if sedimentation is excessive.

Aquatic Environment

Any changes to water quality or development within the riparian areas adjacent to the drainages on site could affect the fisheries values in Trapping Creek and Hallam Creek, which drain into the West Kettle River downstream, and the fisheries values of Whitefoot and Copperkettle Creeks, draining into the Kettle River.

Soils

The predominantly shallow, rocky soils in the study area represent an obvious limiting factor for plant and tree growth, damage to or loss of these soils will negatively affect the productivity of the area and the ability to successfully regenerate vegetation.

Rare and Endangered Wildlife

After a search for Rare and Endangered Wildlife Species within the subject area based on existing habitat, 32 species were listed as having the possibility to reside in the subject area. Of the 32 listed species, CDC indicates a known occurrence polygon (Shape ID 74373) for the red-listed American badger (*Taxidea taxus*) within the subject area. Although no CDC occurrences have been noted within the database, the staff of Big White has reported sighting the occasional blue listed grizzly bear (*Ursus arctos*) within alpine and forested habitats surrounding Big White Mountain and the vicinity of the subject area.

Grizzly bears are expected to occur on an infrequent but yearly basis on and in the vicinity of the proposed development area. The Kettle-Granby grizzly population unit lies to the east of the CRA and has been identified as a recovery unit. This unit covers over 650,000 hectares and is estimated to support up to 81 individuals

Grizzly bear population is not anticipated to be significantly effected by development of the ski area as the subject site will be gladed and thinned with minimal clearing and no low shrub areas or avalanche chutes associated with Grizzly Bear habitat were found within the subject area. Berry producing shrubs will be affected from clearing of ski runs and construction of ski lifts in the short term. Over time, berry producing shrubs will benefit from additional availability of light resulting from forest removal.

The American badger may be a constraint if dens or suitable habitat are located where development is proposed.



Vegetation

Six plant species of concern have the potential to occur within the geographic region of the property's biogeoclimatic subzone's site series. If confirmed in the study area, these species may be constraining to the proposed development.

Valued Ecosystem Components

Valued Ecosystem Components within the Big White CRA, particularly in within the proposed lift expansion include wildlife trees, wildlife movement corridors and riparian areas associated with identified watercourses.

Riparian Areas

Riparian areas within 30 meters of a permanent water course may be subject to assessment in accordance with the *Riparian Area Protection Regulation* (RAPR) of the B.C. *Riparian Protection Act*. Any intrusion in the resulting riparian setback may require permitting under Section 11 of the B.C. *Water Sustainability Act*, and/or approval under Section 35 (2) of the Federal *Fisheries Act*.

Wildlife Movement Corridors

The construction phase of the ski runs has the possibility of affecting mapped wildlife corridors in the subject area.

Wildlife Trees

Wildlife trees that contain dens or breeding cavities may be constraining to development during the breeding season of the animal. Song birds were evident visually and acoustically, but are typically summer breeders and not permanent residents. Wildlife trees that pose a safety risk on the subject site may need to be removed outside of the breeding season.

Conclusions

Based on the information reviewed and the conditions observed on site, the proposed expansion area appears to be suitable for use in the development of all season resort infrastructure and facilities

Recommendations

Cultural Environment

Future developments should consider preserving and maintaining recreational trails connecting the services with residential areas.

Physical Environment

Future developments should implement snow clearing plans to ensure that snow storage or removal does not impact fish-bearing water courses.

Terrestrial Environment

Land clearing activity should be conducted with due diligence between April 1 and August 31, to comply with Section 34 of the *Wildlife Act*, which forbids the destruction of nests occupied by a bird, its eggs, or young (Queen's Printer, 1982).

30 rare and endangered wildlife species and six plant species at risk have the potential to be present on the subject site. Any future detections should trigger the implementation of appropriate BMPs.

Vegetation should be retained wherever possible, particularly near creeks and wetlands and within riparian buffers to facilitate wildlife movement. Efforts should be made to conserve snags and wildlife habitat trees.

Any major timber clearing that occurs within the grizzly bear Wildlife Habitat Area (WHA) will need to be assessed to determine compliance with General Wildlife Measures (GWM's).

Aquatic Environment

Riparian Area Protection Assessments should be conducted at sites of disturbance near watercourses to determine appropriate clearing setbacks for the protection of fish habitat values and water quality.

The potential impacts to water quality from development within riparian areas can be minimized by avoiding contamination of the water courses during operation of the present ski resort and during any future development at Big White, through sound, environmentally prudent construction techniques, and by respecting appropriate buffer strips adjacent to Hallam, Trapping, Whitefoot and Copperkettle Creeks, as well as their tributaries.

Stream crossings should be minimized. Bridges rather than culverts or fords are preferred. Planting of additional native, riparian shrubs and trees may be necessary where intrusions occur.

All wetlands should be protected. A 15 to 30 m vegetated setback should be established adjacent to wetlands to protect the unique plant and wildlife values of the wetland and adjacent riparian areas.

Future developments should implement stormwater management plans that implement BMPs to ensure the protection of the ecological values of receiving waters. In addition to the post-development stormwater management, a drainage plan should also be developed to deal with concerns related to land clearing, grubbing, and construction. This plan should adhere to the Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia (BC Ministry of Environment, 2012).

Additional Studies

Additional detailed environmental assessment may be required during the site planning phase of development. Site specific assessment should be conducted in accordance with the requirements of the *Riparian Areas Regulations (RAR)*, the *BC Water Act* and the *Federal Fisheries Act*, to determine the setbacks from watercourses and wetlands.

Although it is unlikely for the majority of the listed rare and endangered species to occur on the site, detailed surveys of development sites should be conducted by qualified environmental professionals (QEPs), at appropriate times of year, to positively confirm presence or absence of SARA or Red listed species.

Statement of Limitations

This Document was prepared by Cascade Environmental Resource Group Ltd. for the account of Big White Ski Resort.

Should this report contain an error or omission then the liability, if any, of Cascade Environmental Resource Group Ltd. should be limited to the fee received by Cascade Environmental Resource Group Ltd. for the preparation of this Document. Recommendations contained in this report reflect Cascade Environmental Resource Group Ltd.'s judgment in light of information available at the time of study. The accuracy of information provided to Cascade Environmental Resource Group Ltd. is not guaranteed.

Neither all nor part of the contents of this report should be used by any party, other than the client, without the express written consent of Cascade Environmental Resource Group Ltd. This report was prepared for the client for the client's own information and for presentation to the approving government agencies. The report may not be used or relied upon by any other person unless that person is specifically named by Cascade Environmental Resource Group Ltd. as a beneficiary of the report, in which case the report may be used by the additional beneficiary Cascade Environmental Resource Group Ltd. has named. If such consent is granted, a surcharge may be rendered. The client agrees to maintain the confidentiality of the report and reasonably protect the report from distribution to any other person. If the client directly or indirectly causes the report to be distributed to any other person, the client shall indemnify, defend and hold Cascade Environmental Resource Group Ltd. harmless if any third party brings a claim against Cascade Environmental Resource Group Ltd. relating to the report.

This document should not be construed to be:

- A Phase 1 - Environmental Site Assessment;
- A Stage 1 – Preliminary Site Investigation (as per the Contaminated Sites Regulations of the Waste Mgt. Act);
- An Environmental Impact Assessment.

1 Introduction

Big White Ski Resort retained Cascade Environmental Resource Group Ltd. (Cascade) to conduct an Environmental Review (ER) of the existing and proposed resort lands, as described in the draft Big White Ski Resort Master Plan (2020). Big White proposes to increase their Controlled Recreation Area (CRA). The assessment includes the documentation of existing environmental conditions as well as the identification and delineation of environmentally sensitive areas and ecologically significant habitats within the existing CRA as well as the proposed expansion area. As part of the assessment, measures to assist the protection of identified environmentally sensitive areas are outlined, which include but are not limited to riparian retention. This report is based on the initial ER conducted in 2008 (Cascade Environmental Resource Group Ltd., 2008), the 2018 amendment (Cascade Environmental Resource Group Ltd., 2018) and the data analyzed for the proposed CRA extension.

1.1 Background

In 1996 a study team, consisting of Dave Williamson, B.E.S., Mike Cole, P.Eng., Ethan Askey, M.R.M., Mike Nelson, R.P. Bio. and Douglas Wahl, R.P. Bio., conducted a site visit and cursory ecological land survey. During the site visit which was carried out from July 25 to July 27, 1996 aquatic biophysical information was gathered on the main streams flowing from Big White Resort. The data collected was used to classify the streams according to the Riparian Management Area Guidebook standards (BC Ministry of Environment, Lands, and Parks and BC Ministry of Forests, 1998). In addition, Global Positioning System (GPS) transects were made of the Gem Lake area and the existing ski area. General ecological information was gathered on these transects including: geology, geomorphology, hydrology, soils, plant species, wildlife observations and habitat characteristics.

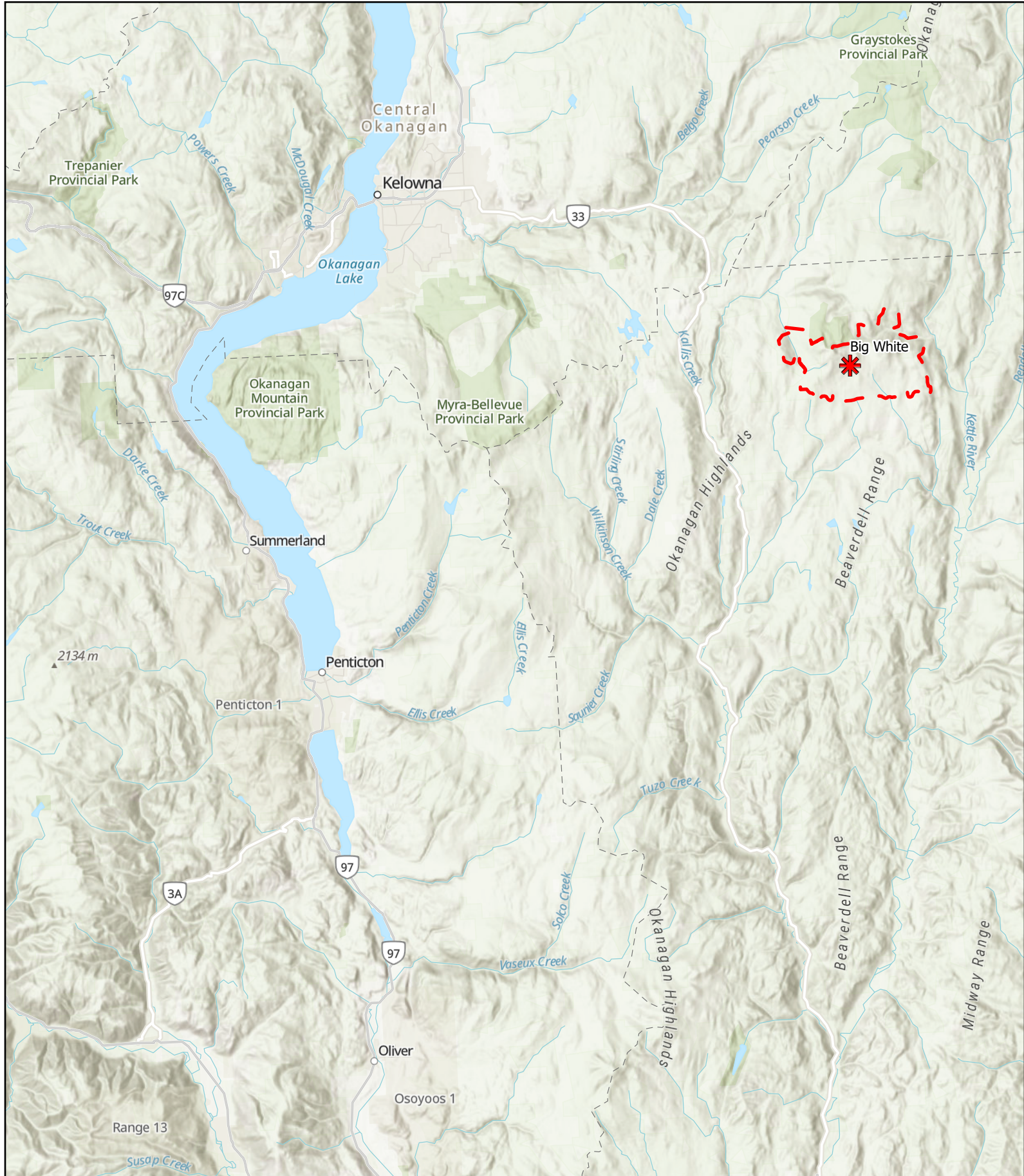
In 1997 Dave Williamson returned to Big White with Martin Gebauer, R.P. Bio, to expand the review to include the bench below the existing village. The information gathered during a cursory site visit conducted on September 2, 1997 was incorporated into this updated document.

Additional site reconnaissance of the Big White was conducted on October 23, 2008 with Dave Williamson and Dan McDonald, M.E.M. attending. Terrestrial Ecosystem Mapping (TEM) principles (BC Integrated Land Management Bureau, 1998) were employed to identify and delineate ecosystem units and show their distribution within the Controlled Recreation Area (CRA). TEM principles use a classification hierarchy of ecological units, including ecoregion units and biogeoclimatic units at a broader level and site units and vegetation development stages at a more detailed scale. Within these broader units, site level polygons describe ecosystem units composed of site series, site modifiers, and structural stages. Chris Wood, M.Sc. and Ryan Coatta, B.Sc. provided G.I.S. based TEM analysis of species accounts. Additionally, prior studies and reports conducted on the study area were reviewed.

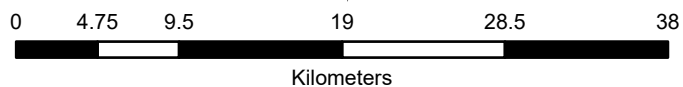
In 2018, Candace Rose-Taylor, M.Sc., R.P. Bio. and Simon Fry, B.Sc. B.I.T of Cascade, and Ms. Heather Moore, Ski Patrol Centre Manager of Big White Resort formed the field study team and conducted the site investigations for the resort lands at the northeast corner of the CRA on August 8 and 9, 2018. Review was provided by Dave Williamson B.E.S., Q.E.P. and Nicola Church M.Sc. constructed applicable maps and conducted initial orthophoto site review.

1.2 Project Area

Big White Ski Resort is located in south-central British Columbia, approximately 50 km east of Kelowna (Map 1). The CRA ranges in elevation from approximately 1500 m to 2300 m (Map 2 and Map 3). The CRA is drained to the south by Trapping Creek into West Kettle River, to the west and north by Hallam Creek into West Kettle River, and to the southeast by Whitefoot Creek and Copperkettle Creek. These drainages, the existing CRA and the proposed expansion area are identified on the Watersheds and Drainage Basins map (Map 4).

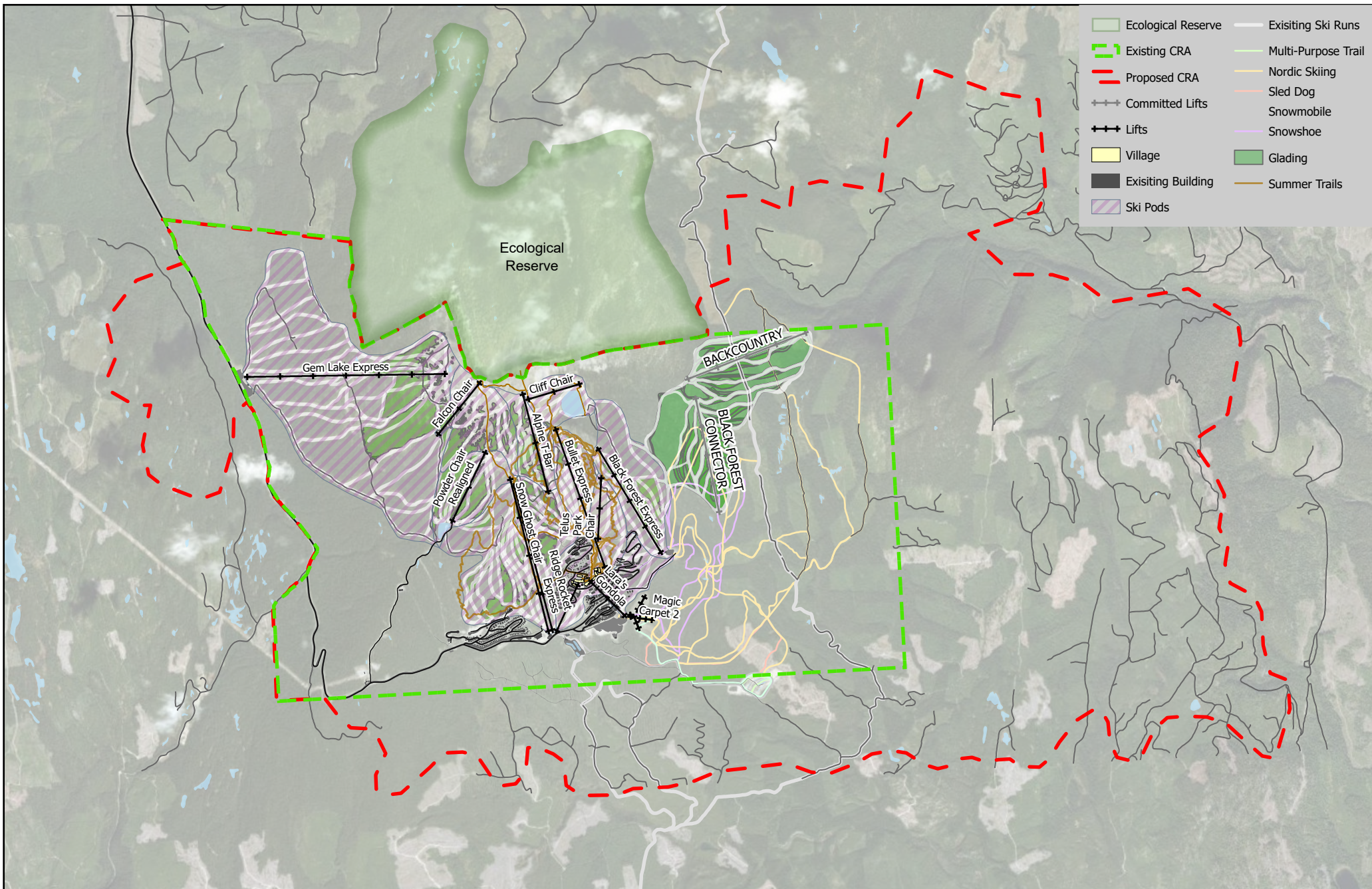


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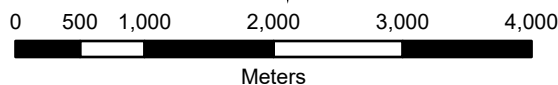


