BW GOLD LTD
a subsidiary company of Artemis Gold Inc

Blackwater Gold Project

Whitebark Pine Management Plan

May 2022

Project No.: 0635833

CONTEXT STATEMENT

The Blackwater Gold Project (Project) received Environmental Assessment Certificate #M19-01 (EAC) on June 21, 2019 under the 2002 *Environmental Assessment Act* and a Decision Statement (DS) (ECCC 2019) on April 15, 2019 under the *Canadian Environmental Assessment Act, 2012*, approving the Project with conditions. The Project is a proposed open pit gold and silver mine with associated ore processing facilities located 112 kilometres southwest of Vanderhoof in central British Columbia.

The Whitebark Pine Management Plan (WPMP) addresses the requirements in DS Condition 8.20. A concordance table is provided in Appendix A which identifies where the DS requirements are located in the plan.

BW Gold is providing this draft version of the WPMP to Indigenous groups for review and comment. BW Gold welcomes comments on the draft plan.

CONTENTS

List of Tables

List of Figures

List of Photos

ACRONYMS AND ABBREVIATIONS

Agency	Impact Assessment Agency
AQDMP	Air Quality and Fugitive Dust Management Plan
BACI	Before-After-Control-Impact
BC	British Columbia
BEC	Biogeoclimatic Ecosystem Classification
Blackwater or Project	Blackwater Project or Blackwater Gold Project
BW Gold	Blackwater Gold LTD.
CDC	Conservation Data Centre
CEO	Chief Executive Officer
CFMP	Country Foods Monitoring Plan
CM	Construction Manager
COO	Chief Operating Officer
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DS	Decision Statement
EAC	Environmental Assessment Certificate #M19-01
ECCC	Environment and Climate Change Canada
EIS	Environmental Impact Statement
EAO	Environmental Assessment Office
EM	Environmental Manager
EMLI	Ministry of Energy, Mines and Low Carbon Innovation
EMP	Environmental Management Plan
EMS	Environmental Management System
EPCM	Engineering, procurement and construction management
ERM	Environmental Resources Management
ESSFmv1	Nechako Moist Very Cold Engelmann Spruce - Subalpine Fir biogeoclimatic unit
ESSFmv1p	Nechako Moist Very Cold Engelmann Spruce - Subalpine Fir parkland biogeoclimatic unit
FLNRO	Ministry of Forests, Lands, and Natural Resource Operations
FLNRORD	Ministry of Forests, Lands, Natural Resource Operations and Rural Development

g	Gram
GM	General Manager
Ha	Hectare
Indigenous groups or Indigenous Peoples	Indigenous groups includes the following Peoples: Lhoosk'uz Dené Nation, Ulkatcho First Nation, Nadleh Whut'en First Nation, Saik'uz First Nation, Stellat'en First Nation, Nazko First Nation, Skin Tyee Nation, Tŝilhqot'in Nation, Métis Nation British Columbia and Nee-Tahi-Buhn Band (as defined in the Project's federal Decision Statement).
km	Kilometre
km^2	Squared kilometre
LDN	Lhoosk'uz Dené Nation
LSA	Local Study Area
m	Metre
MP	Management Plan
MPB	Mountain Pine Beetle
MOE	Ministry of Environment
NWFN	Nadleh Whut'en First Nation
RCP	Reclamation and Closure Plan
RISC/RIC	Resource Inventory Standards Committee; formerly the Resource Inventory Committee
RSA	Regional Study Area
SARA	*Species at Risk Act*
SEPSCP	Surface Erosion Prevention and Sediment Control Plan
SFN	Saik'uz First Nation
StFN	Stellat'en First Nation
STN	Skin Tyee Nation
TNG	Tsilhqot'in Nation
TSF	Taillings storage facility
UFN	Ulkatcho First Nation
USDA	United States Department of Agriculture
WPMP	Whitebark Pine Management Plan
WMMP	Wildlife Mitigation and Monitoring Plan

1. PROJECT OVERVIEW

The Blackwater Gold Project (the Project) is a gold and silver open pit mine located in central British Columbia (BC), approximately 112 kilometres (km) southwest of Vanderhoof, 160 km southwest of Prince George, and 446 km northeast of Vancouver.

The Project is presently accessed via the Kluskus Forest Service Road (FSR), the Kluskus-Ootsa FSR and an exploration access road, which connects to the Kluskus-Ootsa FSR at km 142. The Kluskus FSR joins Highway 16 approximately 10 km west of Vanderhoof. A new, approximately 13.8 km road (Mine Access Road) will be built to replace the existing exploration access road, which will be decommissioned. The new planned access is at km 124.5. Driving time from Vanderhoof to the mine site is about 2.5 hours.

Major mine components include a tailings storage facility (TSF), ore processing facilities, waste rock, overburden and topsoil stockpiles, borrow areas and quarries, water management infrastructure, water treatment plants, accommodation camps and ancillary facilities. The gold and silver will be recovered into a gold-silver doré product and shipped by air and/or transported by road. Electrical power will be supplied by a new approximately 135 km, 230 kilovolt (kV) overland transmission line that will connect to the BC Hydro grid at the Glenannan substation located near the Endako mine, 65 km west of Vanderhoof.

The Blackwater mine site is located within the traditional territories of Lhoosk'uz Dené Nation (LDN), Ulkatcho First Nation (UFN), Skin Tyee Nation and Tsilhqot'in Nation. The Kluskus and Kluskus-Ootsa FSRs and Project transmission line cross the traditional territories of Nadleh Whut'en First Nation (NWFN), Saik'uz First Nation (SFN), and Stellat'en First Nation (StFN; collectively, the Carrier Sekani First Nations) as well as the traditional territories of the Nazko First Nation (NFN), Nee-Tahi-Buhn Band, Cheslatta Carrier Nation and Yekooche First Nation (BC EAO 2019a, 2019b).

Project construction is anticipated to take two years. Mine development will be phased with an initial milling capacity of 15,000 tonnes per day (t/d) or 5.5 million tonnes per annum (Mtpa) for the first five years of operation. After the first five years, the milling capacity will increase to 33,000 t/d (or 12 Mtpa) for the next five years, and to 55,000 t/d (20 Mtpa) in Year 11 until the end of the 23-year mine life. The Closure phase is 24 to approximately 45 years, ending when the Open Pit has filled and the TSF is allowed to passively discharge to Davidson Creek, and the Post-closure phase is 46+ years.

New Gold Inc. (New Gold) received Environmental Assessment Certificate #M19-01 (EAC) on June 21, 2019 under the 2002 *Environmental Assessment Act* (BC EAO 2019c) and a Decision Statement (DS) on April 15, 2019 under the *Canadian Environmental Assessment Act, 2012* (CEA Agency 2019). In August 2020, Artemis Gold Inc. (Artemis) acquired the mineral tenures, assets and rights in the Blackwater Project that were previously held by New Gold Inc. On August 7, 2020, the Certificate was transferred to BW Gold LTD. (BW Gold), a wholly-owned subsidiary of Artemis, under the 2018 *Environmental Assessment Act*. The Impact Assessment Agency of Canada notified BW Gold on September 25, 2020 to verify that written notice had been provided within 30 days of the change of proponent as required in Condition 2.16 of the DS, and that a process had been initiated to amend the DS.

1.1 Ecological Summary

The Project area spans the Fraser Plateau (FAP) and Fraser Basin (BUB) Ecoregions and and three ecosections: the Nazko Upland (NAU), Bulkley Basin (BUB) and Nechako Lowland (NEL) (Demarchi 2011, Delong et al 1993).

The mine area lies within the NAU Ecosection and is characterized by rolling upland areas of higher relief, such as Mount Davidson, and nearby Fawnie Nose, around the proposed mine site (Figure 1.1-1). Hybrid white spruce (*Picea engelmannii x glauca*) tends to dominate on moist to wet sites below 1,500 m, while subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*) are dominant above 1,500 m.

Lodgepole pine (*Pinus contorta*) is a major tree species in seral stands on dry, fire-prone sites at most elevations, while whitebark pine (*Pinus albicaulis*) co-dominates at higher elevations. Creeks and rivers flow northward, and include the Davidson Creek, Entiako River, Chedakuz Creek, and Big Bend Creek. The area has a typical sub-continental climate, resulting in long cold winters and warm summers. Maximum precipitation occurs in late spring or early summer. The recent mountain pine beetle (MPB) infestation has affected all lodgepole pine forests within the NAU ecosection.