Map 1 - Location

Environmental Review
Big White Resort
Kelowna, British Columbia

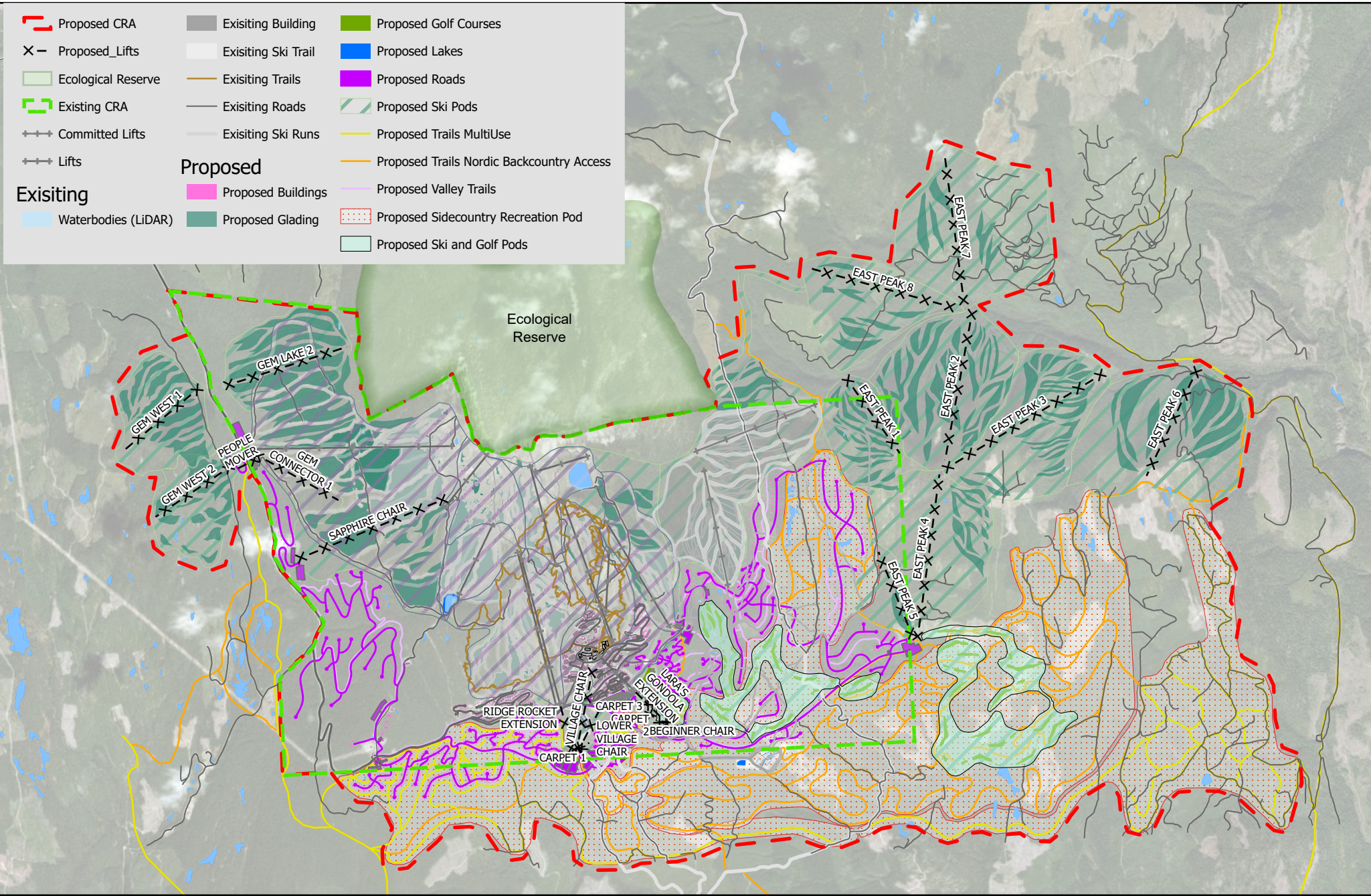


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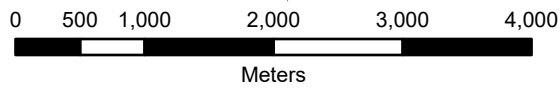


Map 2 - Existing Resort

Environmental Review
 Big White Resort
 Kelowna, British Columbia

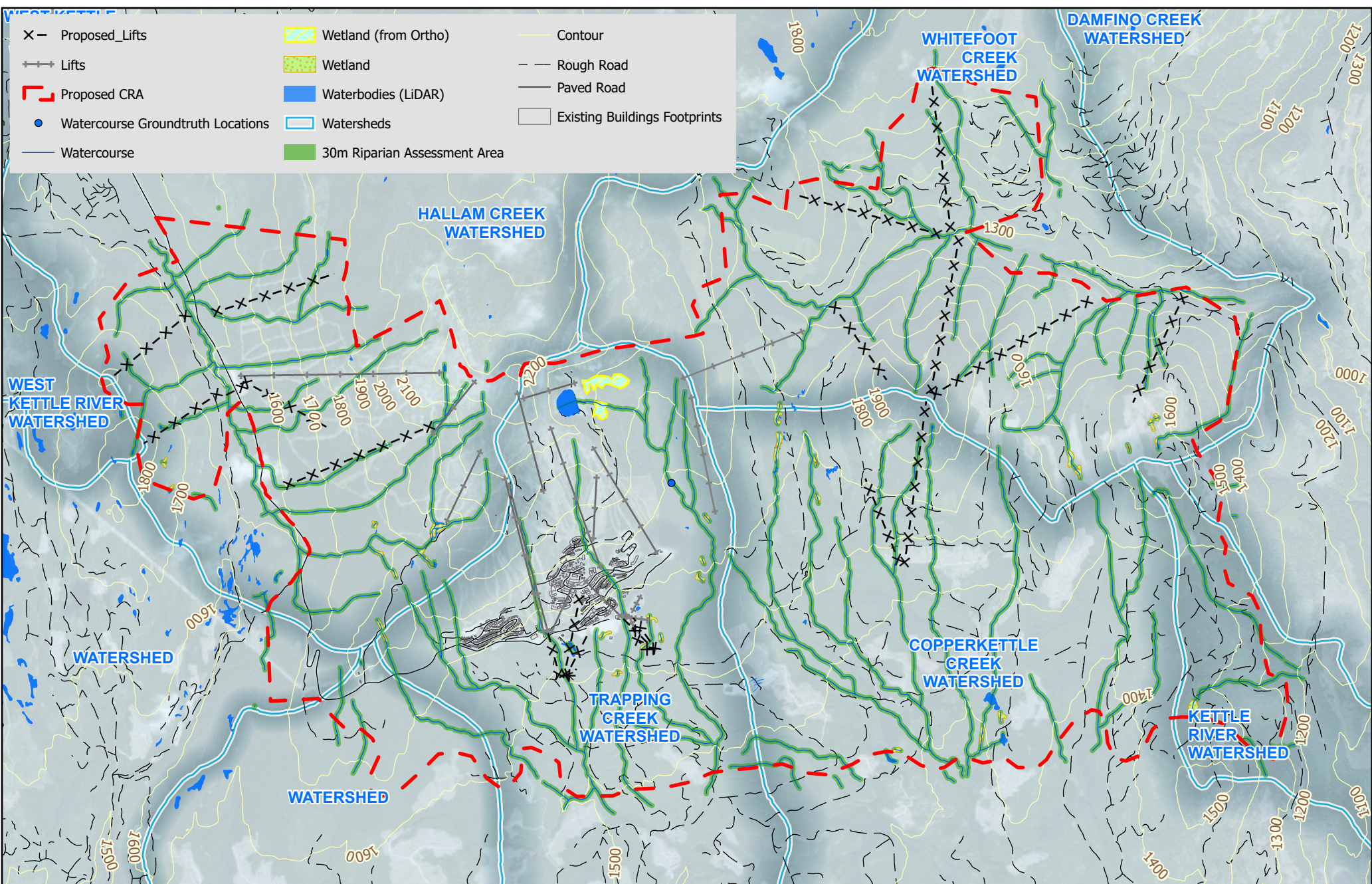


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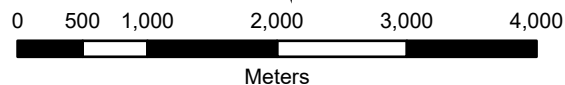


Map 3 - Proposed Development

Environmental Review
 Big White Resort
 Kelowna, British Columbia



GIS Cartographer: Nicola Church
 Date: 2020-07-22
 CERF File #: 017-01-05-
 Projection: NAD 1983 UTM Zone 10N



Map 4 - Hydrology

Environmental Review
 Big White Resort
 Kelowna, British Columbia



1.3 Methodology

This report is an update from the Environmental Review Big White Ski Resort 1996 Master Plan Update (GeoAlpine Environmental Consulting, 1997) and Big White Resort Master Plan 1999, the 2008 Environmental Review (Cascade Environmental Resource Group Ltd., 2008), the 2018 Environmental Review Amendment (Cascade Environmental Resource Group Ltd., 2018) and several earlier studies conducted by other consulting firms as well as by one of Cascade's parent companies, GeoAlpine Environmental Consulting Ltd. These studies include, but are not limited to the following:

- Big White Ski Resort Master Plan, (Brent Harley and Associates, 1996) (Brent Harley and Associates, 2008) (Brent Harley and Associates, The Resort Planning Group, 2018) ;
- Stream Classification: "Bullet" and Trapping Creeks, Big White Mountain (Cascade Environmental Resource Group Ltd., 2000) ;
- Big White Resort – Black Forest Construction Erosion and Sediment Control Plan (Cascade Environmental Resource Group Ltd., 2000);
- Drainage Plan for Base Area of Westside Development, Big White Ski Area (GeoAlpine Environmental Consulting, 1996);
- Gem Lake Express and Associated Trails (management planning document), (Big White Ski Resort Ltd., 1996);
- Big White and Surrounding Area - Resource Emphasis Areas (1:20,000 scale map), (Timberland Consultants Ltd., 1995) ;
- Guidelines for Environmental Good Practices for Ski Areas, (Canada West Ski Area Association, 1992);
- Big White Village Drainage Study, (Klohn Leonoff Consulting Engineers, 1981);
- Geotechnical Assessment - Proposed Village Extension of Big White Mountain, (Golder Associates Consulting Geotechnical Engineers, 1980); and
- Environmental Analysis of Big White, (Selkirk College, 1978).

Terrestrial Ecosystem standards were used to describe the site vegetation, soil and geomorphic features unique to each ecosystem unit within the study area. To ensure accurate descriptions of the current environmental conditions on the property and to reflect updated environmental reporting standards, a recent color orthophoto was used for ecosystem unit interpretation.

Wildlife was identified by visual observation, songs, tracks and feeding signs. Potential wildlife use, not observed during the site reconnaissance, was inferred from available habitats, local information, and known distributions. Valued ecosystem components such as riparian corridors, and first growth (i.e. veteran) trees, if any, were also noted during the survey.

This report provides a reconnaissance-level description of vegetation, wildlife and wildlife habitats surrounding the proposed development at the Big White Ski Resort. Much of the information provided in this report, relating to the known and likely wildlife values within proposed development area is the result of a desktop analysis based on available data and previous reports.

This report does not generally provide species-specific impacts related to the proposed development. Rather, this report provides general conclusions on the likely impacts of the proposed development on various species/communities.

2 Existing Environmental Conditions

2.1 Cultural Environment

2.1.1 First Nations

Traditionally, the Okanagan people (Syilx) occupied an area which extended over approximately 69,000 square kilometers. The northern area of this territory was close to the area of Mica Creek, just north of modern-day Revelstoke, BC, and the eastern boundary was Kootenay Lake. The southern boundary extended to the vicinity of Wilbur, Washington and the western border extended into the Nicola Valley (Okanagan Nation Alliance, Syilx, n.d.).

The Syilx are a division of the Interior Salish and speak the Nsyilxcən (Westbank First Nation, n.d.). The Okanagan people were hunters and gatherers and were noted to be semi-nomadic. Their staple diet consisted of deer, salmon, rabbit and other wild game (Okanagan Nation Alliance, Syilx, n.d.). The Okanagan's were also gatherers of roots, berries and various other plants (Okanagan Nation Alliance, Syilx, n.d.).

Located in south central British Columbia, Canada, the Okanagan Valley is home to Westbank First Nation, one of seven native communities that belong to the Okanagan Nation (Westbank First Nation, n.d.). Westbank First Nation is comprised of five reserves totaling 5,306 acres. Tsinstikeptum Reserves 9 and 10 border Okanagan Lake and are in close proximity to the City of Kelowna, one of the fastest growing cities in British Columbia (Westbank First Nation, n.d.).

A heritage/archaeological investigation was not conducted as part of this study.

2.1.2 Timber Harvesting

Interfor has conducted forest harvesting and silviculture operations in the CRA. As indicated on the orthophoto maps contained within this report the area shows an extensive road forest road network and contains numerous cutblocks. Timber rights within the CRA continue remain with Interfor.

Kootenay Timber Sales Business Area:

- 475 (6) – Nk'Mip Forestry Corporation
- 658 (0) – Boundary
- 29 (8) – F06
- 601 (2) – Boundary

2.1.3 Other Land Uses

The proposed expansion area contains several BC Integrated Land Management Bureau registered land tenures for guide outfitting. These tenures typically cover large areas and are not exclusive use. They are intended to allow guide outfitters to access the land for the purpose of guided outdoor recreation activities including hunting. The following guide outfitters are listed as tenure holders in the study area:

2.1.3.1 Guide outfitters

A single guide outfitting tenure occurs in the vicinity of the resort. It is held by Melvin Kilback.

2.1.4 Anthropogenic Features

Anthropogenic features occurring within the study area include those features relating to forest harvesting and all-season resort communities. In addition to the existing forest road network, the study area is currently occupied by the existing resort community of Big White and its extensive infrastructure of lifts, ski trails, bike trails, hiking trails, accommodations and services.

2.2 Physical Environment

2.2.1 Climate

The study area is located in the Northern Okanagan Highlands (NOH) Ecosection, which is nested within the Thompson Okanagan Plateau Ecoregion. At higher elevations this Southern Dry climate region (Lloyd et al., 1990) is characterized by cold winters, a deep snowpack, and relatively short, cool summers. The study area falls within the Engelmann spruce - subalpine fir (ESSF) biogeoclimatic zone, and the Okanagan Dry Cod variant (dc1) which is associated with a mean annual temperature of 2.0 degrees Celsius and growing season mean precipitation of 261 mm and annual mean snowfall of 635 cm (Lloyd et al., 1990).

Average annual precipitation data for various elevations on the mountain were extrapolated based on local AES climate stations. Average annual precipitation is approximately 950 mm in the present village (1800 m) and increases to 1200 mm near the summit of Big White (2350 m). The Gem Lake area could expect precipitation in the order of 850 mm at the base (1500 m) and 1100 mm near top of the west flank (2220 m) (Klohn Leonoff Consulting Engineers, 1981).

In general, snowfall increases with elevation below 1600 m but remains relatively constant thereafter. Above 1600 m, the snowpack reaches a maximum depth of approximately 160 cm (+/- 30 cm) which occurs in early to mid April. The related snow density at this time of year is approximately 0.30.

Snowmelt occurs rapidly in the latter part of May and June, accounting for 39 and 38% of the year's total runoff, respectively (Klohn Leonoff Consulting Engineers, 1981). Rainfall intensity data for 30- and 100-year return periods were calculated by Klohn Leonoff (Klohn Leonoff Consulting Engineers, 1981). No correlation was found between increasing elevation and rainfall intensity.

2.2.2 Geology

The bedrock within the study area consists of a granodiorite and quartz diorite dome consisting of a coarse crystalline structure providing competent foundations for structures. Two sets of regional jointing occur in a predominantly northern direction: one joint set being approximately 100 to the west, and the second being approximately 25° to the east. Based on elevation, drainage patterns above 2000 m elevation are largely influenced by these regional joint patterns.

The last episode of continental glaciation extended to an elevation of approximately 1800 m with a regional direction to the south (Golder Associates Consulting Geotechnical Engineers, 1980). This glacial advance is responsible for producing the bulk of the surficial materials present in the study area. Alpine glaciation is largely responsible for the topographic features above 1800 m such as the cirque basins.

2.2.3 Geomorphology

The existing morphology of the study area is the direct result of past glacial activity and the resultant surficial expressions are dominated by morainal tills and glacio-fluvial deposits.

The upper elevations of Big White display exposed weathered bedrock with colluvial materials of varying thickness (CRv). Bedrock ridges (caused by jointing) provide gully features along the upper southern face. Till layers (MRv) where present are thinner than those found in the lower reaches. Slopes are moderate to steep. Permanent snowfields exist in the shadow zones of cirque basins on the northeast sides of the mountain summits.

The middle elevations of the existing CRA are covered in a thin mantle of weathered glacial till (M) overlying bedrock (R). The glacial till cover materials consist of silty sandy soils containing some gravels (sg). This material is moderately well drained.

Mid slopes are moderately steep and the thickness of till deposits across the southern hillslope ranges between 3 and 4 m (Mb).

2.2.4 Hydrology

The Gem Lake area drains west to Hallam Creek and then north to the West Kettle River. The remaining portion of the existing Big White Mountain ski terrain drains south to Trapping Creek and then into the West Kettle River. The West Kettle River is a tributary of the Kettle River which in turn is a tributary to the Columbia River drainage basin. The remainder of the existing CRA and the majority of the proposed expanded CRA are drained by Whitefoot Creek and Copperkettle Creek which flows into the Kettle River. A small portion of the proposed CRA is drained to the north via a tributary to Two John Creek, which flows into the West Kettle River just upstream of its confluence with Hallam Creek. Section 2.3 provides further discussion of study area drainages as it relates to fish habitat. Map 4 presented earlier in this report identifies the existing hydrology of the study area.

Much of the available hydrologic data for the study area is the result of studies conducted by Klohn Leonoff (Klohn Leonoff Consulting Engineers, 1981). Due to the long-term nature of the precipitation data used by Klohn Leonoff (two AES climate stations provide data in excess of 50 years), their hydrologic analysis is still considered valid. A summary of available Water Survey of Canada (WSC) information for stream gauging stations in the vicinity is provided in Table 1.

In general, west-facing slopes remain somewhat cooler and more moist than southern slopes. Along the Gem Lake area, winds originating from the North provide enhanced air circulation across the slopes. The south facing slopes are dry with little evidence of surface runoff collection and gullying.

2.3 Aquatic Environment

2.3.1 Streams

Several drainage features exist up-slope of the present village. These channels have been the focus of previous studies which were concerned with the routing of storm runoff (Klohn Leonoff Consulting Engineers, 1981). Recommendations were made, at that time, to upgrade the drainage channels in the vicinity of the village.

Slopes in the Gem Lake development area appear to contain few prominent drainage features. This area contains thin, but well drained soils with little or no concentration of runoff. Below 2000 m elevation, subsurface drainage in the till layers is believed to be a controlling factor.

According to stream flow and precipitation data from Trapping Creek (8 km downstream of the Big White Village), approximately 75% of the annual precipitation reports to the local stream network as runoff. Runoff rates will likely be higher in early spring when the surficial materials are either frozen or saturated, and lower in the summer and fall when the ground is more absorbent.

Table 1: Historical Streamflow Summary, Water Survey of Canada

Name	Station No.	Period of Record	Drainage Area (km ²)	Regulated or Natural Flow	Mean Annual Discharge (m ³ /s)	Maximum Daily Discharge (m ³ /s)	Minimum Daily Discharge (m ³ /s)
West Kettle R. near McCullough	08NN015	1949-2018*	233	Natural	3.45	35.21	0.202
West Kettle R. below Carmi Cr.	08NN022	1973-1998*	1,170	Natural	9.64	88.75	0.553

Name	Station No.	Period of Record	Drainage Area (km ²)	Regulated or Natural Flow	Mean Annual Discharge (m ³ /s)	Maximum Daily Discharge (m ³ /s)	Minimum Daily Discharge (m ³ /s)
West Kettle R. at Westbridge	08NN003	1914-2018*	1,890	Regulated	11.57	112.07	0.0.939
Kettle R. near Westbridge	08NN026	1975-2018*	2,140	Regulated	27.56	231.28	1.710
Trapping Cr. at 1220 m contour	08NN020	1970-1981	22.8	Natural	0.487	7.121	0.032
Trapping Cr. near mouth	08NN019	1965-2018*	145	Natural	1.43	13.88	0.131

* Incomplete data set for expanded WSC period of record

2.3.2 Fish and Fish Habitat

The fisheries and aquatic habitat on site can be divided into those within the Hallam Creek drainage flowing north from the subject site, those within the Trapping Creek drainage flowing south from the project area, and those within the Whitefoot and Copperkettle Creek drainages that flow eastward. Both Hallam and Trapping Creeks flow into the West Kettle River which in turn flows into the Kettle River. Whitefoot Creek flows into Damfino Creek, and eventually into the Kettle River, while Copperkettle Creek flows directly into the Kettle River. The Kettle River and its tributaries are part of the Columbia River watershed.

2.3.2.1 Hallam Creek

Hallam Creek was assessed as part of the Environmental Review Big White Ski Resort Master Plan in 1997 (GeoAlpine Environmental Consulting, 1997). The creek has an overall length of approximately 9.5 km, flowing in a northward direction from the project area. The main stem of the river has an average gradient of 3.5% between its confluence with the West Kettle River and the upper crossing of the Big White access road at approximately 1,615 m elevation level. The headwaters of this system consists of two ephemeral drainages, flowing westward into the main stem, at gradients of approximately 15%. While gradients up to 15% do not pose an insurmountable barrier to fish movements (especially trout and char), the hydrology analyses indicate that these streams could possibly be dry in late fall through winter, limiting their fisheries habitat capability. They would, however, contribute nutrients and food (terrestrial and aquatic insects etc.) to downstream fish bearing waters.

The fisheries capabilities of Hallam Creek was assessed in 2008 (Cascade Environmental Resource Group Ltd., 2008) at a single 100 m long sampling site at approximately the 1,570 m contour level, about 7.5 km upstream from its mouth. This site is located immediately downstream of the Gem Lake development area. The creek had a gradient of 6 % at the sampling site, with an average wetted width of 4 m and a channel width of 5 m. The stream is frequently confined by the valley walls. The flow can be characterized as predominantly runs with lesser amounts of riffle and pool. The average maximum riffle depth was 16 cm, while the average maximum pool depth was 35 cm. The substrate was composed of 40 % cobbles and boulders, 40 % gravels and 20 % fines. There was some small log jams with causing small falls, ranging in height from 0.3 to 0.5 m, which would be unlikely to present a barrier to fish movements. Total stream cover was estimated at 20 %, consisting predominantly of boulder cover, and deep pool, with lesser amounts of large organic debris (LOD), overstream vegetation and cutbank. The tree canopy closure was about 10 %, consisting of subalpine fir and Engelmann spruce. The understory

and forb layers were relatively dense, consisting of mountain alder (*Alnus incana*), queen's cup, black gooseberry, white-flowered rhododendron, Indian hellebore, Sitka mountain-ash (*Sorbus sitchensis*), Douglas' water-hemlock (*Cicuta douglasii*), black twinberry, clasping twisted-stock and arctic lupine. The discharge at the sampling site was 0.35 m³/s. The water temperature was 9 °C, with a conductivity of 32 µs/cm at the time of sampling.

Seven rainbow trout (*Oncorhynchus mykiss*), ranging in fork length from 65 to 145 mm, were caught in a 100 m section of Hallam Creek by electrofishing for 2,160 seconds. The inclusion of fry, juvenile and maturing fish in this section would tend to indicate that this reach is used for rearing, spawning and incubation. No other fish species were observed.

2.3.2.2 Trapping Creek

Trapping Creek was assessed by Cascade (Cascade Environmental Resource Group Ltd., 2000) on behalf of Big White Ski Resort. It has an average gradient of 3.9 % over its overall length of 23.25 km. Tributaries to Trapping Creek, which lies within the project area, are ephemeral in nature, likely flowing only during spring and summer melt. The drainages in this area are also steeper than the main stem, with gradients ranging from 8 to 15%. Fisheries Inventory Data Queries (FIDQ) (BC Ministry Of Environment, 2020a) indicates that "Clear Lake" (also locally known as "Piranha Lake"), a small waterbody located adjacent to Trapping Creek approximately 3 km south of the study area, is suspected to contain rainbow trout. Field work by the study team confirmed the presence of rainbow trout in this shallow lake. Timberland (Timberland Consultants Ltd. 1997, n.d.) have also conducted an overview assessment on Trapping Creek and have conducted enhancement efforts centering on installing large woody debris (LWD) and other instream structures downstream of the CRA.

Two sampling sites on Trapping Creek and one sampling site on a tributary of Trapping Creek were assessed by the Cascade study team on July 26 and 27, 1996. The sampling sites on the main stem of Trapping Creek were located at approximately the 1,460 m contour (Site 1) and at the 1,690 m contour (Site 3). The downstream site was located in the midst of a large clear cut. While the vegetation in the cut was regenerating, there was little to no canopy cover. The shrub layer was fairly dense, however, and accounted for 50% of the total stream cover (estimated at 15 % of the stream area). Shrubs found adjacent to the creek included mountain alder, trappers tea and Utah honeysuckle. The majority of the remainder of the stream cover consisted of LOD, the remnants of past logging activity. The gradient of this section of creek was 1% with a channel width of 4.3 m and a wetted width of 2.8 m. The flow was characterized as 10 % pool, averaging 47 cm deep, 40 % riffle, with mean depths of 9 cm, and 50 % run. The substrate consisted of 25 % fines, 60 % gravels, and 15 % larges. The discharge at the time of sampling was 0.25 m³/s with a water temperature of 15°C and conductivity of 16 µs/cm. The culvert under Link Road at this sampling site was set at a slope of 4 %, which could pose a velocity barrier to fish under certain flow conditions.

Further upstream at sampling site 3, the stream gradient increased to 9 %, with a channel width of 4.7 m and a wetted width of 3.0 m. This section of creek had not been logged, although the tree canopy, consisting of subalpine fir and Engelmann spruce, was fairly scant at 10 % closure. Stream cover increased to about 20 %, consisting of approximately equal amounts of deep pool, LOD, overstream vegetation and cutbank cover. The flow was characterized as 10 % pool, 70 % riffle and 20 % run. The average maximum pool depth was 60 cm, with the average maximum riffle depth at 20 cm. The substrate was somewhat courser than downstream, as might be expected with the increased gradient. The stream discharge was 0.10 m³/s, with similar water quality compared to the downstream sample site.

The sample site on the tributary stream, site 2, had also been impacted from past logging activities. Although the cutblock was not immediately adjacent to the stream, there was significant bar formation, especially upstream of the Link Road culvert. Similar to the culvert on the main stem of Trapping Creek, the culvert on this tributary was set at 6.5 %, and could pose a velocity barrier to fish movements. The stream gradient was low, 2 %, with an average wetted width of 1.3 m (channel width of 4.5 m). The flow



was characterized as 10 % pool, 50 % riffle and 40 % run. The average maximum pool depth was 30 cm with riffles averaging 10 cm deep. Stream cover was very high at an estimated 60 %, consisting of dense overstream vegetation, with less amounts of LOD, deep pool and cutbank cover. The substrate was comprised of 20 % fines, 60 % gravels and 20 % larges. The discharge at the time of sampling was 0.09 m³/s.

Only five fish, all rainbow trout, were captured in Trapping Creek and its tributary. Four of these fish were caught in minnow traps set overnight at the three sampling sites, with only one fish caught by electrofishing (1,530 seconds at site 1 - one fish; 1,050 seconds at site 2, no electrofishing was conducted at site 3). It is interesting to note that all the fish were captured downstream of the culverts on Links Road. Whether the culverts are in fact barriers or not, can only be determined with a more intensive sampling program.

2.3.2.3 Whitefoot Creek

Whitefoot Creek is a 3rd order stream that originates on the eastern flank of Big White and tends eastward to its confluence with Damfino Creek at the 1,010 m elevation. Damfino Creek, in turn, flows into the Kettle River. The creek has an overall length of 10.4 km, with an average gradient of 9.8%. Damfino Creek is known to have a rainbow trout presence (BC Ministry Of Environment, 2020a), and Whitefoot Creek is suspected to contain fish up to 1,500 m elevation (Henderson Environmental Consultants Ltd., 1998).

2.3.2.4 Copperkettle Creek

Copperkettle Creek is a 4th order stream with a total length of 23.7 km and a drainage area of 156 km². The creek originates on the eastern flank of Big White and tends southeast to its confluence with the Kettle River at approximately the 780m elevation. Timberland (Timberland Consultants Ltd., 1997) have conducted an overview assessment on Copperkettle Creek. However, their assessment concluded just downstream of the proposed CRA boundaries. Their report notes that the stream contained both adult and juvenile rainbow trout up to that point. From the last assessed reach at the 1,421 m elevation to the 1600 m elevation, the creek has an average gradient of 9%, and it is likely that providing the stream has sufficient flows, it would be fish bearing to at least that location.

2.3.3 Rare and Endangered Fish Species

Although only rainbow trout have been captured in the creeks within the existing CRA, three provincially listed species are known to occur in the West Kettle and Kettle Rivers. These include the Umatilla dace (*Rhinichthys umatilla*), the speckled dace (*R. osculus*), and chiselmouth (*Acrocheilus alutaceus*). FISS records also note that bull trout occur in Kettle River, however Cannings and Ptolomy (Cannings and Ptolomy, 1998) report that this species does not occur in that drainage.

The speckled dace is on BC Environment's red list, indicating that it is imperiled because of rarity within the province, making it vulnerable to extirpation (BC Ministry Of Environment, 2020b). It is also listed as a species facing imminent extirpation by COSEWIC. The Kettle River system is the only known area where this species occurs in Canada. The speckled dace, however, is globally ranked as G5, "common to very common; demonstrably secure and essentially ineradicable under present conditions" (BC Ministry Of Environment, 2020b). Speckled dace are primarily found in shallow waters within cool streams and rivers with rocky substrate, but can also in large and small lakes, warm permanent and intermittent streams, and outflows of desert springs (Cannings and Ptolomy, 1998).

The Umatilla dace is also red listed for similar reasons as the speckled dace. It is listed as a species of special concern by COSEWIC and is globally ranked G4, "apparently secure". It has a limited distribution in British Columbia and prefers habitats that are relatively warm and productive; being absent from cold

tributaries in the mountains (Cannings and Ptolomy, 1998). It is therefore, unlikely to occur within the CRA.

The chiselmouth is a blue listed species that is confined to the Columbia River system. It is ranked as “not at risk” by COSEWIC and has a ranking of G5 globally, indicating that is “demonstrably widespread, abundant, and secure”. It also prefers warmer streams and is therefore unlikely to occur within the CRA.

2.3.4 Water Quality

The water quality in Trapping Creeks was sampled in July 1996. The samples were analyzed for a variety of routine parameters, including ammonia, nitrate, nitrite, phosphate, total phosphorus, among others. Water quality within the Trapping Creek drainage was sampled at three locations on July 26, 1996: Trapping Creek at the “Sewage plant” road (Site 3, Lab ID # 19743-1), Trapping Creek at Link Road (Site 1, Lab ID # 19743-2), and the western tributary of Trapping Creek at Link Road (Site 2, Lab ID # 19743-3), as shown on Figure 3. The water quality from the samples collected in the Trapping Creek drainage, fell within the Canadian drinking water standards, with the exception of iron (0.99 mg/l) in Trapping Creek at the “Sewage Plant” road (ID # 19743-1). Iron concentrations above the objective level of <0.05 mg/l may cause staining of plumbing fixtures, etc. In addition, total suspended solid levels were slightly elevated at this site (57 mg/l), indicating possible construction activities in or about the creek upstream for the sampling site. The high iron levels may be related to the suspended solids. Nutrient levels within the Trapping Creek drainage’s waters were generally low.

No water samples were taken during the 2018 field survey.

2.4 Terrestrial Environment

The study area is located within the Southern Interior Ecoprovince, the Thompson Okanagan Plateau Ecoregion, and the Northern Okanagan Highlands (NOH) Ecoregion.

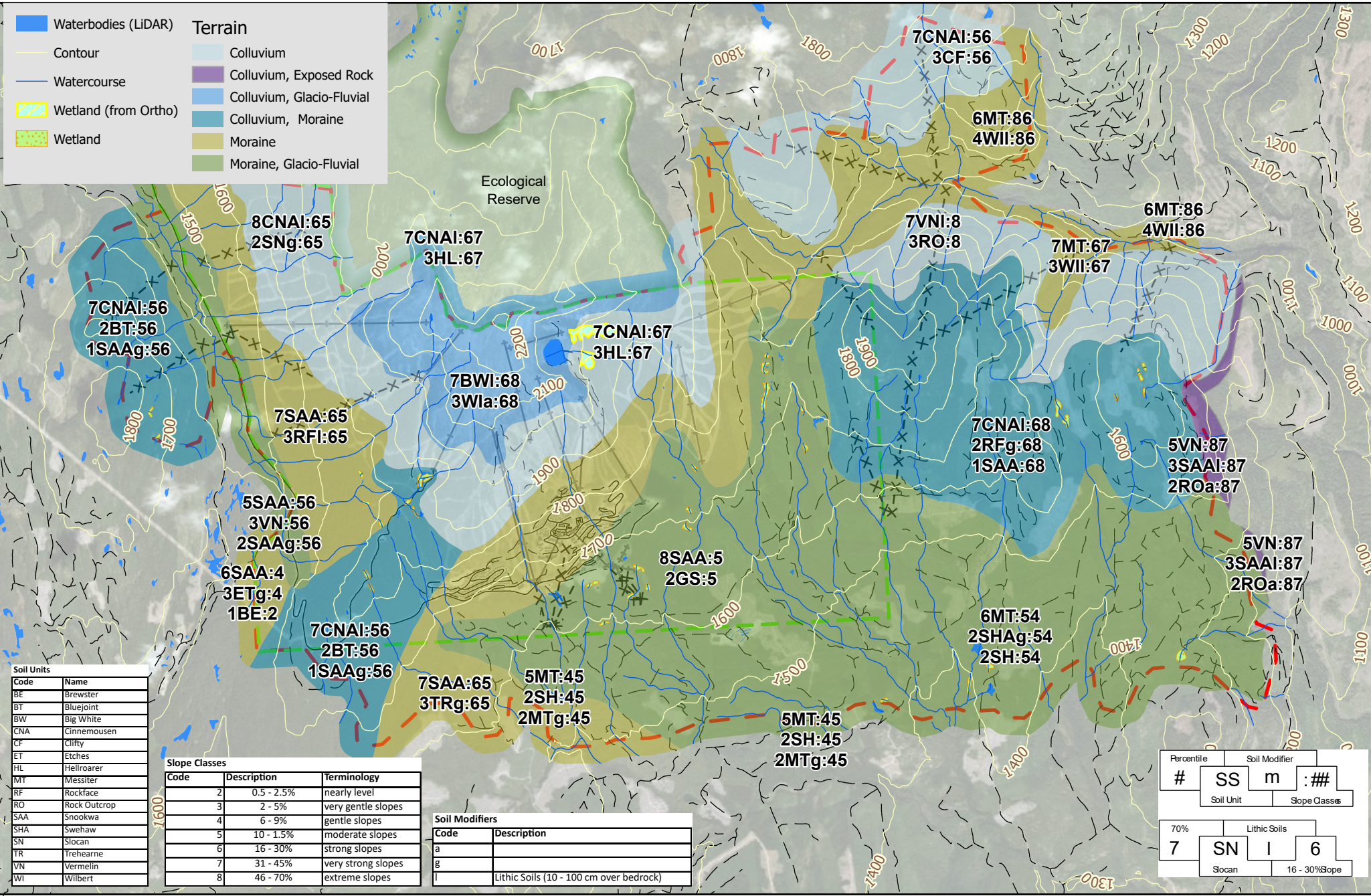
2.4.1 Soils

Soils found within the study area are classified as Orthic Humo-Ferric Podzols (Government of Canada, 2018). These soils are primarily composed of mineral particles. The identified Orthic Humo-Ferric Podzols (OHFP) typically have an organic horizon (commonly LFH, or organic layers which reflect various stages of decomposition) over an eluviated A (Ae) horizon, underlain by a B horizon enriched with amorphous material (e.g. aluminum and iron mixed with organic matter). Furthermore, for the O.HFP classification, the subgroup identifier “Orthic” indicates an intergrading toward soils of another order (e.g. Brunisolic).

The soils that occur at higher elevations of the study area, approximately 1840 m to >2000 m, are described as N (CNINNEMOUSEN). These soils are well drained (Government of Canada, 2018). The uppermost parent material is comprised of colluviums that is massive to moderately-well stratified, non-sorted to poorly sorted sediments with particle sizes ranging from clay to boulders with their present position based on direct gravity induced movement. The parent material below the colluvium is comprised of igneous, acidic bedrock.

The mid elevation soils of the study area, approximately 1620 m to 1840 m, are described as N (SNOOKWA). These soils are moderately well drained, as have intermediate to high water storage capacity within the control section and are usually medium to fine textured. Precipitation is the dominant water source for these soils. The parent material is comprised of morainal till deposited by glacial ice.

Although a detailed sampling program is beyond the present scope of study, preliminary site investigation revealed that Podzols are most widely distributed in the study area.



2.4.2 Vegetation

Information on vegetation in the study area was verified through field investigations (Table 2), and through interpretation using the ecosystem classification system established in B.C. (Lloyd et al., 1990). Other referenced sources provide additional data. A vegetation inventory conducted at Big White by Klaus (Klaus D., 1995) provides further detailed information in support of the development of landscaping guidelines for the resort.

Timber inventory data collected by Drake Forestry Services Ltd. (Drake Forestry Services Ltd., 1996) indicates that the study area forest cover is dominated by two climax species, subalpine ("balsam") fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*). A third major forest component on lower elevation sites is lodgepole pine (*Pinus contorta*). Mature and old lodgepole pine in the area is affected by mountain pine beetle infestation (Drake Forestry Services Ltd., 1996). At elevations below 1900 m, the fir and spruce are an average height of approximately 45 m, and they are between 80 and 115 years old. At higher elevations, less productive soils and other environmental conditions generally represent limiting factors for tree growth. However, veteran Engelmann spruce determined by ring count to be 275 years old was noted during previous studies at an elevation of approximately 2100 m.

The forest is continuous at lower and middle elevations, while at higher elevations a more sparse parkland forest marks the transition to alpine tundra. High elevation areas are associated both with heath communities and with meadows that contain a variety of herbaceous species.

Deciduous tree species are uncommon in this subalpine forest. Understory shrub vegetation is typically dominated by white-flowered rhododendron (*Rhododendrum albiflorum*). Grouseberry (*Vaccinium scoparium*) appears to dominate the herbaceous understory. Wetter sites are likely associated with Sitka valerian (*Valeriana sitchensis*), sedges (*Carex* spp.), and glow moss (*Aulacomnium palustre*) (Lloyd et al., 1990).

Forest stands within the subject area were found to consist of pole/sapling (Structural Stage 4) second growth cut blocks, young forest (Structural Stage 5), mature (Structural Stage 6) and old growth (Structural Stage 7a) forest stands from undisturbed sites, all with a coniferous dominated composition. A description of this structural stage provided in Table 3. Vegetation identified in the subject area is listed in Table 2.

2.4.2.1 Vegetation Associations

All vegetation has been assigned to a layer dependent on vegetation type and height.

- *Tree layer* – includes all woody plants greater than 10 m tall.
- *Shrub layer* – includes all woody plants less than 10 m tall, *except low* (usually < 10 cm tall) woody or trailing plants which are *considered* part of the herb layer. Established tree regeneration more than two years of age and less than 10 m in height is considered part of the shrub layer.
- *Herb layer* - includes all herbaceous species, regardless of height, and some low woody plants less than 15 cm tall.
- *Moss, lichen, liverwort and seedling layer* – Includes all bryophytes, terrestrial lichens, and liverworts, and tree *seedlings less than two years old*.

A summary of the plant species present on the study site is provided in Table 2.