There are three BGC units within the mine site: 1) SBSmc3 (Kluskus Moist Cold Sub-Boreal Spruce variant) at low elevation, 2) ESSFmv1 (Nechako Moist Very Cold Engelmann Spruce-Subalpine Fir variant) at medium to high elevation, and 3) ESSFmvp (Nechako Moist Very Cold Engelmann Spruce-Subalpine Fir Parkland) on the top of Mount Davidson. The ESSFmv1 is the most common BGC variant followed by the SBSmc3 and the ESSFmvp. The mine site lies on the north-facing slope of Mount Davidson (Figure 1.1-1).

The majority of the mine site consists of sub-boreal spruce, Engelmann spruce (*Picea engelmannii*), and subalpine fir (*Abies lasiocarpa*), although there are also areas containing lodgepole pine that have been severely affected by mountain pine beetle (MPB) and have been subject to accelerated salvage logging. The ore deposit is located on the north face of Mount Davidson, the tallest peak in the Fawnie Range. At higher elevations, forestry activity is limited and MPB infestation is less predominant. The TSF, borrow areas, and FWR are located in lower elevation areas that have been extensively logged and where MPB infestation is severe.

1.2 Whitebark Pine

Whitebark pine (*Pinus albicaulis*) *is* blue-listed under the BC Conservation Data Centre (BC CDC and listed as endangered on Schedule 1 of *Species at Risk Act* (*SARA*; BC CDC 2021). This species occurs in dry, high elevation sites such as parklands in the ESSF and as krummhotz in the BAFA on Mount Davidson. Whitebark pine is found in the two parkland ecosystems, both within the ESSFmvp; Subalpine fir - Whitebark Pine - Crowberry parkland and Whitebark pine - White mountain avens. These are situated in the southern part of the mine site (Figure 1.1-1).

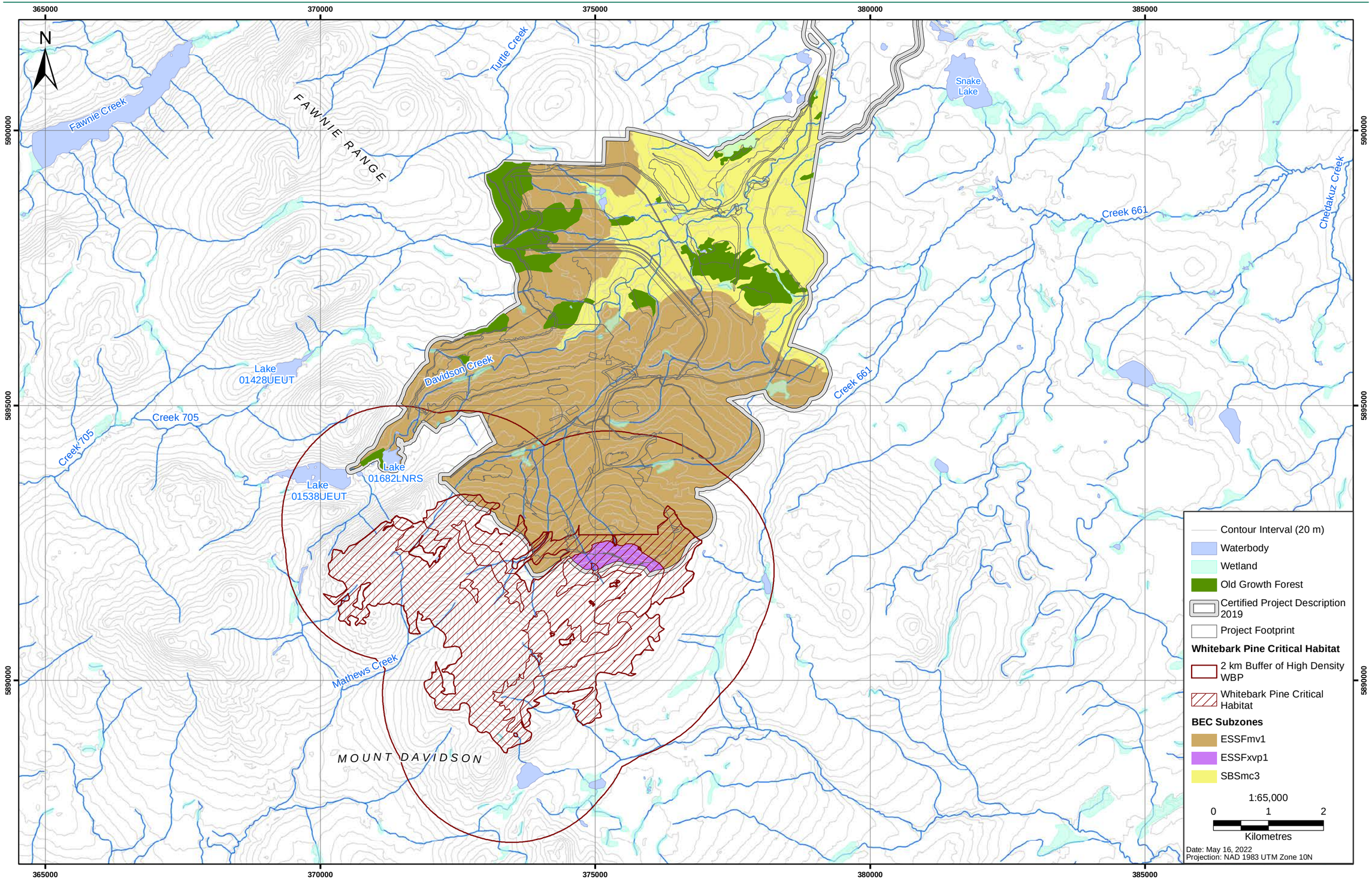


Figure 1.1-1: Whitebark Pine Location within Blackwater Gold Mine Site

2. PURPOSE AND OBJECTIVES

The purpose of the Whitebark Pine Management Plan (WPMP) is generally to mitigate the effects from the Designated Project (the Blackwater Project; Project) on whitebark pine (*Pinus albicaulis*); however, given that whitebark pine operates as a keystone and foundation species crucial to ecosystem function and that whitebark pine faces existential threats, goals and objectives beyond the scope of direct impact mitigation were required.

The overall goals of the WPMP are to:

1. Mitigate impacts to whitebark pine caused by mine development;
2. Mitigate potential impacts to regional Clark's nutcracker populations;
3. Contribute to the knowledge base of deploying whitebark pine in mine reclamation;
4. Contribute to the overall recovery of whitebark pine; and
5. Understand baseline conditions and inform mitigation strategies implemented for whitebark pine and Clark's nutcracker.

Project objectives include:

- Collect baseline data for whitebark pine stands including stand composition, structural sizes, rust infection levels, and trees densities/basal area (1,2);
- Establish criteria for selection for salvage and salvage seedlings, by transplanting out of the impacted area to non-impacted areas (Section 9.1) (1);
- Identify mititgation areas for seedling salvage planting and seedling planting field trials (1,3,4);
- Conduct planting trials to determine rust resistance levels (9.2.2) (1,4);
- Conduct planting trials to determine site suitability (9.2.2) – includes progressive reclamation and field trials (1,3);
- Conduct planting trials to determine if site suitability for whitebark pine is shifting under climate change (1,4);
- Collect baseline Clark's nutcracker population data and monitor populations over time (2);
- Implement measures to support stand and site use by Clark's nutcrackers (2); and
- Monitor and respond to mountain pine beetle populations (4).

The WPMP addresses the requirements in DS Condition 8.19 and 8.20 (CEA Agency 2019). A concordance table is provided in Appendix A which identifies where the DS requirements are located in the plan.

2.1 Related Documents

The WPMP is also associated with the Reclamation and Closure Plan (RCP; BW Gold 2021a), Construction Environmental Management Plan (BW Gold 2021b), Vegetation Management Plan (BW Gold 2021c), Wildlife Mitigation and Monitoring Plan (BW Gold 2021d), Air Quality and Fugitive Dust Management Plan (BW Gold 2019e), and Invasive Plant Management Plan (BW Gold 2021f). These plans will inform the WPMP with respect to potential changes that may impact mitigation measures associated with whitebark pine and Clark's nutcracker. These plans will be considered as part of the WPMP Adaptive Management Framework.

3. ROLES AND RESPONSIBILITIES

BW Gold must ensure that all commitments are met and that all relevant obligations are made known to mine personnel and site contractors during all phases of the mine life. A clear understanding of the roles, responsibilities, and level of authority that employees and contractors have when working at the mine site is essential to meet Environmental Management System (EMS) objectives. The Environmental Management System (EMS) is a framework that helps Blackwater Gold achieve its environmental goals through consistent review, evaluation, and improvement of its environmental performance. This consistent review and evaluation will help to identify opportunities for improving and implementing BW's environmental performance. The EMS allows us to achieve a high level of environmental performance and is tailored to the objectives outlined in relative management plans.