Table 2: Vegetation identified on subject site

Common Name	Scientific Name
<u>Trees</u>	
Subalpine fir	<i>Abies lasiocarpa</i>
Engelmann spruce	<i>Picea engelmannii</i>
Lodgepole pine	<i>Pinus contorta var. latifolia</i>
Red alder	<i>Alnus rubra</i>
Trembling aspen	<i>Populus tremuloides</i>
Black cottonwood	<i>Populus balsamifera ssp. trichocarpa</i>
Douglas-fir	<i>Pseudotsuga menziesii</i>
<u>Shrubs</u>	
white-flowered rhododendron	<i>Rhododendrum albiflorum</i>
Queen Ann's Lace	<i>Daucus carota</i>
Utah Honeysuckle	<i>Lonicera utahensis</i>
Grouseberry	<i>Vaccinium scoparium</i>
Black Huckleberry	<i>Vaccinium membranaceum</i>
Sticky Currant	<i>Ribes viscosissimum</i>
Sitka Mt. ash	<i>Sorbus sitchensis</i>
Red osier dogwood	<i>Cornus sericea</i>
Red elderberry	<i>Sambucus racemosa</i>
Blueberry	<i>Vaccinium ovalifolium</i>
Hard hack	<i>Spirea douglasii</i>
Salsafy	<i>Tragopogon porrifolius</i>
Nootka rose	<i>Rosa nutkana</i>
Salmonberry	<i>Rubus spectabilis</i>
Thimbleberry	<i>Rubus parviflorus</i>
Willow	<i>Salix spp.</i>
Sitka Mt. ash	<i>Sorbus sitchensis</i>
False Solomon's seal	<i>Smilacina racemosa</i>
High Bush Cranberry	<i>Viburnum edule</i>
<u>Forbs</u>	
Fireweed	<i>Epilobium ciliatum</i>
Horsetails	<i>Equisetum arvense</i>
Falsebox	<i>Pachistima myrsinites</i>
Rattlesnake plantain	<i>Goodyera oblongifolia</i>
Hawkweed Sp.	<i>Hieracium</i>
Wild strawberry	<i>Fragaria virginiana</i>
Wall lettuce	<i>Lactuca muralis</i>



Common Name	Scientific Name
Bracted lousewort	<i>Pedicularis bracteosa</i>
Mountain arnica	<i>Arnica latifolia</i>
Indian hellebore	<i>Veratrum viride</i>
Pearly everlasting	<i>Anaphalis margaritacea</i>
Queen Ann's lace	<i>Daucus carota</i>
Violet spp.	<i>Viola spp.</i>
Queens cup	<i>Clintonia uniflora</i>
Hookers fairybell	<i>Disporum hookeri</i>
Sitka valerian	<i>Valeriana sitchensis</i>
Arctic Lupine	<i>Lupinus arcticus</i>
Violet	<i>Viola Sp.</i>
Common red paintbrush	<i>Castilleja miniata</i>
One leaved foamflower	<i>Tiarella unifoliata</i>
Racemose pussytoes	<i>Antenna racemosa</i>
Arrow leaved groundsel	<i>Senecio triangularis</i>
White Mountain Heather	<i>Cassiope mertensiana</i>
Pink Mountain Heather	<i>Phyllodoce empe</i>
Showy sedge	<i>Carex scirpodea</i>
Narrow leaved cotton grass	<i>Riophorum angustifolium</i>
Mountain Hairgrass	<i>Vahlodea atropurpurea</i>
<u>Ferns</u>	
Lady fern	<i>Athyrium felix-femina</i>
Bracken fern	<i>Pteridium aquilinum</i>
<u>Mosses and Lichens</u>	
Witches hair	<i>Alectoria sarmentosa</i>
Mosses	
Pipcleaner moss	<i>Rhytidiopsis robusta</i>
Sphagnum moss	<i>Sphagnum sp.</i>

Table 3: Description of Structural Stages

Structural Stage Code	Interpretation
1 Sparse/Bryoid	<ul style="list-style-type: none"> - Community is in initial stages of primary and secondary development - Bryophytes and lichens often dominant - Times since disturbance typically <20 years but may be 50-100 + years in areas with little or no soil - Shrub and herb cover <20 % of total area - Tree cover < 10 % of total area
2a/b/c/d Herb	<ul style="list-style-type: none"> - Early successional stage or edaphic herb community - 2a forb dominated

Structural Stage Code	Interpretation
	<ul style="list-style-type: none"> - 2b graminoid dominated, including grasses, sedges, reeds and rushes - 2c aquatic plant dominated, but not 2b plants - 2d dwarf shrub dominated, low growing woody shrubs
3a/b Shrub	<ul style="list-style-type: none"> - Shrub dominated communities maintained by environmental conditions or disturbance - 3a low shrub < 2 metres tall - 3b tall shrub < 10 metres tall - Tree cover <10 %
4 Pole/Sapling	<ul style="list-style-type: none"> - Densely stocked trees - Self-thinning not yet evident - Time since disturbance usually < 40 years
5 Young Forest	<ul style="list-style-type: none"> - Stocking density persists - Self-thinning not yet evident - Time since disturbance usually 40-80 years
6 Mature Forest	<ul style="list-style-type: none"> - Trees established after the last disturbance have matured - The second cycle of shade-tolerant trees may have become established - Time since disturbance generally 80–140 years
7a/b Old Forest	<ul style="list-style-type: none"> - Structurally complex stands composed mainly of shade-tolerant and regenerating tree species - Snags and coarse woody debris in all stages of decomposition typical - 7a Old Forest 140-250 years - 7b Very Old Forest >250 years
Modifiers: B – Broadleaf C – Coniferous M – Mixed	<ul style="list-style-type: none"> - Broadleaf stands composed of > 75 % broadleaf tree cover - Coniferous stands composed of > 75 % coniferous tree cover - Mixed stands neither coniferous nor broadleaf compose > 75 % of the total tree cover

2.4.2.2 Biogeoclimatic Zone Classification

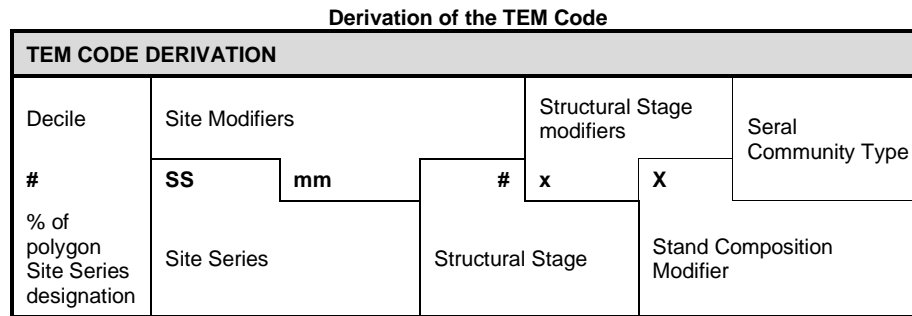
A standard method of land classification used in BC is the Biogeoclimatic Ecosystem Classification system (BEC). The biogeoclimatic ecosystem classification describes the variation in climate, vegetation, and site conditions occurring within ecosections. BEC is also hierarchal, with separate climate and site levels (Ecosystems Working Group et al., 1998). There are six levels of organization with increasing specificity: zone, subzone, phase, variant, site association, and site series. At the highest level, biogeoclimatic zones are classed based on broad macroclimatic patterns; at the lowest level, site series describes the vegetation potential of the land area based on its ability to support the same climax plant association and displaying the same soil moisture and nutrient regimes (Ecosystems Working Group et al., 1998). For the purposes of this report, descriptions are set at the biogeoclimatic subzone, variant, and site series levels of detail using Terrestrial Ecosystem Mapping (Map 6).

Most of the study area is classified as a dry, cold Okanagan variant of the Engelmann spruce subalpine fir biogeoclimatic zone (ESSFdc1). This occur on the southwestern, eastern, and northern edges of the Thompson Plateau (Lloyd et al., 1990). This subzone is drier than all ESSF subzones in the region with the exception of the ESSFxc, which occurs west of the Fraser River. ESSFdc1 classification was confirmed with both the Kamloops Forest Region and Nelson Forest Region offices. Higher elevation (approximately 2000 m asl) sites in the study area comprise the parkland variant (ESSFdcp) of this subzone, while the peak of Big White Mountain (over 2000 m in elevation) falls within the alpine tundra (AT) zone.

2.4.2.3 Terrestrial Ecosystem Mapping

Terrestrial Ecosystem Mapping (TEM) is built on the foundation of the BEC system principles. TEM provides the framework in which biotic and abiotic elements can be integrated to provide information on the spatial distribution of ecological units on the ground. Aerial photos and field surveys are used to delineate ecosystem polygons containing features with the similar site conditions, using variables such as vegetation, soil, aspect, and vegetation structural stage. This information can then be used to develop wildlife habitat capability / suitability mapping based upon individual species habitat preferences.

The derivation of the TEM code is described as:



A temporary supplement to Land Management Handbook 70 was produced in 2016 which contained updates on the site series contained within the ESSFdc1 subzone (MacKillop et al., 2016). This supplement updated the site series contained within the subzone including name and description. Table 4 describes TEM code the original site series and current site series crossover for the ecosystem classifications (MacKillop et al., 2016). The following vegetation descriptions for the polygons are written with the newly classified site series, however, corresponding TEM codes have not currently been published for these sites and therefore, the original site series names were converted and used.

Table 4 TEM Unit Code, Old Site Series and Current Site Series Crossover for ESSFdc1

TEM Code	Old Site Series Name/Description	Current Site Unit/Description
FR	01-BI-Rhododendron - Grouseberry	104- BI-Rhododendron-Grouseberry
EP	02- PISe - Pinegrass	102-BIPI Huckleberry
FG	03-BI-Grouseberry - Cladonia	102-BIPI Huckleberry 103-BIPI-Falsebox-Grouseberry
RV	04-BI-Rhododendron - Valerian	101-BISe-Rhododendron-Valerian
FT	05-BI-Trapper's Tea	111-BI-Valerian-Foamflower
FH	06-BI - Horsetail - Glow moss	112-Se-Horsetail-Globeflower 111-BI-Valerian-Foamflower
SS	07-Sedge - Sphagnum	Ws-Wetland Swamp Wf- Wetland Fen Wm-Wetland Marsh

Table 5: Aerial representation of TEM codes per biogeoclimatic zone

TEM Code	Site Series Name/Description	Area (ha)	% of Total Area
AT			
RO	00- Rocky outcrop	25.05	0.36
MM	00- Mountain heather meadow	0.69	0.01
VC	00- VC - Mountain hairgrass - Merten's cassiope	4.50	0.07
SW	00- Sedge - woodrush	10.21	0.15
WM	00- Wet seepage meadows	6.12	0.09
TA	00- Talus	37.17	0.54
ESSFdc1			
FR	01-BI-Rhododendron - Grouseberry	228.61	33.14
EP	02- PISe - Pinegrass	635.15	9.20
FG	03-BI-Grouseberry - Cladonia	653.24	9.46
RV	04-BI-Rhododendron - Valerian	639.08	9.26
FT	05-BI-Trapper's Tea	59.19	0.86
FH	06-BI - Horsetail - Glow moss	68.54	0.99
SS	07-Sedge - Sphagnum (Wf03 - Water sedge - Peat-moss)	1.59	0.02
PD	Pond – small body of water greater than 2 m deep but not large enough to be classified as a lake e.g. less than 50 ha	8.74	0.13
UR	Urban	203.40	2.95
AV	00-Avalanche chute	56.86	0.82
RO	00-Rocky outcrop	38.29	0.55
OW	00- Shallow Open Water	0.81	0.01
ESSFdcP			
VC	00- Mountain hairgrass - Merten's cassiope	106.05	1.54
FV	00- BI - Sitka valerian	0.54	0.01
HV	00- Indian hellebore - Sitka valerian	0.23	0.00
FC	00- BI - Merten's cassiope	45.45	0.66
ICHmk1			
RF	01- CwSxw - Falsebox	201.55	2.92
DP	02- Fd - Juniper - Penstemon	11.76	0.17
DT	03- FdPI - Pinegrass - Twinflower	61.54	0.89
DA	04- FdPI - Sitka alder - Pinegrass	334.86	4.86
RO	00-Rocky outcrop	5.59	0.08
MSdm1			
SF	01- Sxw - Falsebox - Feathermoss	1276.60	18.52
PG	03- PI - Grouseberry - Cladonia	15.12	0.22
PP	04- PI - Pinegrass - Kinnikinnick	61.27	0.89
SG	06- Sxw - Gooseberry	17.13	0.25



TEM Code	Site Series Name/Description	Area (ha)	% of Total Area
SH	07- Sxw - Trapper's tea - Horsetail	0.22	0.00
SO	08- Sxw - Gooseberry - Oak fern	17.62	0.26
UR	Urban	10.58	0.15
Total TEM Area:			6902.34

Within the subject area eight polygons were ground-truthed and described in details in 2018 while the remaining of the polygons present on the subject area was assessed based on the TEM data available online. TEM descriptions of the other polygons are described in Table 5 The following sections described the polygons ground-truthed in 2018.



Polygon 1 RV4C

Polygon 1 – TEM Code RV – Site Series 101 (BISe-Rhododendron – Valerian)

Polygon 1 TEM CODE DERIVATION			
Decile			
10	RV	4	C
100%	102- BISe- Rhododendron – Valerian	Pole/Sapling	Coniferous

This polygon represents a pole/sapling coniferous forest recently harvested as a cut block. Soils are poorly drained at a receiving position on the slope with deep and medium textured soils. The tree layer is dominated by subalpine fir with lesser amounts of lodgepole pine. White flowered rhododendron dominates the shrub layer and mountain arnica and Indian hellebore are found within the herb layer. Subalpine firs had an average dbh of 80 mm.

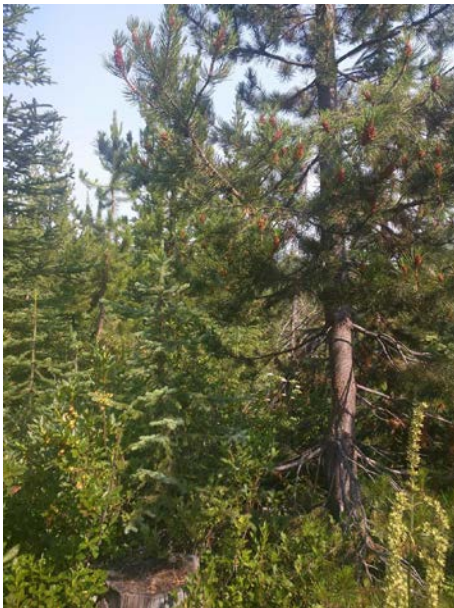


Photo 1: Polygon 1 RV4C vegetation association, August 8, 2018



Polygon 2 FR7aC

Polygon 2 – TEM code FR-Site Series 104 (bl- Rhododendron – Grouseberry)

Polygon 2 TEM CODE DERIVATION					
Decile					
10	FR		7a	a	C
100%	104- Bl-Rhododendron – Grouseberry		Old Forest		Coniferous

This Polygon represents an old forest estimated to between 140-250 years old with moderately steep slopes of 40% with sub-mesic to subxeric soil conditions with deep medium textured soils. Subalpine fir dominates the tree cover with lesser amounts of Engelmann spruce. The shrub layer is dominated by white flowered rhododendron with lesser amounts of black huckleberry. Herb layer was less developed with minimal occurrence of rattlesnake plantain, queen's cup and hooker's fairybells. The average Engelmann spruce were measured at a dbh of 513 mm with an approximate height of 30 m.



Photo 2: Polygon 2 FR7aC, August 8, 2018.

Polygon 3 7FR4C 3RV4C

Polygon 3 – TEM code FR-Site Series 104 (BI- Rhododendron – Grouseberry)

Polygon 3 TEM CODE DERIVATION			
Decile			
7	FR	4	C
70%	104- BI-Rhododendron – Grouseberry	Pole/sapling	Coniferous

Polygon 3 – TEM Code RV – Site Series 101 (BISe-Rhododendron – Valerian)

Polygon 3 TEM CODE DERIVATION			
Decile			
3	RV	4	C
30%	101- BSeI- Rhododendron – Valerian	Pole/Sapling	Coniferous

Polygon 7FR4C 3RV4C represents a harvested cut block vegetation with a pole/sapling structure with an estimate age of 30 year and stand height of 7 m. Lodgepole pine dominated the tree layer with lesser amounts of Engelmann spruce and subalpine fir. Utah honeysuckle dominated the shrub layer with lesser amounts of grouseberry and sticky current. A less developed herb layer was present with a dominant layer of mountain arnica. The site series was in a transition stage between 104 (BI- Rhododendron Grouseberry) and 101 (BISe-Rhododendron – Valerian) with deep and medium textured soils.



Photo 3: Polygon 3 7FR4C 3RV4C vegetation association, August 8, 2018

Polygon 4 5RV4C 5FG4C

Polygon 4 – TEM Code RV – Site Series 101 (BI-Rhododendron – Valerian)

Polygon 4 TEM CODE DERIVATION			
Decile			
5	RV	4	C
50%	101- BI-Rhododendron – Valerian	Pole/Sapling	Coniferous

Polygon 4 – TEM Code FG – Site Series 103 (BIPI-Grouseberry Cladonia)

Polygon 4 TEM CODE DERIVATION			
Decile			
5	FG	4	C
50%	103 –BIPI Falsebox- Grouseberry	Pole/Sapling	Coniferous

This polygon represents a recently harvested cutblock with a pole sapling structural stage. Lodgepole pine is the dominant tree, white flowered rhododendron is dominant within the shrub layer and Indian hellabore, arctic lupine and hookers fairybells is present within the herb layer. Due to drier characteristics and dominant presence of lodgepole pine and arctic lupine and the dominant shrub layer of white-flowered rhododendron the polygon was characterised as a transition stage between site series 101 and 103.



Photo 4: Polygon 4 5RV4C 5FG4C, August 8, 2018.

Polygon 5 RV7aC

Polygon 5 – TEM Code RV – Site Series 101 (BISe-Rhododendron – Valerian)

Polygon 5 TEM CODE DERIVATION					
Decile					
10	RV		7a	a	C
100%	101- BISe-Rhododendron – Valerian		Old forest		Coniferous

Polygon 5 shared the same soil and vegetation associations with polygon 1 RV4C except the forest structural stage was found to be in an old forest structural stage without recent disturbance. Stand age was estimated to be 200 years or more with an estimated height of 20 m.



Photo 5: Polygon 5 RV7aC vegetation associations, August 8, 2018.



Polygon 6 FH7aC

Polygon 6 – TEM Code FH – Site Series 112 (Se - Horsetail - glow moss)

Polygon 6 TEM CODE DERIVATION					
Decile					
10	FH		7a	a	C
100%	112- Se-Horsetail- Globeflower	Old forest		Coniferous	

Polygon 6 FH7aC represents deep hygric soils with a high water table found in level areas on the outflow below Rhonda Lake. Vegetation included Engelmann spruce and subalpine fir on raised microtopography with a well developed herb layer dominated with horsetail and lesser amounts of Indian hellebore and arrow leaved groundsel with a 30% sphagnum moss coverage within the site.



Photo 6: Polygon 6 FH7aC vegetation association, August 9, 2018.

Polygon 7 5RV7aC 5FT7aC

Polygon 7 – TEM Code RV – Site Series 101 (BISe-Rhododendron – Valerian)

Polygon 7 TEM CODE DERIVATION					
Decile					
5	RV		7a	a	C
50%	101- BISe-Rhododendron – Valerian		Old Forest		Coniferous

Polygon 7 – TEM Code RV – Site Series 110 (BISe-Rhododendron - Hellebore)

Polygon 7 TEM CODE DERIVATION					
Decile					
5	FT		7a	a	C
50%	110- BISe-Rhododendron - Hellebore		Old Forest		Coniferous

This polygon is represented by gentler slopes in the higher alpine producing a 110 BISe-Rhododendron-Hellebore series with a forested alpine meadow with a tree cover of 10 % including Engelmann spruce and subalpine fir. The shrub layer is dominated by heather and grouseberry and herb layer mainly dominated by Indian hellebore. As the polygon slopes percentage increases and soils become coarser 101 BISe- Rhododendron -Valerian site series is represented.



Photo 7: 5RV7aC 5FT7aC, August 9, 2018.

Polygon 8 5RV7aC 5FG7aC

Polygon 8 – TEM Code RV – Site Series 101 (BISe-Rhododendron – Valerian)

Polygon 4 TEM CODE DERIVATION					
Decile					
5	RV	7a	a	C	
50%	101- BISe-Rhododendron – Valerian	Old forest	Coniferous		

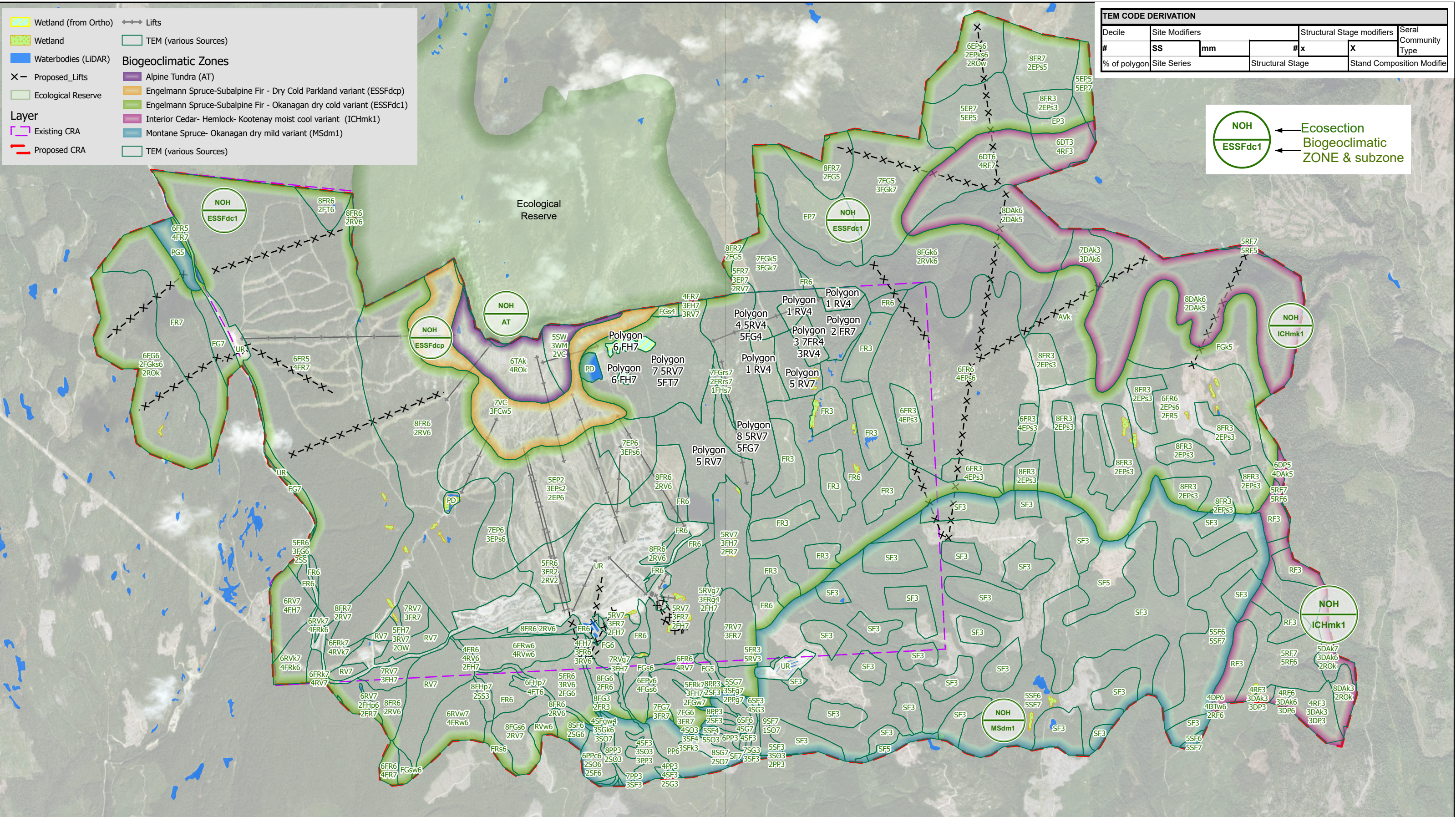
Polygon 8 – TEM Code FG – Site Series 103 (BIPI – Falsebox – Grouseberry)

Polygon 4 TEM CODE DERIVATION					
Decile					
5	FG	7a	a	C	
50%	103 – Grouseberry - Cladonia	Old forest	Coniferous		

This polygon shares similar vegetation and soil characteristics as Polygon 4 5RV4C 5FG4C, however, the structural stage was to be found as old forest with a stand age of approximately 200 years and a stand height of 25 m. Areas of this polygon were observed with steep slopes, rocky outcrops and subxeric soils producing the 103 (BIPI - Falsebox – Grouseberry) vegetation associations.