Table 3-1 provides an overview of general environmental management responsibilities during all phases of the mine life for key positions that will be involved in environmental management. Other positions not specifically listed in Table 3-1 but who will provide supporting roles include independent environmental monitors, Independent Tailings Review Board and Tailing Storage Facility (TSF) qualified person.

Table 3-1: Blackwater Roles and Responsibilities

Role	Responsibility
Chief Executive Officer (CEO)	The CEO is responsible for overall Project governance. Reports to the Board of Directors.
Chief Operating Officer (COO)	The COO is responsible for engineering and Project development and coordinates with the Mine Manager to ensure overall Project objectives are being managed. Reports to CEO.
Vice President (VP) Environment & Social Responsibility	The VP Environment & Social Responsibility is responsible for championing the Environmental Policy Statement and EMS, establishing environmental performance targets and overseeing permitting. Reports to COO.
General Manager (GM) Development	The GM is responsible for managing Project permitting, the Project's administration services and external entities, and delivering systems and programs that ensure the organization's values are embraced and supported: Putting People First, Outstanding Corporate Citizenship, High Performance Culture, Rigorous Project Management and Financial Discipline. Reports to COO.
Mine Manager	The Mine Manager, as defined in the *Mines Act*, has overall responsibility for mine operations, including the health and safety of workers and the public, EMS implementation, overall environmental performance and protection, and permit compliance. The Mine Manager may delegate their responsibilities to qualified personnel. Reports to GM.
Construction Manager (CM)	The CM is accountable for ensuring environmental and regulatory commitments and obligations are met during the construction phase. Reports to GM.
Environmental Manager (EM)	The EM is responsible for day-to-day management of the Project's environmental programs and compliance with environmental permits, updating EMS and management plans (MPs). The EM or designate will be responsible for reporting non-compliance to the CM, and Engineering, Procurement and Construction Management (EPCM) contractor, other contractors, the Company and regulatory agencies, where required. Supports the CM and reports to Mine Manager.
Departmental Managers	Departmental Managers are responsible for implementation of the EMS relevant to their areas. Report to Mine Manager.
Indigenous Relations Manager	Indigenous Relations Manager is responsible for Indigenous engagement throughout the life of mine. Also responsible for day-to-day management and communications with Indigenous groups. Reports to VP, Environment & Social Responsibility.

Role	Responsibility
Community Relations Advisor	Community Relations Advisor is responsible for managing the Community Liaison Committee and Community Feedback Mechanism. Reports to Indigenous Relations Manager.
Environmental Monitors	Environmental Monitors (includes Environmental Specialists and Technicians) are responsible for tracking and reporting on environmental permit obligations through field-based monitoring programs. Report to EM.
Indigenous Monitors	Indigenous Monitors are required under EAC condition 17 and are responsible for monitoring for potential effects from the Project on the Indigenous interests. Indigenous Monitors will be involved in the adaptive management and follow-up monitoring programs. Report to EM.
Employees and Contractors	Employees are responsible for being aware of permit requirements specific to their roles and responsibilities. Report to departmental managers.
Qualified Professionals and Qualified Persons (QP)	Qualified professionals and qualified persons will be retained to review objectives and conduct various aspects of environmental and social monitoring as specified in EMPs and social MPs.

BW Gold will employ a qualified person as an EM who will ensure that throughout the construction phase the EMS requirements are established, implemented and maintained, and that environmental performance is reported to management for review and action. The EM is responsible for retaining the services of qualified persons or qualified professionals with specific scientific or engineering expertise to provide direction and management advice in their areas of specialization. The EM will be supported by a staff of Environmental Monitors that will include Environmental Specialists and Technicians and a consulting team of subject matter experts in the fields of environmental science and engineering.

During the Construction phase, the EPCM contractor and sub-contractors, will report to the BW Gold CM. The EPCM contractor will be responsible for ensuring that impacts are minimized, and environmental obligations are met during the Construction phase. For non-EPCM contractors, who will perform some of the minor works on site, the same reporting structure, requirements, and responsibilities will be established as outlined above. BW Gold will maintain overall responsibility for management of the construction and operation of the mine site, and will therefore be responsible for establishing employment and contract agreements, communicating environmental requirements, and conducting periodic reviews of performance against stated requirements.

The CM is accountable for ensuring that environmental and regulatory commitments/obligations are met during the Construction phase. The EM will be responsible for ensuring that construction activities are proceeding in accordance with the objectives of the EMS and associated MPs. The EM or designate will be responsible for reporting non-compliance to the CM, and EPCM contractor, other contractors, the Company and regulatory agencies, where required. The EM or designate will have the authority to stop any construction activity that is deemed to pose a risk to the environment; work will only proceed when the identified risk has been addressed and concerns rectified.

Environmental management during operation of the Project will be integrated under the direction of the EM, who will liaise closely with Departmental Managers and will report directly to the Mine Manager. The EM will be supported by the VP of Environment and Social Responsibility in order to provide an effective and integrated approach to environmental management and ensure adherence to corporate environmental standards. The EM will be accountable for implementing the approved MPs and reviewing them periodically for effectiveness. Departmental Managers (e.g., mining, milling, and plant/site services) will be directly responsible for implementation of the EMS and MPs and SOPs relevant to their areas. All employees and contractors are responsible for daily implementation of the practices and policies contained in the EMS.

During Closure and Post-closure staffing levels will be reduced to align with the level of activity associated with these phases. Prior to initiating closure activities, BW Gold will revisit environmental and health and safety roles and responsibilities to ensure the site is adequately resourced to meet permit monitoring and reporting requirements. The Mine Manager will have overall responsibility for Closure and Post-closure activities at the mine site.

Pursuant to Condition 19 of the EAC (BC EAO 2019c), BW Gold has established an Environmental Monitoring Committee to facilitate information sharing and provide advice on the development and operation of the Project, and the implementation of EAC conditions, in a coordinated and collaborative manner. Committee members include representatives of the Environmental Assessment Office (EAO), UFN, LDN, NWFN, StFN, SFN, NFN, Ministry of Energy, Mines and Low Carbon Innovation (EMLI), Ministry of Environment and Climate Change Strategy, and Ministry of Forests, Lands, Natural Resource Operations and Rural Development. The EMC will be engages in the update, review and implementation of this plan.

Pursuant to Condition 17 of the EAC (BC EAO 2019c), Indigenous Group Monitor and Monitoring Plan, BW Gold will retain or provide funding to retain a monitor for each Indigenous Group prior to commencing construction and through all phases of the mine life. The general scope of the Monitor's activities will be related to monitoring for potential effects from the Project on the Indigenous Group's interests.

4. COMPLIANCE OBLIGATIONS, GUIDELINES, AND BEST MANAGEMENT PRACTICES

4.1 Legislation

Federal legislation applicable to whitebark pine management includes:

- *Canadian Environmental Protection Act, 1999;*
- *Canadian Environmenal Assessment Act, 2012;*
- *Migratory Birds Convention Act, 1994;*
- *Species at Risk Act;* and
- *United Nations Declaration on the Rights of Indigenous Peoples Act.*

Provincial legislation applicable to whitebark pine management includes:

- *Declaration on the Rights of Indigenous Peoples Ac*t;
- *Environmental Assessment Act*;
- *Forest and Range Practices Act*;
- *Mines Act*;
- Health, Safety and Reclamation Code for Mines in British Columbia (Code; EMLI 2021);
- *Wildfire Act;*
- *Wildfire Regulation;* and
- *Wildlife Act*.

4.2 Environmental Assessment and Federal Decision Statement Conditions

There are no specific conditions in the EAC (BC EAO 2019c) pertaining to whitebark pine.

The WPMP addresses federal DS Condition 8.20 (CEA Agency 2019), which requires the development of a WPMP to mitigate effects on whitebark pine and its critical habitat. The concordance table in Appendix A identifies where the requirements for relevant DS Conditions are located within the WPMP.

4.3 Existing Permits

BW Gold received *Mines Act* Permit M-246 on June 22, 2021, authorizing early construction works (Early Works) for the Project. This permit contains general conditions related to land use, wildlife, vegetation management and revegetation that are pertinent to this plan.

The requirements in the WPMP (and any conditions in the *Mines Act* permit for full mine construction) will supersede requirements in Permit M-246 relating to whitebark pine management.

4.4 Guidelines and Best Management Practices

The management and monitoring in the WPMP is informed by:

- Best Management Practices for Whitebark Pine (*Pinus albicaulis)* (Moody and Pigott 2021); and
- Recovery Strategy for the Whitebark Pine (*Pinus albicaulis*) in Canada (Proposed) (Environment and Climate Change Canada [ECCC] 2017), which provides strategic direction to arrest or reverse the decline of the species, including identification of critical habitat and conservation measures.

5. ENGAGEMENT AND CONSULTATION

5.1 Approach to Engagement and Consultation with Indigenous Groups

Implementation of the WPMP will be responsive to Indigenous groups' concerns from planning through execution. The plan will be informed by meetings with Indigenous groups and regulators to ensure their issues and concerns are addressed. Adjustments to the plan will be accommodated where feasible.

5.1.1 Engagement and Consultation on Draft WPMP

Indigenous Groups and relevant government agencies are continually involved in the development of this plan will have an opportunity to review and comment on proposed updates to the WPMP during construction, operations, closure and post-closure.

5.1.2 Future Engagement and Consultation on the WPMP

Conditions 2.3 and 2.4 of the federal DS (CEA Agency 2019) requires the Proponent to consult with Indigenous groups and reach consensus as follows:

"2.3 The Proponent shall, where consultation is a requirement of a condition set out in this Decision Statement:

2.3.1 provide a written notice of the opportunity for the party or parties being consulted to present their views and information on the subject of the consultation;

2.3.2 provide all information available and relevant on the scope and the subject matter of the consultation and a period of time agreed upon with the party or parties being consulted, not less than 15 days, to prepare their views and information;

2.3.3 undertake a full and impartial consideration of all views and information presented by the party or parties being consulted on the subject matter of the consultation;

2.3.4 strive to reach consensus with Indigenous groups; and

2.3.5 advise the party or parties being consulted on how the views and information received have been considered by the Proponent including a rationale for why the views have, or have not, been integrated. The Proponent shall advise the party or parties in a time period that does not exceed the period of time taken in 2.3.2.

2.4 The Proponent shall, where consultation with Indigenous groups is a requirement of a condition set out in this Decision Statement, determine and strive to reach consensus with each Indigenous group regarding the manner by which to satisfy the consultation requirements referred to in condition 2.3, including:

2.4.1 the methods of notification;

2.4.2 the type of information and the period of time to be provided when seeking input;

2.4.3 the process to be used by the Proponent to undertake impartial consideration of all views and information presented on the subject of the consultation; and

2.4.4 the period of time and the means by which to advise Indigenous groups of how their views and information were considered by the Proponent."

It is expected the WPMP will be reviewed and revised, as required, on a regular basis throughout the life of mine to ensure that the objectives described in Section 2 are achieved. Future revisions to the WPMP

may include adjusting, adding, or removing monitoring components to ensure the objectives are achieved and to address or resolve uncertainties identified in future monitoring.

It is anticipated the WPMP will be reviewed as part of each reporting cycle (i.e., each time a WPMP report is issued). As appropriate, qualified professions will recommend any changes to the plan in the WPMP report.

In addition, Indigenous groups or regulators may submit recommendations, input, or feedback to BW Gold following their review of the draft WPMP report after each WPMP reporting cycle. BW Gold will track and respond to comments received on the WPMP report, which may include proposing changes to the WPMP sampling or analysis. The process and timelines for review of future WPMP reports and changes to the plan itself will be defined through engagement and consultation with Indigenous groups and regulators during the draft WPMP plan review; thus, details are not provided yet in this version of the plan.

Upon approval of the WPMP Version 1.0, future changes to the WPMP will require robust review to ensure that the WPMP will continue to meet regulatory requirements (e.g., elimination of a monitoring component required by the federal DS cannot be completed without regulator agreement or amendment authorizing the removal). Changes to the WPMP could also affect the ability to conduct some statistical analyses (e.g., before-after- control- impact) that rely on collecting similar or analogous data over time at the same locations. To the extent possible, BW Gold intends to engage in dialogue with Indigenous groups and regulators regarding changes to the scope, methods, and analysis used in the WPMP, while maintaining regulatory compliance.

Results of the WPMP will be provided to regulatory agencies and Indigenous groups, and discussed with the Blackwater Environment Committee.

5.2 Engagement with Regulators

Condition 8.20 of the DS (CEA Agency 2019) requires that the WPMP be developed in consultation with Indigenous groups and “relevant authorities” prior to construction, with any subsequent updates to the plan identified as part of the adaptive management plan be provided to the same groups within 30 days of updates being made.

BW Gold provided the Draft WPMP for review and comment to BC ENV, UFN/LDN and ECCC prior to the beginning of Construction phase.

BW Gold is providing this draft of the WPMP to Indigenous Groups for review and comment in advance of submission to the Impact Assessment Agency of Canada (IAAC). BW Gold will undertake full and impartial consideration the comments and feedback provided by Indigenous Groups. BW Gold will offer for Indigenous Groups to review draft responses to their comments and questions prior to finalizing the draft WPMP for submission to the IAAC. An effort will be made to reach consensus with Indigenous groups regarding comments and revisions to this WPMP.

Once the plan is submitted to the IAAC (and Indigenous Groups) in accordance with DS Condition 8.20, there is an opportunity for further review by Indigenous groups. The timeline for comments will be determined after the draft is submitted based on input from all reviewers. BW Gold will receive, consider, and respond to all comments received from reviewers.

At the completion of the draft review, a Version 1.0 of the program will be completed and issued that incorporates all changes made to the draft WPMP during the review and is compliant with the requirements under the DS.

6. ADAPTIVE MANAGEMENT FRAMEWORK

The WPMP is a living document that will evolve over time in response to monitoring results, through consultation and discussions with Indigenous groups, and regulatory changes. This process of continuous improvement with changing conditions is referred to as adaptive management.

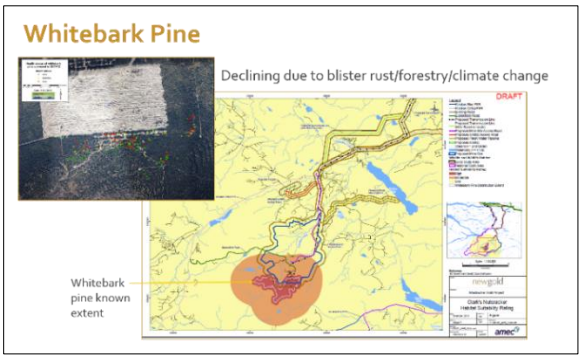
The WPMP incorporates adaptive management as follows:

- Plan
  - Conduct pre-construction surveys within the Project area, identify potential mitigation areas adjacent to the proposed mine footprint within the Local Study area and document extent of whitebark pine on Mount Davidson within the Regional Study Area (Figure 1.1-1);
  - Confirm and map potentially impacted whitebark pine habitat;
  - Confirm the area of whitebark pine habitat that existed prior to exploration to better understand the impacts to whitebark pine, and;
  - In collaboration with Indigenous groups, develop a mitigation and monitoring plan described in Section 10 and Section 11.
- Do
  - Implement training, mitigation measures and the monitoring plan.
- Monitor
  - Implement monitoring described in Section 11. BW Gold will review and update the monitoring program over the life of the Project. This will include:
    - Review of the monitoring program in terms of effectiveness in detecting level of environmental change;
    - Recommendations provided by a Qualified Professional (QP) as described in Table 3-1 and Indigenous groups on the monitoring plan; and
    - Engagement tracking to record input from Indigenous groups.
  - QA/QC monitoring records.
- Adjust
  - Review the effectiveness of the implementation of mitigation and monitoring measures as presented in Table 11-1 (see Section 11); and
  - Update the WPMP as required.

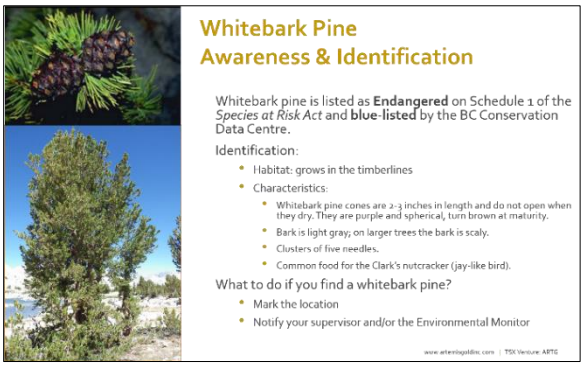
7. TRAINING AND AWARENESS

Employees and contractors whose work will bring them into contact with whitebark pine in a way that has the potential to negatively impact the trees will receive training in whitebark pine management and awareness on their arrival to site and prior to the start of work as part of the Site Orientation (Slides 7-1, 7-2, 7-3, and 7-4 in Table 7-1). The purpose of the training is to provide site personnel with a basic level of environmental awareness and an understanding of their obligations regarding compliance with regulatory requirements and best practices.