Photo 8: Polygon 8 5RV7aC 5FG7aC, August 9, 2018.



GIS Cartographer: Nicola Church
Date: 2020-07-23
CERG File #: 017-01-05-
Projection: NAD 1983 UTM Zone 10N



Map 6 - Terrestrial Ecosystem Mapping

Environmental Review
Big White Resort
Kelowna, British Columbia

2.4.2.4 Rare and Endangered Plant Species and Ecological Communities

2.4.2.4.1 Plant Species

In BC, there are two governing bodies involved with the ranking of species and/or ecological communities at risk. At the national level, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) provides advice to the *Species at Risk Act* (SARA), and at the provincial level, the Conservation Data Centre (CDC) manages the BC Status List.

The Canadian government created SARA in 2002 to complement the Accord for the Protection of Species at Risk (a national effort to identify and protect threatened and endangered wildlife and their associated habitats across the country). COSEWIC is the scientific body responsible for assigning the status of species at risk under SARA. This system uses the following terminology:

- Extinct (XX)
- Extirpated (XT)
- Endangered (E)
- Threatened (T)
- Special concern (SC)
- Not at risk (NAR)
- Data deficient (DD)

A species that is listed as Endangered, Extirpated or Threatened is included on the legal list under Schedule 1 of the *Act* and is legally protected under the Act with Federal measures to protect and recover these species in effect.

The BC CDC designates provincial red or blue list status to animal and plant species, and ecological communities of concerns (BC Ministry Of Environment, 2020b). The red list includes indigenous species or subspecies considered to be endangered or threatened. Endangered species are facing imminent extirpation / extinction, whereas threatened groups or species are likely to become endangered if limiting factors are not reversed. The blue list includes taxa considered to be vulnerable because of characteristics that make them particularly sensitive to human activities or natural events. Although blue listed species are at risk, they are not considered endangered or threatened. Yellow listed species are all others not included on the red or blue list and may be species which are declining, increasing, common, or uncommon. Table 6 below include CDC listed (i.e. rare and threatened) species that have the potential to occur on the subject site; species designated as SARA Schedule 1 are also noted.

This potential is based on broad habitat preferences delineated by MOE region (Okanagan), regional district (Kootenay Boundary Regional District) and biogeoclimatic zone and refined by habitat type available in the subject area. The biogeoclimatic zone ESSF, ICH and MS were used in the search.

Potential occurrences are then designated as unlikely or possible based upon species specific habitat requirements and an on-site assessment of those habitats. Note that a comprehensive evaluation of the study area for each species was not possible due to time constraints, seasonal migration patterns, and the transient nature of some species. The occurrence of “Possible” specific rare and endangered plant species can only be verified through a detailed field survey specific to the areas of the property slated for disturbance and including a reasonable buffer around those areas.

The CDC indicated that there are no recorded observations for red or blue-listed plant species within the immediate study area (Government of British Columbia, 2020). The closest occurrence is displayed in CDC polygon #14329 is the nettle-leaved giant hyssop (*Agastache urticifolia*), which is currently yellow-listed by the CDC, has been identified at a location approximately 30 km east/southeast of the study area, near the Granby River. The blue-listed Regel's rush (*Juncus regelii*) has been identified at a location

approximately 35 km northeast of the study area, on the upper Kettle River above Woodmouse Creek. A list of plant species potentially occurring in the general vicinity of Big White is provided in Table 6.

The occurrence of specific rare and endangered plant species can only be verified through a detailed field survey specific to the areas of the property slated for disturbance and including a reasonable buffer around those areas.

Table 6: Rare and Endangered Plant Species Potentially Occurring Within the Subject Area.

Common Name <i>Scientific name</i>	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA Status		
<i>Bryum calobryoides</i>	Red		Non-vascular moss found on moist to dry soil or rock; found at montane to alpine elevations in the Coast Ranges and Rocky Mountains	Possible
<i>Philonotis yezoana</i>	Blue		Non-vascular plant which grows over rock in shaded stream gorges and on cliffs or steep slopes wet by seepage	Possible
<i>Pohlia elongata</i>	Blue		Non-vascular plant, limited information on habitat data	Possible
Lemmon's holly fern <i>Polystichum lemmonii</i>	Red	Threatened	Evergreen Perennial fern found in Dry to mesic, ultramafic rock outcrops in the montane zone; rare in BC, known only from the Mt. Baldy area	Possible
Alpine Sorrel <i>Rumex paucifolius</i>	Red		Moist to wet forest openings and meadows in the subalpine and alpine zones	Possible
sweet-marsh butterweed <i>Senecio hydrophiloides</i>	Blue		Wet to moist meadows and forest openings in the montane and lower subalpine zones	Possible

Source: Conservation Data Centre (BC Ministry Of Environment, 2020b)

2.4.2.4.2 Rare and Endangered Ecological Communities

The term "ecological" is a direct reference to the integration of non-biological features such as soil, landform, climate and disturbance factors. The term "community" reflects the interactions of living organisms (plants, animals, fungi, bacteria, etc.), and the relationships that exist between the living and non-living components of the community. Currently, the most common ecological communities that are known in BC are based on the Vegetation Classification component of the Ministry of Forests and Range Biogeoclimatic Ecosystem Classification, which focuses on the terrestrial plant associations of BC's native plants.

During the 2018 field survey, one blue listed and four yellow listed ecological communities were observed in the study area. Table 7 list those ecological communities at risk. In addition, six yellow and five blue listed ecological communities have been confirmed through a desktop analysis. While three yellow, eight blue and one red listed ecological communities have the potential to be present within the proposed CRA (Table 8). Yellow listed plant communities are neither rare nor endangered, but are of concern and are listed here for information purposes only.



Table 7: Rare and Endangered Ecological Communities Observed during the 2018 Field Assessment.

Site Series Name Common Name <i>Scientific name</i>	TEM Code	Status BC List	BCG Zone/Site Series	Polygons	Structural stage	Size of polygon (ha)
subalpine fir / horsetails / leafy mosses <i>Abies lasiocarpa</i> / <i>Equisetum</i> spp. / <i>Mnium</i> spp.	FH	Yellow	ESSFdc1/06	6	7	8.38
subalpine fir / white-flowered rhododendron / grouseberry <i>Abies lasiocarpa</i> / <i>Rhododendron</i> <i>albiflorum</i> / <i>Vaccinium scoparium</i>	FR	Yellow	ESSFdc1/01	2	7	45.81
				3	4	8.60
subalpine fir / white-flowered rhododendron / sitka valerian <i>Abies lasiocarpa</i> / <i>Rhododendron</i> <i>albiflorum</i> / <i>Valeriana sitchensis</i>	RV	Blue	ESSFdc1/04	5	7	98.22
				1	4	32.62
				7	7	55.06
				4	4	1.98
				8	7	48.95
				3	4	3.69
subalpine fir / trapper's-tea / grouseberry <i>Abies lasiocarpa</i> / <i>Rhododendron</i> <i>columbianum</i> / <i>Vaccinium</i> <i>scoparium</i>	FT	Yellow	ESSFdc1/05	7	7	55.06
subalpine fir / grouseberry / clad lichens <i>Abies lasiocarpa</i> / <i>Vaccinium</i> <i>scoparium</i> / <i>Cladonia</i> spp.ens	FG	Yellow	ESSFdc1/03	8	7	48.95
				4	4	1.98

Source: Conservation Data Centre (BC Ministry Of Environment, 2020b)

Table 8: Rare and Endangered Ecological Communities Potentially Occurring in the Big White Resort.

Common Name <i>Scientific name</i>	BC List	BGC/ Site Series	Ecosystem Group	Potential Occurrence
mountain alder / hardhack / Sitka sedge <i>Alnus incana</i> / <i>Spiraea</i> <i>douglasii</i> / <i>Carex</i> <i>sitchensis</i>	Yellow	MSdm1/Ws02	Wetland Swamp	Potential
scrub birch / water sedge <i>Betula nana</i> / <i>Carex</i> <i>aquatilis</i>	Blue	MSdm1/Wf02	Wetland Fen	Potential
water sedge / peat-mosses <i>Carex aquatilis</i> / <i>Sphagnum</i> spp.	Yellow	ESSFdc1/07; ESSFdc1/Wf03	Wetland Fen	Confirmed
slender sedge / common hook-moss <i>Carex lasiocarpa</i> / <i>Drepanocladus aduncus</i>	Blue	MSdm1/Wf05	Wetland Fen	Potential



Common Name Scientific name	BC List	BGC/ Site Series	Ecosystem Group	Potential Occurrence
beaked sedge - water sedge <i>Carex utriculata</i> - <i>Carex aquatilis</i>	Yellow	ICHmk1/Wf01, MSdm1/Wf01; MSdm1/Wm01	Wetland Marsh, Wetland Fen	Potential
narrow-leaved cotton-grass - white mountain marsh-marigold <i>Eriophorum angustifolium</i> - <i>Caltha leptosepala</i>	Yellow	ESSFdc1/Wf12; MSdm1/Wf12	Wetland Fen	Potential
narrow-leaved cotton-grass - shore sedge <i>Eriophorum angustifolium</i> - <i>Carex limosa</i>	Blue	ESSFdc1/Wf13; MSdm1/Wf13;	Wetland Fen	Potential
Idaho fescue - bluebunch wheatgrass - silky lupine – junegrass <i>Festuca idahoensis</i> - <i>Pseudoroegneria spicata</i> - <i>Lupinus sericeus</i> - <i>Koeleria macrantha</i>	Red	MSdm1/Gg11	Grassland	Potential
hybrid white spruce / falsebox / red-stemmed feathermoss <i>Picea engelmannii</i> x <i>glauca</i> / <i>Paxistima myrsinites</i> / <i>Pleurozium schreberi</i>	Yellow	MSdm1/01	Forest: Coniferous - mesic	Confirmed
hybrid white spruce / trapper's-tea / horsetails <i>Picea engelmannii</i> x <i>glauca</i> / <i>Rhododendron columbianum</i> / <i>Equisetum</i> spp.	Yellow	MSdm1/07	Forest: Coniferous - moist/wet	Confirmed
hybrid white spruce / black gooseberry <i>Picea engelmannii</i> x <i>glauca</i> / <i>Ribes lacustre</i>	Blue	MSdm1/06	Forest: Coniferous - moist/wet	Confirmed
hybrid white spruce / black gooseberry / oak fern <i>Picea engelmannii</i> x <i>glauca</i> / <i>Ribes lacustre</i> / <i>Gymnocarpium dryopteris</i>	Yellow	MSdm1/08	Forest: Coniferous - moist/wet	Confirmed
lodgepole pine / Sitka alder / pinegrass <i>Pinus contorta</i> / <i>Alnus alnobetula</i> ssp. <i>sinuata</i> / <i>Calamagrostis rubescens</i>	Blue	ICHmk1/04	Forest: Coniferous - mesic	Confirmed
lodgepole pine / pinegrass - kinnikinnick <i>Pinus contorta</i> / <i>Calamagrostis rubescens</i> - <i>Arctostaphylos uva-ursi</i>	Yellow	MSdm1/04	Forest: Coniferous - dry	Confirmed
lodgepole pine / common juniper / pinegrass <i>Pinus contorta</i> / <i>Juniperus communis</i> / <i>Calamagrostis rubescens</i>	Yellow	ESSFdc1/02	Forest: Coniferous - dry	Confirmed



Common Name Scientific name	BC List	BGC/ Site Series	Ecosystem Group	Potential Occurrence
bluebunch wheatgrass - junegrass <i>Pseudoroegneria spicata</i> - <i>Koeleria macrantha</i>	Blue	MSdm1/Gg02	Grassland	Potential
Douglas-fir / pinegrass - twinline <i>Pseudotsuga menziesii</i> / <i>Calamagrostis rubescens</i> - <i>Linnaea borealis</i>	Blue	ICHmk1/03	Forest: Coniferous - dry; mesic	Confirmed
Douglas-fir / shrubby penstemon - pinegrass <i>Pseudotsuga menziesii</i> / <i>Penstemon fruticosus</i> - <i>Calamagrostis rubescens</i>	Blue	ICHmk1/02;	Forest: Coniferous - dry	Confirmed
Drummond's willow / bluejoint reedgrass <i>Salix drummondiana</i> / <i>Calamagrostis canadensis</i>	Blue	MSdm1/FI05	Low Bench	Potential
MacCalla's willow / beaked sedge <i>Salix maccalliana</i> / <i>Carex</i> <i>utriculata</i>	Blue	MSdm1/Ws05	Wetland Swamp	Potential
Sitka willow / Sitka sedge <i>Salix sitchensis</i> / <i>Carex</i> <i>sitchensis</i>	Blue	MSdm1/Ws06	Wetland Swamp	Potential
western redcedar / falsebox - Utah honeysuckle <i>Thuja plicata</i> / <i>Paxistima</i> <i>myrsinites</i> - <i>Lonicera</i> <i>utahensis</i>	Blue	ICHmk1/01	Forest: Coniferous - mesic	Confirmed
tufted clubrush / golden star-moss <i>Trichophorum</i> <i>cespitosum</i> / <i>Campyllum</i> <i>stellatum</i>	Blue	ESSFdc1/Wf11	Wetland Fen	Potential

Source: Conservation Data Centre (BC Ministry Of Environment, 2020b)

2.4.3 Wildlife and Wildlife Habitats

2.4.3.1 Wildlife

Research for this study area was conducted in three stages. First, a literature search of available information related to the terms of reference for this study was conducted including: environmental impact assessments undertaken within or adjacent to the Big White Ski Resort; available literature on relevant studies undertaken within the study area; and life history information including habitat requirements of species suspected of occurring within the study area.

The second stage of research involved obtaining all relevant wildlife habitat information for the study area including: 1:100,000 scale Biogeoclimatic subzone and variant mapping; 1:15,000 scale forest cover mapping; and 1:12500 scale (approx.) colour air photos; and communication with Ministry of Environment, Lands and Parks personnel including the Wildlife Program and the Conservation Officer Service.

In 2008 site reconnaissance surveys were conducted to identify known or probable wildlife use, based on sightings or evidence of wildlife use (i.e., scat, tracks, browsing etc.). No wildlife surveys were conducted during the 2018 field survey.

Species use were noted by visual observation, the occurrence of tracks, fecal droppings, feathers, browsing, game trails, shed antlers and wildlife tree use. Existing habitat conditions were also evaluated.

While the area apparently has had little inventory work, it is known to provide habitat for several ungulate species including moose (*Alces alces*), mule deer (*Odocoileus hemionus hemionus*), white-tailed deer (*O. virginianus*), and several mammal species such as black bear (*Ursus americanus*), grizzly bear (*Ursus arctos*) and American badger (*Taxidea taxus*). Wildlife species associated with the AT, ESSF, ICH and MS are described in more detail below.

2.4.3.2 Birds

During the 2008 reconnaissance surveys a total of 12 bird species were observed. Species observed included blue grouse (see Table 5 for scientific names), boreal chickadee, Clark's nutcracker, flycatcher, violet-green swallow and dark-eyed junco, golden-crowned kinglet, gray jay, mountain chickadee, red crossbill, red-breasted nuthatch, red-naped sapsucker, Steller's jay and winter wren. An American pipit was also seen along the edge of the sewage treatment ponds. All birds, except blue grouse, were observed either within or moving between residual spruce/balsam clumps. Little activity was noted in open habitats. During the August 2018 survey a hummingbird (*Selasphorus rufus*) was observed at the base of the proposed Backcountry Connector chairlift (Map 3).

Several other bird species are expected to occur in the alpine, riparian and forested habitats of the study area. Table 8 lists bird species known or expected to occur regularly in the study area.

Table 9: Bird Species Known or Expected to Occur in the Study Area.

Common Name	Scientific Name	Status
Geese and Ducks		
Canada Goose	<i>Branta Canadensis</i>	RarVis
Mallard	<i>Anas platyrhynchos</i>	RarVis
Shorebirds		
Killdeer	<i>Charadrius vociferous</i>	RarSuRes
Solitary Sandpiper	<i>Tringa solitarius</i>	RarMig
Spotted Sandpiper	<i>Actitis macularia</i>	RarSuRes
Hawks		
Merlin	<i>Falco columbarius</i>	RarRes
Northern Goshawk	<i>Accipiter gentilis</i>	UncRes
Red-tailed Hawk	<i>Buteo jamaicensis</i>	RarRes
Sharp-shinned Hawk	<i>Accipiter striatus</i>	UncMig
Grouse		
Blue Grouse	<i>Dendragapus obscurus</i>	UncRes
Ruffed Grouse	<i>Bonasa umbellus</i>	RarRes
Spruce Grouse	<i>Dendragapus canadensis</i>	UncRes
Owls		
Barred Owl	<i>Strix varia</i>	RarRes
Boreal Owl	<i>Aegolius funereus</i>	RarRes
Great Horned Owl	<i>Bubo virginianus</i>	UncRes
Northern Hawk-Owl	<i>Surnia ulula</i>	RarRes
Northern Pygmy-Owl	<i>Glaucidium gnoma</i>	RarRes



Common Name	Scientific Name	Status
Northern Saw-whet Owl	<i>Aegolius acadicus</i>	UncRes
Hummingbirds		
Calliope Hummingbird	<i>Stellula calliope</i>	RarRes
Rufous Hummingbird	<i>Selasphorus rufus</i>	UncRes
Woodpeckers		
Black-backed Woodpecker	<i>Picoides arcticus</i>	RarRes
Downy Woodpecker	<i>Picoides pubescens</i>	RarRes
Hairy Woodpecker	<i>Picoides villosus</i>	UncRes
Northern Flicker	<i>Colaptes auratus</i>	RarRes
Red-naped Sapsucker	<i>Sphyrapicus nuchalis</i>	UncRes
Three-toed Woodpecker	<i>Picoides tridactylus</i>	UncRes
Flycatchers		
Hammond's Flycatcher	<i>Empidonax hammondi</i>	UncSuRes
Olive-sided Flycatcher	<i>Contopus borealis</i>	UncSuRes
Western Wood-Pewee	<i>Contopus sordidulus</i>	UncSuRes
Larks		
Horned Lark	<i>Eremophila alpestris</i>	RarSuRes
Swallows		
Tree Swallow	<i>Tachycineta bicolor</i>	RarSuRes
Violet-green Swallow	<i>Tachycineta thalassina</i>	RarSuRes
Corvids		
Clark's Nutcracker	<i>Nucifraga columbiana</i>	ComRes
Common Raven	<i>Corvus corax</i>	ComRes
Gray Jay	<i>Perisoreus canadensis</i>	ComRes
Steller's Jay	<i>Cyanocitta stellar</i>	UncRes
Chickadees		
Black-capped Chickadee	<i>Parus atricapillus</i>	RarRes
Boreal Chickadee	<i>Parus hudsonicus</i>	ComRes
Mountain Chickadee	<i>Parus gambeli</i>	ComRes
Nuthatches and Creepers		
Brown Creeper	<i>Certhia americana</i>	RarRes
Red-breasted Nuthatch	<i>Sitta canadensis</i>	ComRes
Wrens		
Winter Wren	<i>Troglodytes troglodytes</i>	ComRes
Kinglets and Thrushes		
American Robin	<i>Turdus migratorius</i>	ComSuRes
Golden-crowned Kinglet	<i>Regulus satrapa</i>	ComRes

Common Name	Scientific Name	Status
Hermit Thrush	<i>Catharus guttatus</i>	UncSuRes
Mountain Bluebird	<i>Sialia currucoides</i>	RarSuRes
Ruby-crowned Kinglet	<i>Regulus calendula</i>	UncMig
Swainson's Thrush	<i>Catharus ustulatus</i>	RarSuRes
Townsend's Solitaire	<i>Myadestes townsendii</i>	RarRes
Varied Thrush	<i>Ixoreus naevius</i>	RarSuRes
Pipits		
American Pipit	<i>Anthus rubescens</i>	UncSuRes
Waxwings		
Bohemian Waxwing	<i>Bombycilla garrulous</i>	RarMig
Cedar Waxwing	<i>Bombycilla cedrorum</i>	RarSuRes
Vireos		
Solitary Vireo	<i>Vireo solitarius</i>	UncSuRes
Warbling Vireo	<i>Vireo gilvus</i>	RarSuRes
Warblers		
MacGillivray's Warbler	<i>Oporornis tolmiei</i>	UncSuRes
Northern Waterthrush	<i>Seiurus noveboracensis</i>	RarSuRes
Orange-crowned Warbler	<i>Vermivora celata</i>	UncSuRes
Townsend's Warbler	<i>Dendroica townsendii</i>	UncSuRes
Wilson's Warbler	<i>Wilsonia pusilla</i>	RarSuRes
Yellow-rumped Warbler	<i>Dendroica coronate</i>	ComSuRes
Sparrows		
Chipping Sparrow	<i>Spizella passerina</i>	RarSuRes
Dark-eyed Junco	<i>Junco hyemalis</i>	ComRes
Fox Sparrow	<i>Passerella iliaca</i>	UncSuRes
Lincoln's Sparrow	<i>Melospiza lincolni</i>	RarSuRes
Song Sparrow	<i>Melospiza melodia</i>	UncSuRes
Western Tanager	<i>Piranga ludoviciana</i>	UncSuRes
White-crowned Sparrow	<i>Zonotrichia atricapilla</i>	UncSuRes
Blackbirds		
Brown-headed Cowbird	<i>Molothrus ater</i>	UncSuRes
Rusty Blackbird	<i>Euphagus carolinus</i>	RarSuRes
Finches		
Common Redpoll	<i>Carduelis flammea</i>	UncWiRes
Evening Grosbeak	<i>Coccothraustes vespertinus</i>	UncRes
Pine Grosbeak	<i>Pinicola enucleator</i>	UncRes
Pine Siskin	<i>Carduelis pinus</i>	ComRes

Common Name	Scientific Name	Status
Red Crossbill	<i>Loxia curvirostra</i>	ComRes
White-winged Crossbill	<i>Loxia leucoptera</i>	RarVis

Primary references include Cannings *et al.* (1987), Campbell *et al.* (1990a and 1990b) and Campbell *et al.* (1997), BSC (2018).
 Symbol definitions for status are Common (Com), Uncommon (Unc), Rare (Rar), Summer (Su), Visitor (Vis), Migrant (Mig), and Resident (Res).

Mammals

Within alpine habitats, evidence of mammal use was predominantly restricted to ungulates, bears and small mammals. Considerable evidence of ground squirrel use was observed, particularly within well established alpine ski areas. One hoary marmot (*Marmota caligata*) was sighted using a small rock pile. A single mule deer buck was sighted adjacent to a forest clump, although overall, evidence of ungulate presence was low. Black bear use was noted, particularly within patches of succulent forbs. Lynx, cougar, moose (*Alces alces*) and red fox have been observed in the Big White Resort (Big White Ski Resort Ltd., 2017) (Kelowna Capital News, 2011) (Big White Ski Resort Ltd., 2013).

Mammal use was limited near several small lakes situated in the AT with some deer tracks and suspected weasel tracks (1 animal) being observed. Foraging of browse species such as *Salix* spp. by ungulates was noted around residual stands of spruce/balsam in alpine habitats. Within the forested ESSFdc habitats, signs of red squirrel (*Tamiasciurus hudsonicus*), yellow pine chipmunk (*Tamias amoenus*), snowshoe hare (*Lepus americanus*), deer use was noted, with moose and deer use primarily occurring in riparian habitats on the west side of Big White Mountain. Although browse species abundance within all habitats surveyed was high, particularly within the ESSFdc use of these habitats by ungulates was low.

Several other mammal species may occur within the Big White study area. These species along with those known to occur are described in more detail below. General references include McTaggart-Cowan and Guiguet (Mc Taggart-Cowan and Guiguet, 1965) and Nagorsen (Nagorsen, 1990).

Shrews

Given the diversity of habitats on the subject property, a number of shrew species are expected to occur. Water shrews (*Sorex palustris*) are expected to occur in creeks and wetland habitats. Other shrew species likely include common shrew (*Sorex cinereus*) and dusky shrew (*S. monticolus*) (Nagorsen, 1996).

Bats

The availability of snags and wetlands on the site provides some roosting and foraging opportunities for bats. The Big White area falls within the known geographical and elevational distribution of two bat species. These species include western long-eared myotis (*M. evotis*) and little brown myotis (*M. lucifugus*) (Nagorsen and Brigham, 1993).

Snowshoe Hare and Common Pika

Signs of snowshoe hares was observed during the 2008 field survey. They are expected to be relatively common on the site in most shrub and forest habitats. Snowshoe hare populations exhibit marked cycles in abundance, ranging from an over abundance of individuals to very few individuals. Common pikas (*Ochotona princeps*) may occur in rock talus slopes and other habitats in alpine and subalpine areas.

Small Rodents

Deer mouse (*Peromyscus maniculatus*) likely occurs throughout the site, whereas southern red-backed vole (*Clethrionomys gapperi*) likely only inhabits forested regions. Other small rodent species that may occur on the subject property include bushy-tailed woodrat (*Neotoma cinerea*) and meadow vole (*Microtus pennsylvanicus*).



Porcupine

Porcupine (*Erethizon dorsatum*) was not observed during the field survey but is expected to occur in moderate numbers throughout forested regions of the site.

Squirrels, Chipmunks and Marmots

Red squirrel sign and individuals were observed on numerous occasions. Signs included cone scales, middens and calls. The predominance of cone-bearing trees on the site provides an abundance of foraging opportunities.

Yellow-pine chipmunk was observed and is expected to occur throughout the study area, especially in areas with high coarse woody debris, or windthrow areas with large, dense brush piles. Columbian ground squirrel (*Spermophilus columbianus*) and possibly mantled ground squirrel (*Spermophilus lateralis*) occur in open areas in alpine and subalpine habitats and around cleared areas, and northern flying squirrel (*Glaucomys sabrinus*), a nocturnal squirrel, likely inhabits forested regions. Hoary marmot is known to occur in subalpine and alpine habitats.

Canids

Habitats of the subject property are suitable for all three canid species. Coyote (*Canis latrans*) is likely the most abundant species followed by red fox (*Vulpes vulpes*) and gray wolf (*Canis lupus*).

Cats

Because of the abundance of deer on the subject property, cougars (*Felis concolor*) are expected to occur regularly during the growing season when deer are present. Lynx (*Lynx canadensis*) and bobcat (*Lynx rufus*) likely also occur occasionally and at low numbers. Lynx numbers are closely related to the densities of snowshoe hares, their primary prey species.

Mustelids

Marten (*Martes americana*) and ermine (*Mustela erminea*) are expected to be relatively common residents of the subject property. An abundance of coarse woody debris and mature forests in the study area are preferred habitats for these species. Red squirrels and small rodents provide an abundance of prey. Long tailed weasel (*Mustela frenata*), striped skunk (*Mephitis mephitis*) and wolverine (*Gulo gulo luscus*) are expected to occur at lower densities. Wolverine is blue-listed by the B.C. Ministry of Environment (BC Ministry Of Environment, 2020b).

Bears

Black bear (*Ursus americanus*) signs including scats and feeding sign were observed. Black bears are common residents of the study area, especially in the spring when forbs and herbs in subalpine habitats are an attractive food source. Grasses and sedges in several of the wetlands also provide foraging opportunities for bears, Black huckleberry and oval-leaved blueberry provide foraging opportunities in the fall. Grizzly bear (*Ursus arctos*), a blue-listed species, has been reported on several occasions by Big White Ski Resort staff.

Grizzly bears are expected to occur on an infrequent but yearly basis on and in the vicinity of the proposed development area. The Kettle-Granby grizzly population unit lies to the east of the CRA and has been identified as a recovery unit. Ongoing coordinated access management planning process has been undertaken with the forest industry for this population unit.

Moose

In 2008 Moose (*Alces alces*) pellet groups and tracks were noted in several areas of the subject property, but particularly in lowland areas. Dense shrub vegetation adjacent to wetlands, and in other openings provides good winter foraging opportunities.



Elk

Populations of elk (*Cervus canadensis*) are known to occur in the plateau areas east of Okanagan Lake and in the Kettle River valley (Mc Taggat-Cowan and Guiguet, 1965). Thus, elk may occur occasionally in the Big White area.

Deer

Mule deer (*Odocoileus hemionus hemionus*) are common summer residents of the study area. White-tailed deer also apparently occur, however, likely at lower population densities than mule deer. Deer and deer sign were observed on several occasions, especially in open clearcuts where forb and herb productivity was high. Utilization of the site in winter does not occur because of high snow depths.

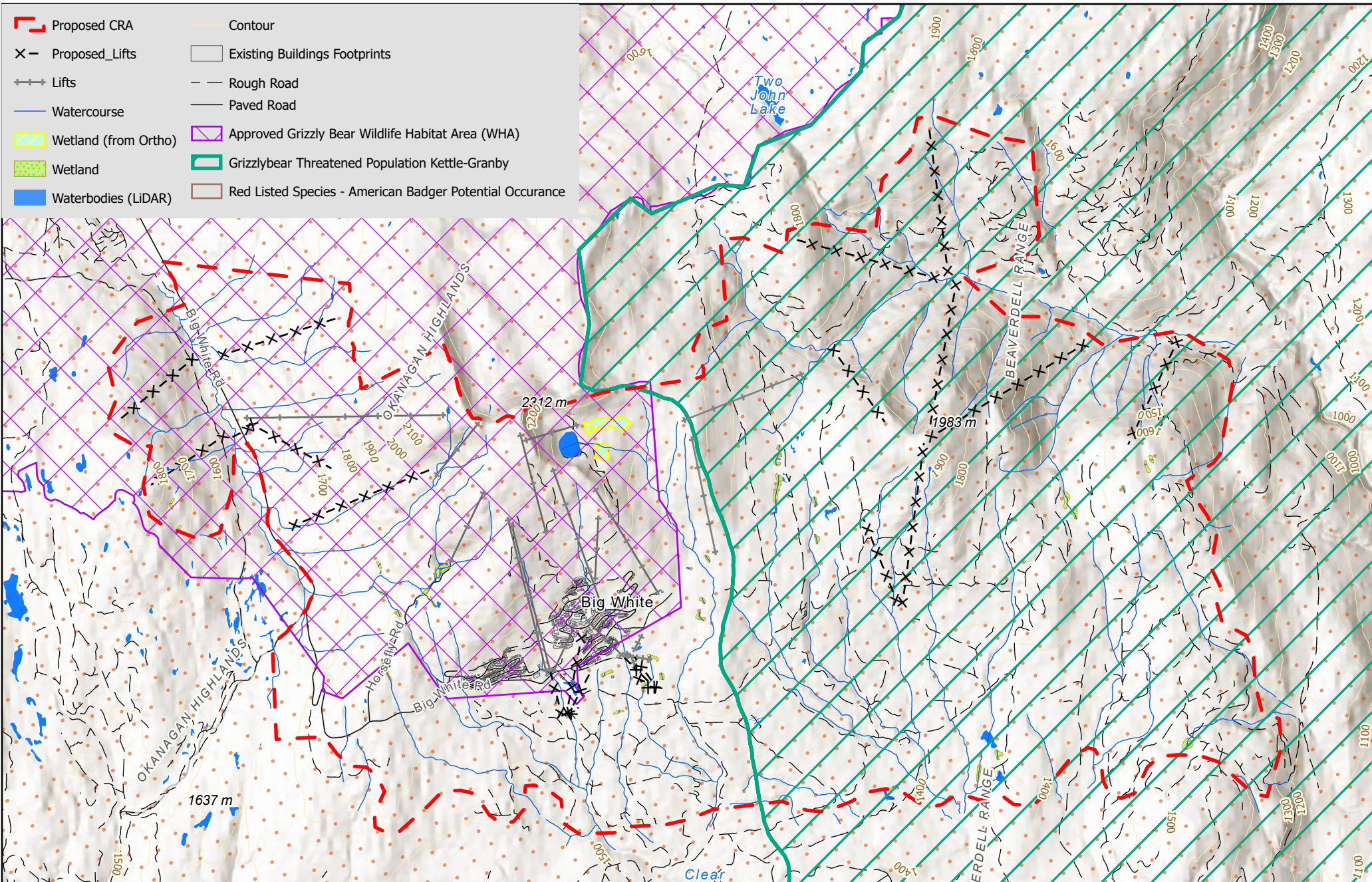
Caribou

Previous reports have referred a nearby Caribou (*Rangifer tarandus*) sighting however the reliability of that sighting is suspect and staff at MOE confirm that no Caribou herds currently exist near Big White Resort. Mountain Caribou management direction has been addressed within the LRMP and does not affect the Big White CRA.

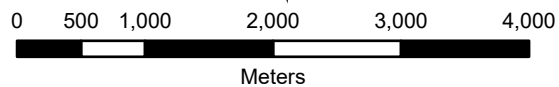
Amphibians and Reptiles

No reptiles or amphibians were recorded during the site assessment. Reptile and amphibian species occurrence within or near Big White Mountain are limited by the occurrence of suitable habitats and climate. Although no data regarding the distribution or abundance of reptiles and amphibians is available, existing habitat conditions may be adequate for some species. Amphibian species likely to occur include long-toed salamander (*Ambystoma macrodactylum*), western toad (*Bufo boreas*), Pacific tree frog (*Hyla regilla*) and spotted frog (*Rana pretiosa*) (Gregory and Campbell, 1987). Reptile species likely to occur include common garter snake (*Thamnophis sirtalis*) and western terrestrial garter snake (*T. elegans*) (Gregory and Campbell, 1987).

- ▬ Proposed CRA
- X - Proposed_Lifts
- + + Lifts
- Watercourse
- Wetland (from Ortho)
- Wetland
- Waterbodies (LiDAR)
- Contour
- Existing Buildings Footprints
- - Rough Road
- Paved Road
- Approved Grizzly Bear Wildlife Habitat Area (WHA)
- Grizzlybear Threatened Population Kettle-Granby
- Red Listed Species - American Badger Potential Occurance



GIS Cartographer: Nicola Church
 Date: 2020-07-23
 CERF File #: 017-01-05-
 Projection: NAD 1983 UTM Zone 10N



Map 7 - Wildlife Habitat Areas

Environmental Review
 Big White Resort
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2.4.3.3 Rare and Endangered Species

The occurrence of endangered and threatened (red-listed), vulnerable and sensitive (blue-listed) birds, mammals, amphibians and reptiles within subject area was investigated through several sources. The CDC indicates a known occurrence polygon (Shape ID 74373) for the red listed American badger (*Taxidea taxus*) within the subject area. Four hundred and ninety-eight sightings of badgers are represented by the polygon between 1995 and 2012 the polygon is large representing the habitat from the U.S. border to north of Okanagan Lake.

Although no CDC occurrences have been noted within the database, staff of Big White have reported sighting the occasional blue listed grizzly bear (*Ursus arctos*) within alpine and forested habitats surrounding Big White Mountain and the vicinity of the subject area

Table 9 indicates the red, blue and yellow-listed species that may potentially occur within the subject area based on their habitat requirements and provincial distribution. This list does not imply that the species are known to occur within the study area.

Table 10: Rare and Endangered Wildlife Potentially Occurring in the Subject Area

Common Name <i>Scientific name</i>	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Northern Goshawk, atricapillus subspecies <i>Accipiter gentilis atricapillus</i>	Blue		Remote, often mountainous forested regions throughout its range. Found in all forest types, from coniferous and mixed forests to pure deciduous forests (e.g., aspen woodlands, riparian strips, etc.), and tends to be associated with mature or old growth stands when they are available, at least during the breeding season. Nesting sites are commonly typified by dense canopy closure, especially where the canopy closure exceeds 70%, and it often hunts for prey near permanent sources of water such as along lakeshores, seacoasts, rivers, creeks, lagoons, and estuaries	Possible- Suitable breeding habitat in the study area. However no known record near Big White
White-throated Swift <i>Aeronautes saxatalis</i>	Blue		Primarily mountainous country, especially near cliffs and canyons where breeding occurs; forages over forest and open situations in a variety of habitats. Nests in rock crevices in cliffs and canyons. Sometimes nests in buildings, and on seacliffs.	Possible – although at northerly extent of its range which extends to Mexico. Closest known record approximately 10 km from Big White.
Lance-tipped Darner <i>Aeshna constricta</i>	Blue		Rare at small ponds and open, warm, nutrient-rich marshes dominated by cattails and bulrushes; sometimes develops in waters that dry up in summer	Possible- Wetlands within subject area. However, the closest known record is near Penticton.