Table 7-1: Site Orientation Communication for Employees and Contractors

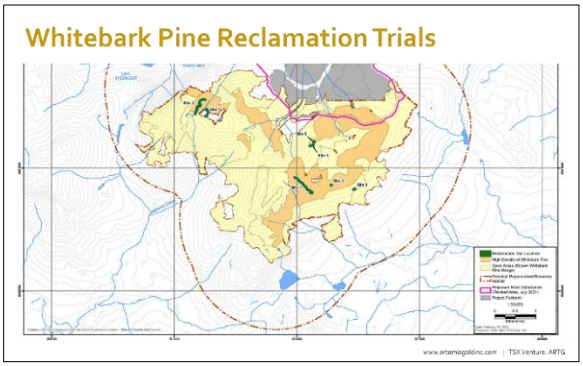


Slide 7-1: Employees and contractors are shown the extent of whitebark pine in the Project area.



Slide 7-2: The status of whitebark pine and how to identify it and report the location is communicated to employees and contractors.

Slide 7-3: Guidance on whitebark pine management is provided to workers.



Slide 7-4: Reclamation areas are shown to ensure management compliance.

Site managers will be provided with access to a copy of the WPMP and will receive additional training with respect to the requirements that are outlined in the plan. Targeted training will be provided by the Environment Department to personnel with responsibility for whitebark pine management activities. It will include training on incidental observations and protection measures specific to sensitive ecosystems. This training will be delivered by means of classroom instruction, toolbox/tailgate meetings or other means as appropriate.

BW Gold will regularly review, and update training and awareness documentation based on changes in training needs and regulatory requirements:

- Blackwater-BC-Vanderhoof-Plan-Vegetation Management Plan Appx. A2-3(3.1)(1003);
- Blackwater-BC-Vanderhoof-Permit-Plan-Whitebark Pine Management Plan-7(1001); and
- Blackwater-BC-Vanderhoof-Plan-Construction Environmental Management Plan-12(1004).

8. WHITEBARK PINE BASELINE SUMMARY

Whitebark pine (*Pinus albicaulis*) is a foundation and keystone species in high elevation ecosystems in BC (Moody and Pigott 2021). The deep and spreading whitebark pine root system stabilizes slopes, reduces erosion, and regulates snowpack and runoff (Arno and Hoff 1989; Farnes 1990; COSEWIC 2010; Moody and Pigott 2021). This species also provides wildlife with habitat and a food source for both birds and mammals. It is a slow-growing, long-lived and hardy subalpine conifer that can withstand poor soils, steep slopes, and windy exposures (AMEC 2013; Clason and Moody 2013). Whitebark pine is endemic to the western North American cordillera from northern California to BC (Farrar 1995; AMEC 2013). The distribution of this species is largely dependent on the Clark's nutcracker (*Nucifraga columbiana)*, since whitebark pine depends on this species to successfully disperse its seeds. Whitebark pine is in decline due to a combination of four main threats: disease (i.e., white pine blister rust), mountain pine beetle (MPB), fire and fire exclusion, and climate change (Barringer et al. 2012; COSEWIC 2010; Smith et al. 2012). Threats related to anthropogenic activities also affect whitebark pine populations at local scales (ECCC 2017).

Whitebark pine was identified as a species of special management concern during development of the Application/EIS. It was first identified in the Blackwater project area during rare plant surveys and Terrestrial Ecosystem Mapping (TEM) baseline programs in 2011 (AMEC 2013). Additional populations of whitebark pine were identified on Tsacha Mountain (AMEC 2013), and are also known in Itcha Ilgachez, Neneikekh/Nanika-Kidprice and Tweedsmuir Provincial parks (ERM 2016; BC CDC 2022) (Figure 8-1).

Whitebark pine work and restoration efforts initiated by the Project includes:

- Education and training regarding conservation and best management practices was integrated into the Blackwater new employee/contractor site orientation process;
- Regional inventory and extent field surveys;
- Critical and Regeneration/Recovery Habitat mapping;
- Clark's nutcracker surveys;
- Cone collection, health transects and seed propagation;
- Seed submitted to bister rust resistance screening trials; and
- Restoration trials – seedlings transplanted to trials area, and blister rust monitoring.

8.1 Baseline Results

This Section presents the baseline data that was collected in support of the Application/EIS as well as through ongoing restoration efforts.

8.1.1 Whitebark Pine

Field surveys, conducted from 2011 to 2013 (Clason and Moody 2013), estimate the distribution of whitebark pine on Mount Davidson to span more than 1,000 ha. Current mapping verifies that 329 ha overlaps the LSA and of that, 115 ha intersects with the mine footprint (Figure 8.1-1). These initial surveys were conducted to identify and quantify distribution but were not done to develop comprehensive mititgation strategies, thus for some of the actions described in this document additional surveys are warranted.

It should be noted that prior to the identification of whitebark pine on Mount Davidson, the Open Pit and associated access roads were cleared prior to the initiation of the whitebark pine surveys. This area is identified on Figure 8.1-1 as the area where the whitebark pine distribution polygon overlaps with the previously disturbed Open Pit area. This area was included in the estimated distribution area for whitebark pine.