Common Name <i>Scientific name</i>	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Blotched Tiger Salamander <i>Ambystoma mavortium</i>	Red	Endangered	Associated with ponderosa pine (<i>Pinus ponderosa</i>), bluebunch wheatgrass, and Douglas-fir. Found near ponds and small lakes, in animal burrows and beneath coarse woody debris in damp areas	Unlikely-known occurrence mainly at lower elevation
Western toad <i>Anaxyrus boreas</i>	Yellow	Special Concern	Various upland habitats around ponds, lakes, reservoirs, and slow-moving rivers and streams.	Possible -ponds and reservoirs in subject area. However nearest record is approximately 80 km from Big White
Great Blue Heron, herodias subspecies <i>Ardea herodias herodias</i>	Blue		Foraging habitats include aquatic areas such as tidal mudflats, riverbanks, lakeshores, and wetlands. black cottonwood comprises 54% of nest trees with coniferous species —Douglas-fir, western white pine, hybrid white spruce, ponderosa pine, western redcedar and western hemlock —accounting for the remaining 46%	Unlikely – lack of fish populations in the watercourses of the subject area,
Short-eared Owl <i>Asio flammeus</i>	Blue	Special Concern	Occurs in a variety of open native habitats, including grasslands, Arctic tundra, taiga, bogs, marshes, coastal wetlands, coastal barrens, estuaries and grasslands dominated by sand-sage. Also found in many types of man-made agricultural habitats. There is little specific information regarding habitat preferences at the landscape scale, but a mosaic of grasslands and wetlands provides optimal breeding and foraging habitats	Possible -suitable habitat in the study area. However, closest record is near Kelowna.
Swainson's Hawk <i>Buteo swainsoni</i>	Red		Breeds in open woodlands with mixed forests and groves adjacent to grasslands, farmlands and wetlands. Has been recorded breeding at elevations between 335 and 975 m	Unlikely-subject site at high elevations
Immaculate Green Hairstreak <i>Callophrys affinis</i>	Blue		<i>Callophrys affinis</i> is known to occur in dry gullies within sagebrush and meadow habitats brushland, woods and scrub.	Unlikely-no meadows or sagebrush habitat within subject area
Canyon Wren <i>Catherpes mexicanus</i>	Blue		Lives in rugged terrain fractured cliff faces, talus slopes, rocky bluffs and gorges, canyon walls with large boulders or rock outcroppings interspersed with open, patchy forests of ponderosa pine and Douglas-fir in shrublands featuring big sagebrush, rabbitbrush and antelope brush.	Unlikely- No suitable habitat



Common Name <i>Scientific name</i>	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Northern Rubber Boa <i>Charina bottae</i>	Yellow	Special Concern	Often associated with low elevation mountainsides	Unlikely-subject site at high elevations
Lark Sparrow <i>Chondestes grammacus</i>	Blue		Summer resident in the lower elevation grasslands of the Okanagan Valley and is common only in the few remaining tracts of antelope-brush	Unlikely- No suitable habitat
Common Nighthawk <i>Chordeiles minor</i>	Yellow	Threatened	Roosting and nesting in a variety of habitats including: beaches, farm fields, sagebrush and grassland habitat, open Ponderosa pine forests, rock outcrops, logged and slash-burned forest areas, coastal island meadows and urban areas. Ground substrates at nesting sites included gravel, sand, bare rock, wood chips, needles, leaves, and occasional living vegetation: lichen, dandelion and moss	Unlikely- No suitable habitat
Painted Turtle <i>Chrysemys picta</i>	No status	Endangered/ Special concern	Inhabit muddy bottomed ponds and marshes, the margins of small lakes, sluggish streams and river back-waters with abundant aquatic plants. Found up to about 1000 metres in elevation	Unlikely- No suitable habitat
Painted Turtle - Intermountain - Rocky Mountain Population <i>Chrysemys picta</i> pop. 2	Blue	Special Concern	Inhabit muddy bottomed ponds and marshes, the margins of small lakes, sluggish streams and river back-waters with abundant aquatic plants. Found up to about 1000 metres in elevation	Unlikely- No suitable habitat
Hairy-necked Tiger Beetle <i>Cicindela hirticollis</i>	Blue		Habitats vary enormously in different parts of the range. Can be found in riparian area, beach, seashore and sand	Unlikely- No suitable habitat
Evening Grosbeak <i>Coccothraustes vespertinus</i>	Yellow	Special Concern	Coniferous (primarily spruce and fir) and mixed coniferous- deciduous woodland, second growth, and occasionally parks; in migration and winter in a variety of forest and woodland habitats, and around human habitation.	Possible- coniferous woodland and around human habitation. The species was recorded in the CRA in 1994. More recent observation near Highway 33.
North American Racer <i>Coluber constrictor</i>	Blue	Special Concern	Grasslands, open sparsely treed forests, farmland, and marshy or riparian areas	Unlikely- No suitable habitat

Common Name <i>Scientific name</i>	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Olive-sided flycatcher <i>Contopus cooperi</i>	Blue	Threatened	Mixed coniferous-deciduous forest with old growth snags along forest edges.	Possible - mixed coniferous-deciduous forest on site. Known records near Big White.
Townsend's Big-eared Bat <i>Corynorhinus townsendii</i>	Blue		Associated with a variety of habitats from coastal forests to arid grasslands of the interior. Its elevational range in the province is from sea level to 1070 metres, although most occurrences are from low elevations	Unlikely-subject site at high elevations
Shorthead Sculpin <i>Cottus confusus</i>	Blue	Special Concern	Occurs in fast, rocky riffles of cold headwaters, creeks and rivers	Unlikely- No known occurrence near Big White
Columbia Sculpin <i>Cottus hubbsi</i>	Blue	Special Concern	Endemic to the Columbia River mainstem and tributaries downstream of Arrow Lakes. In B.C. they have been captured in the Similkameen, Tulameen, Kettle, Columbia , and Kootenay Rivers	Unlikely- outside of species distribution
Eastern Tailed Blue <i>Cupido comyntas</i>	Blue		Known from only three populations in BC, one in the Flathead drainage, one near Vernon, and another near the mouth of the Pend-d'Oreille River, south of Trail. Natural riparian situations with, in the case of the Flathead population, little or no human disturbance	Unlikely- No known occurrence near Big White
Black Swift <i>Cypseloides niger</i>	Blue		Nests behind or next to waterfalls and wet cliffs, on sea cliffs and in sea caves.	Unlikely- subject area not near ocean or waterfalls
Monarch <i>Danaus plexippus</i>	Blue	Special Concern	Monarch's migrate north into low-elevation areas of southern BC , The Monarch's larval foodplant in BC is the showy milkweed (<i>Asclepias speciosa</i>).	Unlikely-subject site at high elevations
Bobolink <i>Dolichonyx oryzivorus</i>	Blue	Threatened	Open country with a preference for large hayfields, moist meadows and weedy fields dominated by a mixture of tall grasses; birds will also use marshes and other open places in the autumn	Unlikely- No suitable habitat
White-headed Woodpecker <i>Dryobates albolarvatus</i>	Red	Endangered	Mature to old-growth stands of ponderosa pine	Unlikely- No suitable habitat



Common Name <i>Scientific name</i>	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Alkali Bluet <i>Enallagma clausum</i>	Blue		Lakes, ponds, open water	Possible- suitable habitat in the study area. However, closest record is near Kelowna
Horned Lark, <i>merrilli</i> subspecies <i>Eremophila alpestris merrilli</i>	Blue		Grassland and meadow	Unlikely- No suitable habitat
Rusty Blackbird <i>Euphagus carolinus</i>	Blue	Special Concern	Wetlands, lakes, ponds forages on ground and shallow water	Possible- suitable habitat in the study area. However, closest record is near Kelowna
Prairie Falcon <i>Falco mexicanus</i>	Red		Primarily open situations, especially in mountainous areas, steppe, plains or prairies. Typically nests in pot hole or well-sheltered ledge on rocky cliff or steep earth embankment, 10 to more than 100 meters above base	Possible- Subject area is mountainous with nearby cliffs. However, closest record is near Kelowna
Peregrine Falcon, <i>anatum</i> subspecies <i>Falco peregrinus anatum</i>	Red	Special Concern	Typically nest on rock cliffs above lakes or river valleys where abundant prey is nearby. Interior populations are typically associated with wetland habitats that support a sufficient prey base. In the Okanagan valley, aeries have been reported as low as 6 m above a lake and high on cliffs that towered >260 m above the valley floor	Possible- Subject area is mountainous with nearby cliffs. However nearest observation is unknown
Dusky Fossaria <i>Galba dalli</i>	Blue		Physical barriers, particularly for flowing water, is presence of upland habitat between water connections. High waterfalls and anthropogenic barriers to water flow such as dams are barriers as they limit movement in an upstream direction.	Unlikely- No suitable habitat
Golden Fossaria <i>Galba obrussa</i>	Blue		Perennial lakes and vernal ponds with a mud substrate and macrophytes	Possible- potential suitable habitat in the study area. However, closest record is in the Okanagan Lake

Common Name <i>Scientific name</i>	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Attenuate Fossaria <i>Galba truncatula</i>	Blue		Among vegetation in permanent lakes, ponds, streams and marshes; usual substrate is mud	Possible- potential suitable habitat in the study area. However no known record near Big White
Wolverine <i>Gulo gulo</i>	No Status	Special Concern	A range of habitat types from valley bottoms to alpine meadows, strongly associated with the presence of large ungulate prey.	Possible- large range area around subject area. However, closest record is near Kelowna
Wolverine, <i>luscus</i> subspecies <i>Gulo gulo luscus</i>	Blue	Special Concern	A range of habitat types from valley bottoms to alpine meadows, strongly associated with the presence of large ungulate prey.	Possible- large range area around subject area. However no known record near Big White
Pale Jumping-slug <i>Hemphillia camelus</i>	Blue		In dry to moist coniferous forests, on and around mossy stumps, rocks and logs; also in leaf litter	Possible- suitable habitat in the study area. However closest record is near Creston.
Barn swallow <i>Hirundo rustica</i>	Blue	-	Open areas, fields, ponds with vertical nesting habitat, especially buildings.	Unlikely- subject area mainly forested limited open areas
Yellow-breasted Chat <i>Icteria virens</i>	Red	Endangered	Associated with shrubby and riparian habitats with open canopies and dense subcanopy layers. In British Columbia, this includes black cottonwood, water birch stands with dense understoreys of wild rose, willow, and common snowberry.	Possible- potential suitable habitat in the study area. However closest record is near Penticton.
Lilac-bordered Copper <i>Lycaena nivalis</i>	Blue		Habitat includes dry flowering meadows and forest clearings in the mountains, streamsides and sage flats in the interior valleys of British Columbia.	Possible potential suitable habitat in the study area. However closest record is north west of Kelowna



Common Name <i>Scientific name</i>	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Magnum Mantleslug <i>Magnipelta mycophaga</i>	Blue	Special Concern	Under moist logs, pieces of bark, in depressions in moist earth and within talus in cool, moist coniferous forests.	Possible suitable habitat in the study area. However no known record near Big White
Western Screech-Owl <i>Megascops kennicottii</i>	No Status	Threatened	Woodland, especially broadleaf (e.g. oak) and riparian woodland, and scrub (Subtropical and Temperate zones). Also, moist coniferous forest and woodland on northwest coast. Usually found at lower elevations, where in southwest range overlaps with Whiskered Screech-owl.	Unlikely-subject site at high elevations
Western Screech-Owl, <i>macfarlanei</i> subspecies <i>Megascops kennicottii macfarlanei</i>	Blue	Threatened	Dry to moist coniferous forest, broadleaf and mixed forest and riparian forest.	Possible- suitable habitat in the study area. However closest record is near Kelowna
Lewis's Woodpecker <i>Melanerpes lewis</i>	Blue	Threatened	Open forested areas at low elevations where an abundance of large snags provides suitable nesting sites and an open, grassy understory supports high populations of flying insects	Unlikely-subject site at high elevations
Little brown myotis <i>Myotis lucifugus</i>	yellow	Endangered	Wide range of habitats and often use human-made structures for resting and maternity sites; they also use caves and hollow trees. Foraging habitat requirements are generalized; foraging occurs over water, along the margins of lakes and streams, or in woodlands near water.	Possible- suitable habitat in the study area. However closest record is near Kelowna
Fringed Myotis <i>Myotis thysanodes</i>	Blue		Associated with arid grassland and Ponderosa Pine - Douglas-fir forest. Its elevational range in the province is 300 to 800 metres	Unlikely-subject site at high elevations
Cutthroat Trout, <i>lewisii</i> subspecies <i>Oncorhynchus clarkii lewisii</i>	Blue	Special Concern	Small mountain streams, main rivers, and large natural lakes; requires cool, clean, well-oxygenated water; in rivers, adults prefer large pools and slow velocity areas (stream reaches with numerous pools and some form of cover generally have the highest fish densities); often occurs near shore in lakes	Unlikely-outside of distribution range
Sinuous Snaketail <i>Ophiogomphus occidentis</i>	Blue		Sunny stream banks and sandy lakeshore beaches at low elevations	Unlikely-stream banks vegetated with riparian cover

Common Name <i>Scientific name</i>	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Mountain goat <i>Oreamnos americanus</i>	Blue	-	Alpine and subalpine habitat; steep grassy talus slopes, grassy ledges of cliffs, or alpine meadows. Usually at timberline or above. May seek shelter and food in stands of spruce or hemlock in winter.	Possible- Suitable habitat in the study area. However no known record near Big White
Big Horn Sheep <i>Ovis canadensis</i>	Blue		Bighorn sheep occur in mesic to xeric, alpine to desert grasslands or shrub-steppe in mountains, foothills, or river canyons. Many of these grasslands are fire-maintained. Suitable escape terrain (cliffs, talus slopes, etc.) is an important feature of the habitat.	Possible- Suitable habitat in the study area. However no known record near Big White
Fisher <i>Martes pennanti</i>	Blue	-	Low to mid-elevation large tracts (>100 ha) dense forests <2500 m in elevation.	Unlikely-as subject site in higher elevations
Common Sootywing <i>Pholisora catullus</i>	Blue		Very seldom in any kind of natural setting in most of its range, most typically weedy backyards, vacant lots, landfills, edges of croplands; any place where its weedy annual foodplants grow in the open.	Unlikely-subject area in natural state.
Eared Grebe <i>Podiceps nigricollis</i>	Blue		Nests in areas with seasonal to permanent water: marsh, marshy section of lake, sewage pond, fishpond, newly flooded area, reservoir, river backwaters. Nests over water in shallow eutrophic wetlands that are particularly vulnerable to yearly fluctuations in water levels, including periodic natural lowering due to drought	Unlikely-no significant lakes or ponds within subject area
Checkered Skipper <i>Pyrgus communis</i>	Blue		A generally transient species in a great variety of dry disturbed situations and some more natural ones such as short grass prairies. Low vegetation, flowers, and patches of bare ground are probably important. Strays can turn up in almost any open situation	Possible- suitable habitat in the study area. However, closest record is near Vernon
Caribou (southern mountain population) <i>Rangifer tarandus pop. 1</i>	Red	Threatened	The most important ecological requirement of Mountain Caribou is large tracts of old forest. Old forest is necessary for the provision of abundant arboreal lichen, and may also positively influence the forage value of understory forage plants	Possible- Suitable habitat in the study area. However no known record near Big White
Umatilla Dace <i>Rhinichthys umatilla</i>	Red		Inhabits rubble riffles and runs of large rivers	Unlikely- No large river in the subject site



Common Name <i>Scientific name</i>	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Bull Trout <i>Salvelinus confluentus</i>	Blue		Occurs in deep pools of large cold rivers and lakes. Most common in high mountainous areas where snowfields and glaciers are present	Unlikely- No large river in the subject site
California Hairstreak <i>Satyrium californica</i>	Blue		Open woodland and edges, brushland, chaparrals and is found at willows surrounding water reservoirs and natural lakes and along meandering streams.	Possible - potential suitable habitat in the study area. However closest record is south of Penticton
Great Basin Spadefoot <i>Spea intermontana</i>	Blue	Threatened	Dry grasslands and open woods with loose soil, near water, and hibernate in burrows, with emergence in early spring. found primarily in sagebrush country, in bunchgrass prairie, alkali flats, semi-desert shrublands, pinyon-juniper woodland to open ponderosa pine communities, and high elevation spruce-fir forests. Up to 1800 m in elevation	Possible - potential suitable habitat in the study area. However closest record is near Kelowna
Mormon Fritillary, erinna subspecies <i>Speyeria mormonia erinna</i>	Red		In the southern BC it is usually found at high elevations above 1,250 m, with the males hill topping to 2,300 m.	Possible - subject area at high elevations
Herrington Fingernailclam <i>Sphaerium occidentale</i>	Blue		Found in stillwaters of swamps, ditches and ponds; prefers habitats that dry up for part of the year, sometimes found among damp leaves on land and only known from regions containing calcareous deposits	Unlikely- No suitable habitat
Striated Fingernailclam <i>Sphaerium striatinum</i>	Blue		Lotic and lentic environments and on mud, sand, gravel and rock substrates and is most abundant at water depths of less than 2 m, although it has been found down to 13.5 m depths	Possible - potential suitable habitat in the study area. However closest record is south of Penticton
Williamson's Sapsucker <i>Sphyrapicus thyroideus</i>	Blue	Endangered	Associated with mature, dry, middle-elevation coniferous forests of Douglas-fir, Western Larch, and (at lower elevations) Ponderosa Pine. Some populations occur in deciduous groves of Trembling Aspen, especially in northern and western portions of its range in the province, and even in coniferous forests this species will often choose to nest in an aspen tree if it is available. The presence of at least some very old (>200 years) coniferous trees, especially larch, within the breeding range appears to be an important feature of the habitat of this species	Unlikely-as subject site in higher elevations

Common Name <i>Scientific name</i>	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Williamson's Sapsucker, thyroideus subspecies <i>Sphyrapicus thyroideus thyroideus</i>		Endangered	mixed coniferous forests primarily composed of western larch and Douglas-fir mixed severity fire regime	Unlikely- No suitable habitat
Widelip Pondsnail <i>Stagnicola traski</i>	Blue		Found in relatively broad habitat types in south eastern BC; however, there are only 5 known records	Unlikely- no know record in the Big White Resort
American Badger <i>Taxidea taxus</i>	Red	Endangered	Grasslands and dry open forests associated with suitable soils for digging burrows. Badgers will use mid-elevation and alpine areas where open habitats that contain prey and suitable burrowing soils exist.	Confirmed- CDC shapefile 74373 overlaps subject area.
Grizzly Bear <i>Ursus arctos</i>	Blue	Special Concern	Non-forested or partially forested sites with a wide range of foraging opportunities and choice of habitats	Confirmed- confirmed sightings of species in area in by Big White Staff.

(from BC Ministry of Environment 2020)

2.4.3.4 Valued Ecosystem Components

Wildlife Trees

Wildlife trees include significant standing snags, veteran trees, and trees with broken tops. These trees are important as perching areas for raptors such as red-tailed hawk (*Buteo jamaicensis*) and bald eagle (*Haliaeetus leucocephalus*), and foraging and nesting sites for woodpeckers, small owls and other cavity nesters. Outside of harvest blocks and forest service roads there has been a significant period since the last disturbance, therefore there is an abundant supply of wildlife trees snags and veteran trees.

Mid Elevation Young/Mature Forests

Typically, mature and young seral forest at middle elevations, as well as subalpine meadows at higher elevations, represent productive wildlife habitat in the ESSF biogeoclimatic zone (Meidinger and Pojar, 1991). The ESSF is also noted as one of the most productive zones for grizzly bears, particularly where avalanche activity serves to maintain abundant forage in a seral state preferred by both grizzly and black bears (Meidinger and Pojar, 1991).

The mid elevation slopes of the study area are mainly comprised of mature climax forest and with pole sapling forest regenerating cut block areas.

Creek and Riparian Areas

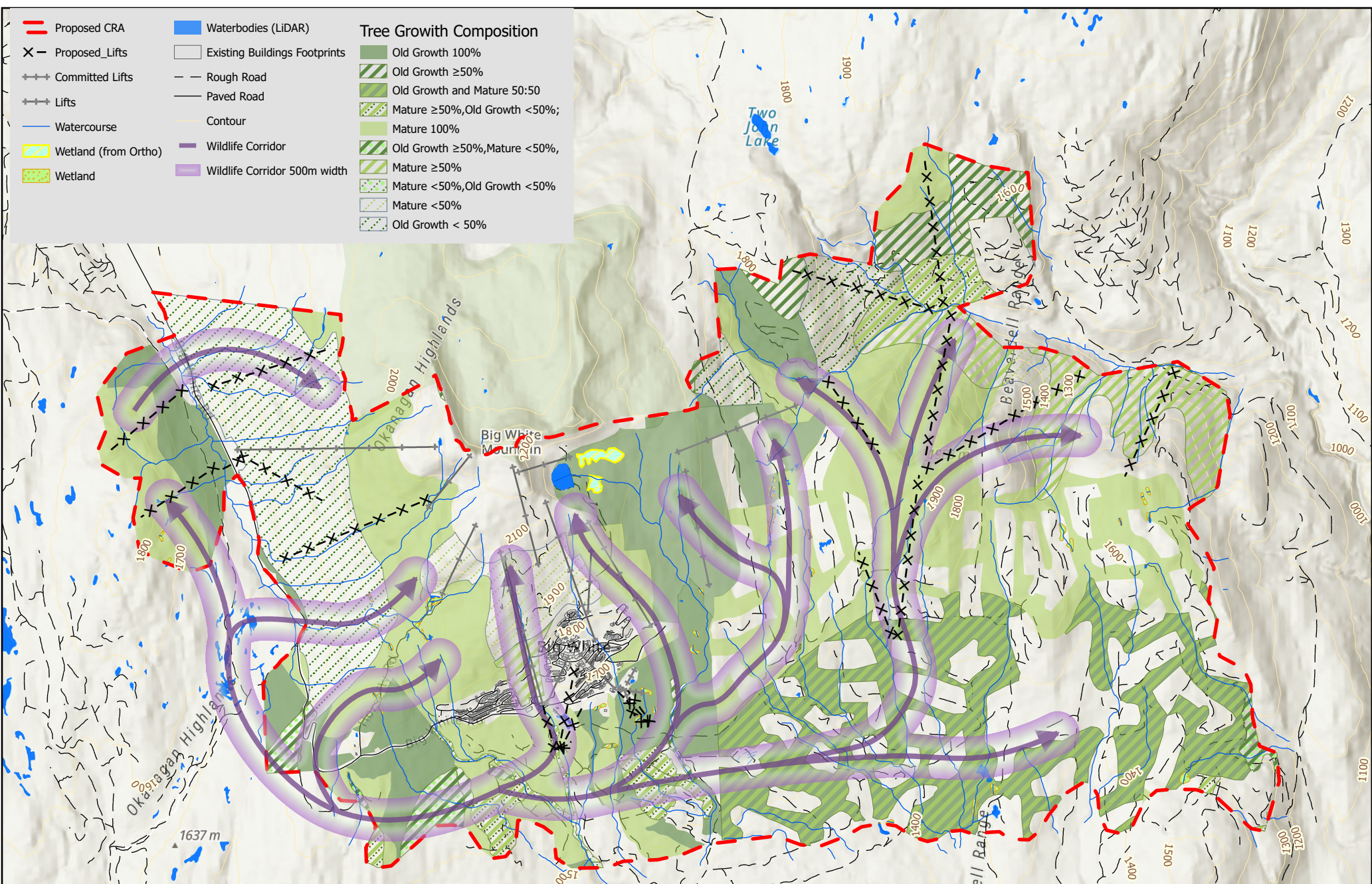
Riparian habitats are attractive to numerous bird, mammal, and amphibian species. Creek and wetland habitats are utilized as drinking and preening areas for wildlife, and breeding areas for frogs and salamanders. Permanent cascade-pool tributaries to fish-bearing creeks run through the study area.