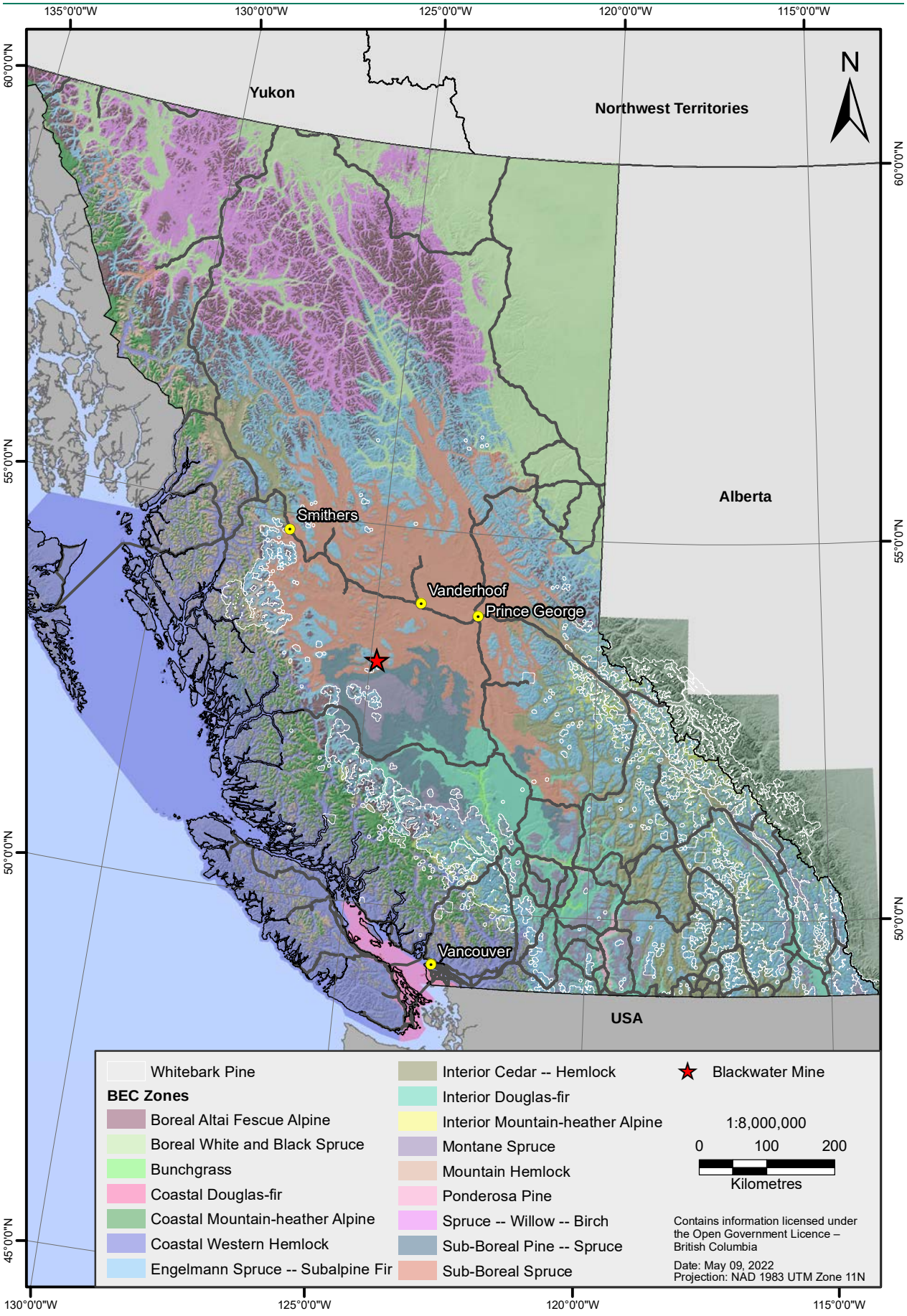


Figure 8-1: Distribution of Whitebark Pine in BC

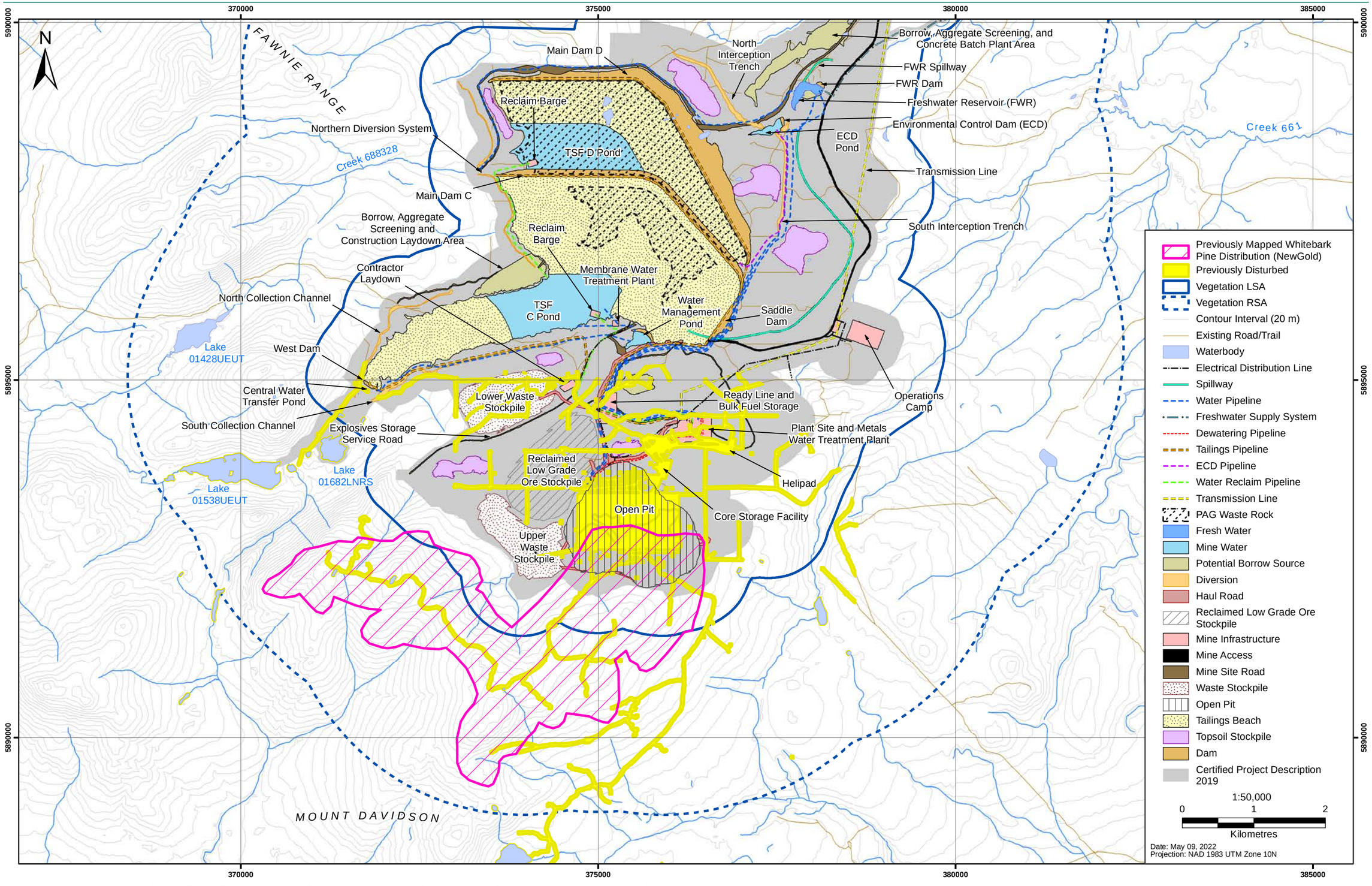


Figure 8.1-1: Project Footprint Overlap with Mapped Habitat for Whitebark Pine on Mount Davidson

Whitebark pine is a subalpine tree species that can occur in several habitat types, with different stand characteristics. Within the mine site, whitebark pine was observed in the Sub-boreal Spruce – Kluskus Moist Cold (SBSmc3), Nechako Moist Very Cold Engelmann Spruce - Subalpine Fir (ESSFmv1), Nechako Moist Very Cold Engelmann Spruce - Subalpine Fir Parkland (ESSFmvp) and Alpine Tundra - Undifferentiated (BAFAun) BGC units (AMEC 2013). Within these subzones whitebark pine typically occurs on xeric to mesic sites, with self-replacing stands commonly occuring on warm aspects and ridge crests and seral stands occuring on cooler aspects characterized by more mesic sites (Table 8.1-1). Stand types were highly variable on Mount Davidson including krummholz shrub whitebark pine in the BAFAun, parkland stands of mixed whitebark pine-subalpine fir, drier stands dominated by whitebark pine with components of lodgepole pine, and closed mixed species stands with whitebark pine as a seral component. Parkland and Alpine Tundra areas likely contain areas of unoccupied habitat (Table 8.1-1). Ecosystem units are described in detail in Appendix B.

Table 8.1-1: Ecosystem Units with Observed or Likely Occuring Whitebark Pine

BGC	Ecosystem	Site Series	Map Code
SBSmc3	Hybrid white spruce - Huckleberry	01	SB
SBSmc3	Lodgepole pine - Juniper - Dwarf huckleberry	02	LJ
SBSmc3	Lodgepole pine - Feathermoss - Cladina	03	LF
SBSmc3	Hybrid white spruce - Huckleberry - Soopolallie	04	SS
ESSFmv1	Lodgepole pine - Huckleberry - Cladonia	02	LC
ESSFmv1	Subalpine fir - Huckleberry - Feathermoss	03	FF
ESSFmv1	Subalpine fir - Huckleberry - Gooseberry	04	FG
ESSFmvp	Subalpine fir - Indian Hellebore	00	FH
ESSFmvp	Subalpine fir - Whitebark Pine - Crowberry parkland	00	PC
ESSFmvp	Subalpine fir - Heather parkland	00	FM
ESSFmvp	Mountain-heather - Slender hawkweed	00	MH
ESSFmvp	Whitebark pine krummholz	00	WK
ESSFmvp	Whitebark pine - White mountain avens	00	WW
ESSFmvp	Altai fescue - dwarf snow willow	00	FW
BAFAun	Heather - Lichen meadow (Dry heath meadow)	00	HL

The naturally occurring stand types and characteristics on Mount Davidson were documented to establish restoration targets and monitoring mitigation and reclamation success. In addition, the amount of whitebark pine within a stand or habitat may have important implications for both the ecological role of the stand and the regulatory requirements with respect to Critical Habitat as defined by Environment Canada (ECCC 2017). Stands having potential to produce a volume of 1000 cones/ha (basal area greater than 2 m2/ha) are reported as having higher visitation rates by Clark's nutcrackers (McKinney et al., 2009; Barringer et al., 2012) and is the volume used to identify stands as Seed Dispersal Critical Habitat under the *Species at Risk Act* (ECCC 2017).

To determine the amount and distribution of size classes in each whitebark pine forest type, Moody and Clason (2016) estimated the basal area and density of whitebark pine stands in 39 fixed radius plots (11.28 m radius) across Mount Davidson (Figure 8.1-2). Following timber cruise methodology, trees >1.3 m tall were counted and stems diameter was measured.

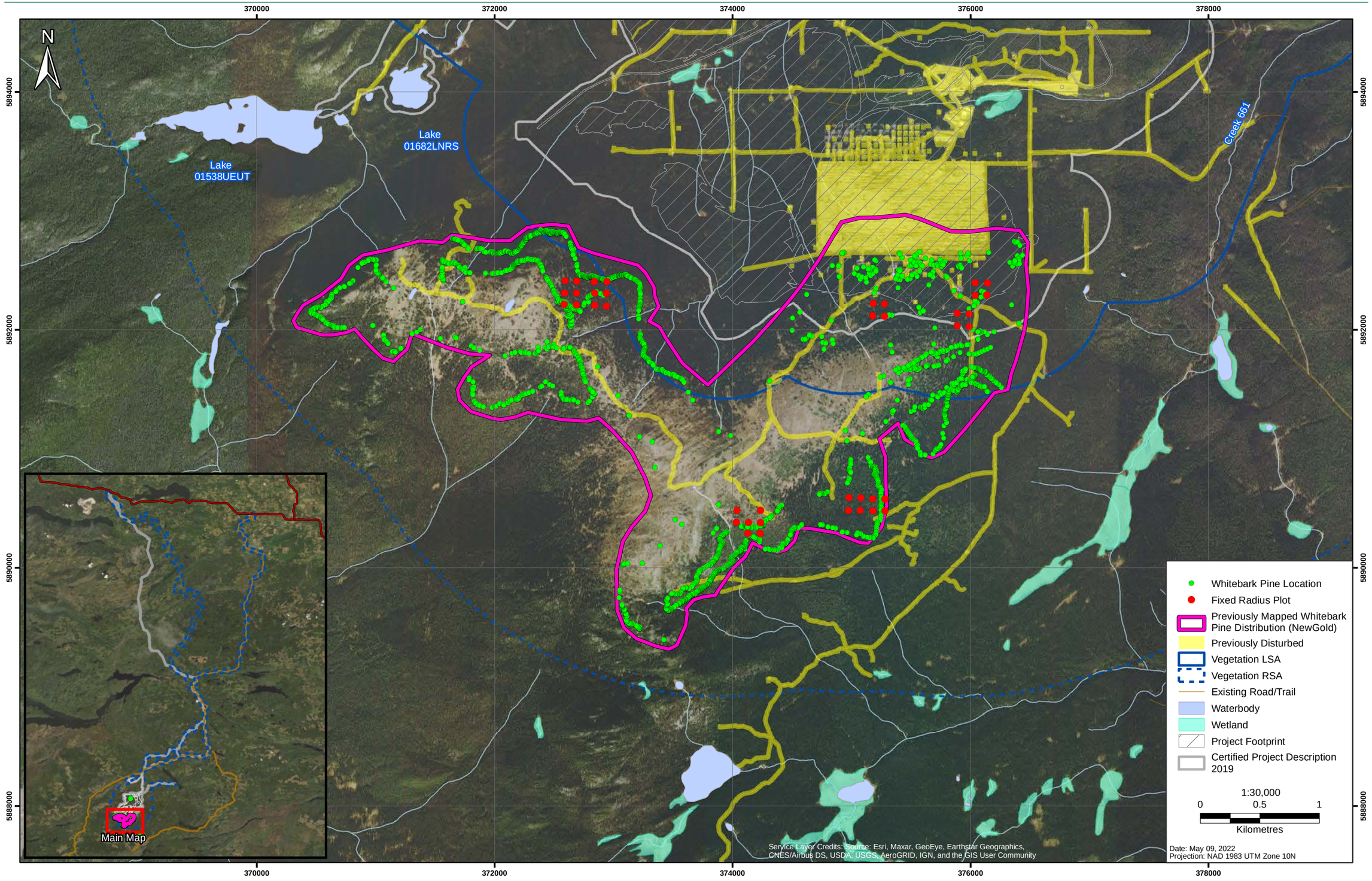


Figure 8.1-2: Whitebark Pine Density Mapping Locations

In addition, individual tree point locations were mapped along transects to provide further density indicators for polygons with whitebark pine (Figure 8.1-2). Plot locations were stratified across TEM forest cover types and polygon boundaries. Whitebark pine likely occurs in 17 of the ecosystem units identified in the area (Table 8.1-1); however, project constraints limited the sampling to 12 polygons. That whitebark occurs in 17 was deduced through other work in the region such as tree mapping, cone collections, health transects, and other work where knowledge of whitebark pine disctirbution was gained; though not enough information about whitebark pine densities was known to determine the whitebark pine densities or basal areas in these polygons. Additonal data will be collected in 2022 to better describe all polygons. The mean and standard deviation of the plots basal area and stems/ha were summarized at the polygon scale and the results are shown in Table 8.1-2. The high variability in plot basal area as shown by the high SD in some plots is common in whitebark pine as it occurs in high density clusters separated by areas with little to no whitebark pine largely due to the seed dispersal habits of the Clark's nutcracker. Despite some areas classified as lower density, many of these areas are likely to see management such as cone collections. All polygons will be sampled in 2022 to better describe the landscape (Section 10). Within the LSA, a total of 381.2 ha of whitebark pine was identified as high density habitat (>2 m^2/ha) and 33 ha intersect with the mine footprint.

Table 8.1-2: Mean Basal Area and Stems/ha for the Sampled Polygons

Polygon ID	Mean (± SD) Basal Area (m^2/ha)	Mean (± SD) Stems/ha	Polygon ID	Mean (± SD) Basal Area (m^2/ha)	Mean (± SD) Stems/ha
89	1.58 ± 1.58	117 ± 29	6	1.17 ± 1.54	25 ± 35
70	3.04 ± 3.93	510 ± 512	12	0.02 ± 0.04	25 ± 25
49	0.69 ± 0.41	331 ± 159	1	3.87 ± 4.28	185 ± 207
74	0.93 ± 0.77	625 ± 403	59	0.87 ± 1.27	158 ± 210
92	4.98 ± 3.84	388 ± 311	67	1.04 ± 1.23	225 ± 71
32	2.86	275	66	2.57	500

Source: Extracted from Moody and Clason (2016)

Whitebark pine Critical Habitat as defined in the Recovery Strategy consists of two types:

1. Seed Dispersal and Regeneration Habitat linked to mature trees and the capacity for seed dispersal and habitat suitable for whitebark pine seedling establishment; and
2. Recovery Habitat where recovery actions have been implemented on the landbase (ECCC 2017).

Seed Dispersal Habitat consistis of high density (>2 m^2/ha) mature trees. This volume of trees was deemed sufficient to ensure stand use and seed dispersal by Clark's nutcracker (McKinney et al. 2009; Barringer et al. 2012). It is characterized as habitat that is required for seed dispersal services, i.e., for maintaining the mutualistic relationship between whitebark pine and the Clark's nutcracker (which is essential for recruitment and maintaining genetic diversity within and between populations) across the range of whitebark pine. Seed Dispersal Habitat not only includes the individual trees, but the habitat required to support individual trees includes root area, ectomycorrhizal fungal associations, and specific soil attributes at established suitable microsites as described. Maintaining the integrity of this substratum layer is important for the persistence and viability of cached seeds (ECCC 2017).

Regeneration habitat for whitebark pine consists of habitat within high density polygons and suitable natural openings greater than 0.5 ha with suitable substrate and climatic conditions within 2 km of Seed Dispersal Habitat (ECCC 2017). Research indicates that seedlings require limited overstory and understory competition, avoidance of frost pockets, protection from shade and wind, protection from snow or soil movement, adequate growing space, and absence of crowding from other species, particularly lodgepole pine (McCaughey et al. 2009, Campbell and Antos 2000). Regeneration needs for this species

are characterized as habitat that is required for regeneration, recognizing the importance of seral stage and successional dynamics, which may vary widely across the range of sites on which it occurs, and which may limit recruitment or facilitate self-replacing stands (ECCC 2017). These regeneration needs can be characterized as dry sites open areas with site factors limiting the ingress of more competitive shade-tolerant species or more mesic sites subject to recent fire disturbance provided local seed sources are retained to ensure rapid recolonization by whitebark pine ahead of other species suited to the site.

Recovery habitat consists of the areas where recovery work has occurred. It is characterized as areas and activities focused on the identification and propagation of white pine blister rust-resistant individuals, as well as other areas and activities for habitat restoration, and assisted migration to newly identified and available suitable habitat created by climate change. Recovery habitat is within the known whitebark pine range area within 2 km of whitebark pine critical habitat (ECCC 2017).

Whitebark pine critical habitat was determined following the guidelines outlined in the Whitebark Pine Recovery Strategy (ECCC 2017). High density habitat and natural openings greater than 0.5 ha with suitable substrate and climatic conditions within 2 km of the high density habitats were identified as critical habitat. To ensure correct calculation of available habitat, unsuitable habitat such as lakes and ponds, anthropogenic features (including trails, roads, and buildings) were removed from the area calculations. In the mapped whitebark pine polygon delineating habitat, 51 ha were previously disturbed due to exploration activities (Figure 8.1-3).

Whitebark pine Seed Dispersal/High Density Critical Habitat was determined to cover 1,592 ha on Mount Davidson. This area consists of 381.2 ha of High Density habitat and 658.6 ha of Seed Dispersal (open areas > 0.05 ha) habitat. Potential Regeneration Habitat (2 km buffer on High Density Critical Habitat) is estimated to cover approximately 2,861.7 ha. These results are summarized in Table 8.1-3 and shown in Figure 8.1-3.

Mapping shows that based on the current development plan, approximately 115 ha (7%) of critical habitat and 425 ha (15%) of regeneration habitat will be impacted by mine activities (Figure 8.1-3).