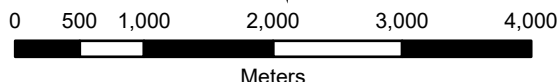
Wildlife Movement Corridors

Creeks, riparian habitats, and wetland areas are natural movement corridors for wildlife. These corridors connect habitats within the subject property to adjacent forested areas while providing wildlife with thermal cover and security.

Noted wildlife corridors in the subject area include Trapping Creek to the east and south, West Kettle River and its major tributaries to the north and west, and the Big White Road corridor along the western boundary of the site (Timberland Consultants Ltd., 1995). Additional wildlife movement is noted along an elevational gradient between the Big White Road and the northwest edge of the existing ski area, and within the eastern portion of the Ecological Reserve to the north of the ski area (Map 8).



GIS Cartographer: Nicola Church
 Date: 2020-07-23
 CERF File #: 017-01-05-
 Projection: NAD 1983 UTM Zone 10N



Map 8 - Wildlife Corridor

Environmental Review
 Big White Resort
 Kelowna, British Columbia

3 Environmental Constraints

3.1 Cultural Environment

No impacts to the cultural environment are anticipated from the proposed development and CRA expansion.

3.2 Physical Environment

3.2.1 Climate

No climatic impacts are anticipated from the proposed development and CRA expansion.

3.2.2 Geology

Caution should be taken in locating ski runs and traffic areas below cliffs faces. The integrity of the rock mass should be assessed by trail crews and any concerns should be addressed by a professional engineer (P.Eng.). Geotechnical issues associated with potential development of the site should be addressed in a separate report.

3.2.3 Geomorphology

The thin soils present on the ski runs are highly susceptible to surface erosion. This condition is exacerbated by summer grooming techniques which may disturb the upper soil layers or remove larger material.

3.2.4 Hydrology

With the creation of a large number of new ski runs, surface erosion is likely to deposit sediment in the local stream channels over the first few seasons. Debris flows/torrents in larger creeks are possible if sedimentation is excessive. Visual inspections of the creek systems should be conducted by summer crews prior to the fall to monitor any accumulations of debris. Any wetlands encountered in the study area should be considered as constraining to development.

3.2.5 Aquatic Environment and Water Quality

Any changes to water quality or development within the riparian areas adjacent to the drainages on site could affect the fisheries potential of Hallam and Trapping Creek which drains into the West Kettle River downstream, and the fisheries potential of Whitefoot and Copperkettle Creeks, draining into the Kettle River.

The water quality of the creeks within the study area is generally of drinking water quality. While the quality of the water in itself does not present any environmental constraints, the maintenance of the good water quality should be a high priority. Given that the study area is at the headwaters of Hallam, Trapping, Whitefoot and Copperkettle Creeks, any impacts on water volumes or quality could impact downstream users.

3.3 Terrestrial Environment

3.3.1 Soils

Rock and mineral soil removal near the bottom of the Sun Run/Spruce Trail is evident, likely as a means of preventing rock damage to grooming machines on these lower slopes. Previous reports also indicate that a significant amount of topsoil in the Big White village area has been either removed during



construction or lost to surface erosion associated with road and infrastructure development (Klaus D., 1995). The displacement and removal of mineral soil represents a concern which requires management attention.

Given that the predominantly shallow, rocky soils in the study area represent an obvious limiting factor for plant and tree growth, damage to or loss of these soils will negatively affect the fertility of the area and the ability to successfully replant.

3.3.2 Vegetation

The vegetation on the subject property does not present any constraints or concerns for the proposed CRA expansion or development. Vegetation constraints relate to the habitat provided and the need to maintain biodiversity in the Big White Resort Area. Large tree islands should be preserved between ski runs to provide adequate shelter for resident fauna and to prevent excessive windthrow. Larger tree islands will allow for preservation of standing wildlife snags while maintaining safe distances from ski runs, trails and roads. As a result of the climatic constraints imposed on growth of vegetation, maximizing preservation of existing vegetation should always be a priority in development planning.

Vegetation removal should be limited to the minimum necessary for development and all vegetation within the Streamside Protection and Enhancement Area must be preserved, as dictated by the *Riparian Area Protection Regulation* (RAPR).

Rare and Endangered Plant Species

Six plant species of concern have the potential to occur within the geographic region and based on the biogeoclimatic subzone's site series' of the study area. If confirmed in the study area, these species may be constraining to the proposed development.

Rare and Endangered Ecological Communities

The subject property contains six blue listed and ten yellow listed ecological communities. While eight blue and one red listed ecological communities have the potential to be present within the proposed CRA. With regards to ecological communities, large tracts of undisturbed plant communities are considered ecologically more important than disturbed / fragmented second growth communities, therefore it is recommended to preserve the blue listed communities within old growth forest polygons where possible.

3.3.3 Wildlife and Wildlife Habitat

The expansion and development of Big White into a four-season destination resort will alter wildlife use of the area. The greatest modification of habitat use will likely be associated with changes in vegetative cover as a result of run cutting in areas used by wildlife for cover and forage. Clearing of habitats at the proposed golf course development site will displace wildlife species currently utilizing these habitats. Increased levels of human presence and recreational activity in the summer months may also affect the summer migration of a number of wildlife species, but particularly larger mammals such as grizzly bears. The highway presently appears to serve to delineate the boundary between the undisturbed Riparian Area / Wildlife Migration Corridor and Big White Ski Resort (GeoAlpine Environmental Consulting, 1996).

The number of wildlife species sighted reflects the intensity and timing of the field survey. Although, AT and ESSFdc habitats are not generally considered to contain as high wildlife diversity as lower elevation biogeoclimatic zones, it is clear from the previous species discussions that large numbers of wildlife species may occur. ESSFdc habitats supports few bird species, likely attributed to the lack of structural diversity of forested habitats.

Determining the direct and indirect impacts of the proposed ski facility expansion on resident and migratory wildlife species is constrained by the availability of accurate data on the extent of existing



habitat alienation within similar habitat types throughout the region and the current and potential use of those habitats by wildlife. Furthermore, an equally important factor not considered in this review is the impact of recreational activities on wildlife, particularly during summer.

3.3.3.1 Birds

Modification and permanent removal of forest cover and understorey vegetation for Big White Ski Resort may have a positive or negative impact on bird communities. For example, the development of physical structures, will result in the permanent loss of forest cover and understorey vegetation and subsequent loss of use of these areas by birds. However, ski facility developments such as downhill runs, where some forest cover is removed and grasses and forbs remain, may benefit other bird communities that are attracted to more open vegetation.

3.3.3.2 Rare and Endangered Species

Based on the BC ecosystem explorer and CDC, a total of 29 listed species have the potential to occur on the study area. Any of these species may be constrained if occurrence is confirmed within the study area. Details on the two confirmed listed species are presented below.

Grizzly Bear

The Kettle-Granby grizzly bear population unit (GBPU), shown on Map 7, covers over 650,000 hectares and is estimated to support up to 87 individuals (Forest Practices Board, 2017). Habitat effectiveness modeling conducted in 2005 (Gyug, 2005) finds that of the 3000 hectares of overlap between the proposed CRA expansion and the GBPU over 99% of that habitat is rated as "Low effectiveness" while less than 0.5% is rated as "Medium effectiveness".

A Grizzly Bear Wildlife Habitat Area (WHA) was authorized under the Forest and Range Practices Act within the existing CRA (Map 7). The "General Wildlife Measures" (GWM's) of this WHA are relevant to Big White Resort and Interfor (who owns the timber rights within the CRA), however they are not expected to be significantly constraining. There are five GWM's described of which three should not have any effect on resort development:

1. Forest harvesting along avalanche tracks, that are at least 40 meters in width, will result in forest stands that are at least 15 meters in height for: 100 meters on one side of the avalanche track or 50 meters on both sides of the avalanche track.
2. Timber harvest and site preparation practices... will not inhibit *Vaccinium* spp productivity.
3. Planting of tree seedlings in harvested riparian site series will result in stocking densities that are consistent with maintaining plant communities that produce bear forage. Areas that did not have forest cover before timber harvesting was carried out will not be subject to planting of trees.

Two GWM's may have a minor effect on resort development activities:

1. No cutting of non-merchantable stems within 20 meters of main haul roads.
2. Forest practices will result in at least 10% of each management unit containing forest stands that exhibit a height of at least 19.5 meters, in patches that are at least 5 hectares in size.
Management units are defined as the area of each BEC subzone within each landscape unit.

Interpretation of these last two GWM's follows: The first impacting GWM (preventing cutting within 20 meters of main haul roads) is likely a measure instituted to maintain visual barriers for the bears to protect habitat. In the case of Big White Resort nearby high quality habitat is largely absent (Gyug, 2005) except where created by clearing, and in the interest of reducing bear/human conflict it may be considered beneficial to allow clearing to the edge of main roads.



American Badger

As of 2012, it is estimated that there are 35-65 badgers within the Okanagan-Boundary subpopulation (Government of British Columbia, 2020). Suitable habitat for the American badger is highly dependent on prey habitat (i.e. ground squirrel, yellow-bellied marmot or microtine rodents). Badgers can use areas that have been modified by humans and tolerate some level of human activity (Newhouse and Kinley, 2000). Roads are a significant mortality source of both adults and young. Local occupancy affected by habitat suitability (soil conditions, prey), mortality risk (roads, persecution) and proximity to other occupied areas (Government of British Columbia, 2020). The American badger may be a constraint if dens or suitable habitat are located where development is proposed.

3.3.3.3 Valued Ecosystem Components

Valued Ecosystem Components within the Big White CRA, particularly in the proposed lift expansion area, include wildlife trees, wildlife movement corridors and riparian areas associated with identified watercourses.

Riparian Areas

Riparian areas within 30 meters of a permanent water course are subject to assessment prior to issuance of a building or development permit, in accordance with the Riparian Area Protection Regulation (RAPR) of the B.C. *Riparian Areas Protection Act*. Any intrusion in the resulting riparian setback contravenes the *Act*. Any disturbance within the top of bank for a watercourse may require permitting under Section 11 of the BC *Water Sustainability Act*, and/or approval under Section 35 (2) of the Federal *Fisheries Act*.

Wildlife Movement Corridors

Wildlife movement corridors are important for protection of wildlife populations in the area. While no corridors are designated, a number of corridor opportunities are identified and merit consideration for protection during the planning process.

Wildlife Trees

Wildlife trees that contain dens or breeding cavities may be constraining to development during the breeding season of the animal. Animals occupying or utilizing wildlife trees are protected under the BC *Wildlife Act*. Song birds were evident visually and acoustically and are typically summer breeders but not permanent residents.

4 Management strategies

4.1 Aquatic Environment

Proposed development should remain outside of the 30 m setback from any watercourse where possible in order to minimize impact to water quality and the aquatic environment. Should development be required within the 30 m riparian assessment area, a Riparian Area Protection Assessment should be conducted at sites of disturbance near watercourses to determine appropriate clearing setbacks for the protection of fish habitat values and water quality. If the appropriate riparian setback cannot be maintained a site specific sediment erosion control plan should be prepared and implemented.

All wetlands should be retained and left undisturbed. All wetlands with the exception of bogs are protected below the top of bank under the *Water Sustainability Act*. Cascade recommends maintaining a 15 to 30 m vegetated setback adjacent to wetlands to protect the unique plant and wildlife values of the wetland and adjacent riparian areas.

4.2 Rare and Endangered Wildlife Species

4.2.1 Grizzly bear

In order to minimize the impact to grizzly bear during the proposed development, the following mitigation efforts should be considered:

- Prior to clearing or ground disturbance a den survey should be conducted.
- Any work involving vegetation clearing or ground disturbance should be scheduled for the summer and fall season. This will avoid the period when grizzly bears are denning and potential interactions with occupied grizzly bear dens will be avoided (Transmountain, 2017a).
- When a grizzly bear is observed within 50 m of a worksite, contractors should halt work and not approach the bear. Contractors should cease work in the 50 m buffer until the animal is out of sight.
- Grizzly bear should not be fed or harassed. Food should not be stored in beds of pick-up trucks or areas readily accessible to wildlife.
- All garbage should be stored in wildlife-proof containers when potential wildlife/human conflicts may occur.
- Pets should be prohibited on the worksite. During operation of the resort expansion, pets should be kept on leash.
- Root grubbing should be restricted to areas where soil removal is necessary to reduce surface disturbance and encourage natural regeneration of trees and shrubs.

4.2.2 American badger

Big White staff should be vigilant in observing and recording any American badger presence on resort lands. The following biophysical attributes are required for the American badger habitat (Transmountain, 2017b):

- habitats with soil types that allow for digging (both in pursuit of prey and to establish dens) (i.e., Brunisols, Chernozems and Aeolian soil types with Glaciolacustrine, Lacustrine and Fluvial parent materials and low coarse fragments).
- non-forested habitats that support an abundance of small-mammal prey;
 - non-forested habitat types that support small-mammal prey for badger - natural grasslands, pasture, open forested sites, as well as recently cleared areas and burned sites,

- prey - primarily Columbian ground squirrels (*Urocitellus columbianus*), but also yellow-bellied marmots (*Marmota flaviventris*), northern pocket gophers (*Thomomys talpoides*), voles (*Microtus spp.*) and muskrat (*Ondatra zibethica*).
- continuous habitat and/or corridors to facilitate necessary movements (i.e., dispersal to new prey areas, finding mates) that are not impeded by anthropogenic barriers such as major roadways (where those roadways lack safe passage features) and large developed areas. These habitats may be non-forested and/or may represent non-characteristic habitats such as forested and alpine areas.

The badger is a fossorial species; meaning they dig dens in the ground. Therefore, anywhere that American badgers are known or suspected:

- ground disturbance should be avoided, and
- proper soil handling technique should be used to avoid compaction of soil and erosion.

If badgers are confirmed or suspected in the area, clearing and construction is recommended to commence in the period from mid-summer to fall (July 15 to October 15) since this is the period when badgers are most active. Should clearing or construction be required outside of this period (i.e., mid-October to mid-July), in areas with high suitability to support badgers, a pre-construction survey to identify any active badger dens should be completed. Depending on the schedule of the project, pre-construction surveys should be completed in March/early April to identify active maternal dens or prior to snowfall (late fall) to identify potential winter dens. In the event an active den is identified, mitigation will consider the site-specific circumstances (e.g., season and type of activity, location of den). The recommended setback is 500 m for a maternal den and 50 m for a summer or winter den (Transmountain, 2017b).

4.2.2.1 Preconstruction survey

Preconstruction surveys will consist of a badger den sweep aiming to determine the presence/absence of active American badger burrows. Preconstruction sweeps should be conducted from April 1 to July 15 to identify active maternal and summer dens. Maternal dens are utilized for longer periods of time with young typically dispersing by mid-July. Summer dens are used for shorter durations (in some cases only a day). Winter dens are difficult to determine occupancy, therefore, if clearing and construction activities are scheduled to be initiated in the winter when there can be snowfall accumulation, a pre-construction survey in areas with known potential to support badgers will be conducted prior to snowfall to identify potential dens that have evidence of recent use (Transmountain, 2017b).

5 Conclusion and Recommendations

5.1 Conclusions

This report summarizes the baseline conditions found on site and investigates environmental constraints to development. Based on the information reviewed and the conditions observed on site, the proposed expansion area appears to be suitable for use in the development of all season resort infrastructure and facilities. In order to avoid or mitigate potent adverse impacts arising from resort development and operation the following general recommendations are provided.

5.2 Recommendations

Based on the information reviewed and the site conditions observed, the following recommendations are made to minimize potential negative impacts on the site arising from development at Big White Resort:

4.2.1 Cultural Environment

Future developments should consider maintaining recreational trails connecting the services with residential areas.



4.2.2 Physical Environment

Future developments should implement snow clearing plans to ensure that snow storage or removal does not impact fish-bearing water courses.

4.2.3 Terrestrial Environment

1. Land clearing activity should be conducted with due diligence between April 1 and August 31, to comply with Section 34 of the *Wildlife Act*, which forbids the destruction of nests occupied by a bird, its eggs, or young (Queen's Printer, 1982). All areas protected for wildlife habitat should be flagged and enclosed by temporary fence (e.g., snowfence) prior to initiation of work on the site to ensure no encroachment occurs into those areas.
2. Prior to clearing, a nesting bird survey should be conducted. During July and August all nests are protected under the *Migratory Bird Convention Act* and the BC *Wildlife Act*, while raptor nests are protected all year. Nests of raptors such as northern goshawk, boreal owl and great horned owl found during land clearing activity must be adequately protected by forested buffer while the nest is occupied.
3. 30 rare and endangered wildlife species and six plant species at risk have the potential to be present on the subject site. Any future detections should trigger the implementation of appropriate BMPs.
4. Vegetation should be retained wherever possible, particularly near creeks and wetlands and within riparian buffers to facilitate wildlife movement. Efforts should be made to conserve snags and wildlife habitat trees. Wildlife movement corridors will be provided if retention zones along creeks are designated as recommended above. Road and trail crossings of these creeks should be designed so that wildlife movement is not impeded or discouraged.
5. Any major timber clearing that occurs within the grizzly bear WHA will need to be assessed to determine that GWM's are maintained.

4.2.4 Aquatic Environment

1. Riparian Area Protection Assessments should be conducted at sites of disturbance within 30 m of watercourses to determine appropriate clearing setbacks for the protection of fish habitat values and water quality.
2. The potential impacts to water quality from development within riparian areas can be minimized by avoiding contamination of the water courses during operation of the existing ski resort and during any future development at Big White, through sound, environmentally prudent construction techniques, and by respecting appropriate buffer strips adjacent to Hallam, Trapping, Whitefoot and Copperkettle Creeks, as well as their tributaries.
3. Stream crossings should be minimized. Bridges rather than culverts or fords are preferred. Planting of additional native, riparian shrubs and trees may be necessary where intrusions occur.
4. All wetlands should be retained. No disturbance such as filling, redirection of runoff etc. should occur. Water utilization for irrigation and other uses should ensure that current hydrology of wetlands are not altered. A 15 to 30 m vegetated setback should be established adjacent to wetlands to protect the unique plant and wildlife values of the wetland and adjacent riparian areas. Often wildlife trees important to bats and other wildlife species are located within the setback area.
5. Future developments should implement stormwater management plans that implement BMPs to ensure the protection of the ecological values of receiving waters. In addition to the post-development storm-water management, a drainage plan should also be developed to deal with

concerns related to land clearing, grubbing, and construction. This plan should adhere to the Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia (BC Ministry of Environment, 2012).

5.3 Additional Studies

Additional detailed environmental assessment should be conducted during the site planning phase of development. Site specific assessment should be conducted in accordance with the requirements of the *Riparian Areas Protection Regulations* (RAPR), the *BC Water Sustainability Act* and the *Federal Fisheries Act*, to determine the setbacks from watercourses and wetlands.

Although it is unlikely for the majority of the listed rare and endangered species to occur on the site, detailed surveys of development sites should be conducted by qualified environmental professionals (QEPs), at appropriate times of year, to positively confirm presence or absence.

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