Table 8.1-3: Mapped Summary of Existing Whitebark Pine Habitat on Mount Davidson

Whitebark Pine Habitat Type	Total Habitat Area (ha)	Habitat Impacted by Mine Activities (ha)
Seed Dispersal/High Density Critical Habitat	1,592	115
Potential Regeneration/Recovery Habitat	2,861.7*	425
Total	**4,453.7**	**540**

** Total existing habitat areas identified as Potential Regeneration/Recovery Habitat was calculated by removing existing disturbance (Open Pit, roads) and unsuitable habitats such as lakes, wetlands, and streams.*

*** Habitat available for recovery efforts is the area that is expected to be impacted by mine activities.*

8.1.2 Clark's Nutcracker

Whitebark pine is an obligate mutualist with the Clark's nutcracker (ECCC 2017). Although Clark's nutcrackers do not exclusively feed on whitebark pine seeds, they use seed stores for feeding nestlings and fledged juveniles (Tomback 1980). Clark's nutcrackers extract the seeds and carry them to a number of different cache locations up to 32 km away (Lorenz et al. 2011; Pigott et al. 2015).

Preferred alternate foods include ponderosa pine and Douglas fir; however, these alternate food sources are generally lacking in the region. Therefore, it is likely for their numbers to decrease during low cone/seed production years or due to whitebark pine loss. Stands with the potential to produce 1,000 cones/ha or a volume of 2 m^2/ha were identified as having higher visitation rates by Clark's nutcrackers (McKinney et al. 2009; Barringer et al. 2012).

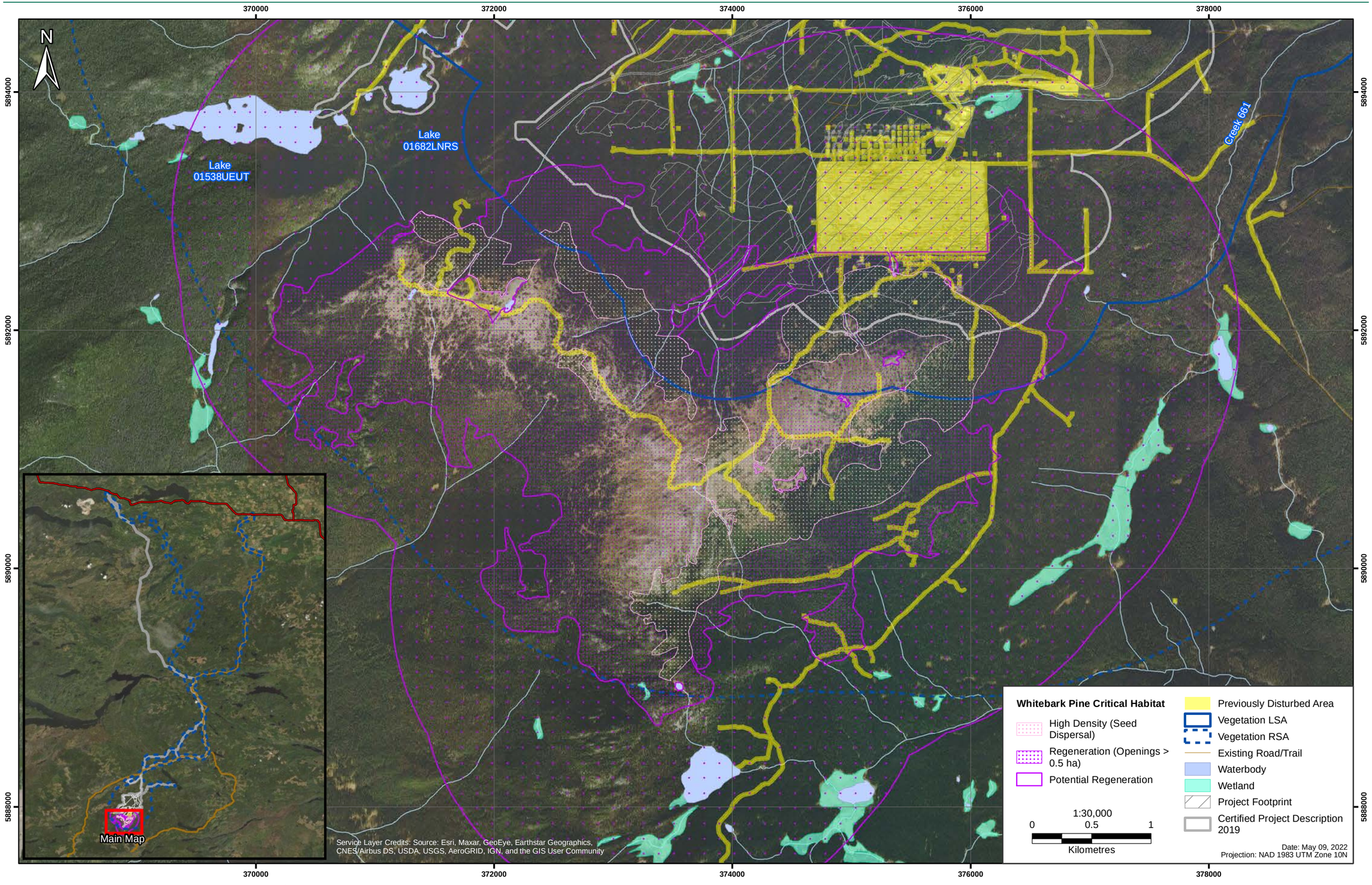


Figure 8.1-3: Mapped Whitebark Pine Critical Habitat on Mount Davidson

Due to the importance of Clark's nutcracker on seed disbursal and natural regeneration, a baseline survey of Clark's nutcracker was conducted in 2012 and 2013 following Tomback (2005). No Clark's nutcrackers were observed within the Mine Site and LSA during the 2012 surveys. In 2013, one Clark's nutcracker was observed in June, five in July, and one in September.

Incidental observations of Clark's nutcracker within the Mine Site and LSA from 2011 to 2013 include: five individuals within the Mine Site and LSA, one individual within the ESSFmvp subzone (in old growth subalpine fir), and four individuals within the ESSFmv (three in old growth subalpine fir forest and two in mature pine forest) between 1,325 m and 1,646 m in elevation (AMEC 2013). A single Clark's nutcracker was recorded incidentally in 2016 (ERM 2016).

In the RSA, Clark's nutcrackers were observed at six locations around Mount Davidson. The maximum group size observed was five individuals at km 2 on the mine exploration road in July 2013. Observations in the RSA occurred in mature subalpine fir (three observations), non-treed alpine (one observation), and lodgepole pine forest, a recently harvested area and a 121+ year stand (two observations). No Clark's nutcrackers were observed in species targeted reconnaissance surveys in July 2013 on two adjacent mountains: Fawnie Nose (22 km away) and Mount Kayakuz (23 km away) (AMEC 2013).

Based on observations of low cone production in 2012 and 2015 (Moody and Clason 2016), combined with the lack of preferred alternate foods, the low numbers of bird sightings is reasonable.

In addition to this, there is a low reliability of the 2013 survey data for Clark's nutcracker. A large cone crop was reported for 2013 that was entirely eaten by Clarks nutcracker. "We (Moody and Clason) spoke with biologist doing (CLNU) surveys who surveyed essentially at the wrong time, as the birds come in and eat for a few weeks, then leave" (Moody pers comm 2022).

Additional studies of Clark's nutcracker will be implemented as a component of this management plan to better determine baseline populations and responses to habitat enhancement and reclamation treatments.

8.2 Restoration Trials

Targeted field surveys in 2013 and 2014 and planting trials in 2016 were implemented outside of the mine footprint on Mount Davidson to support whitebark pine growth with the following objectives:

- Collect cones from phenotypically rust-resistant trees to propagate potentially rust-resistant seedlings in a pine cone collection program (Section 8.2.1 and 8.2.2);
- Identify potential mitigation areas adjacent to the proposed mine footprint for transplantation (Section 8.2.3); and
- Establish reclamation trials to determine suitable conditions for transplantation the establishment of seedlings, and to monitor rust impacts to planted seedlings (Section 8.2.4).

8.2.1 Cone Collection

In 2013, 624 cones were collected for a total of 4,212 grams (g) of seed (Figure 8.2-1). Two-hundred and eight-eight grams (288 g) of seed were sent to the Forest Genetics Council for long-term ex-situ genetic conservation, and 2,550 g of seed were sent to the Surrey Tree Seed Centre (TSC) and are currently in storage, based on the seed storage conditions at the TSC, seed viability is estimated as high but no studies of viability have been conducted on this seedlot . The remaining 1,376 g were put into stratification for seedling production to be used for rust screening and reclamation trials (See 8.2.4) (Moody and Clason 2013). Based on Moody and Pigott (2021) the 2,550 g of seed in storage may yield between 5,230 and 7,846 seedlings. This determination was based on estimates of eight seeds per gram, and oversow factor of 1.3 and a sowing factor or 2 (high estimate) or 3 (low estimate). Standard planting densities are typically 500/ha resulting in between 10.5 and 15.7 ha planted by this seed.

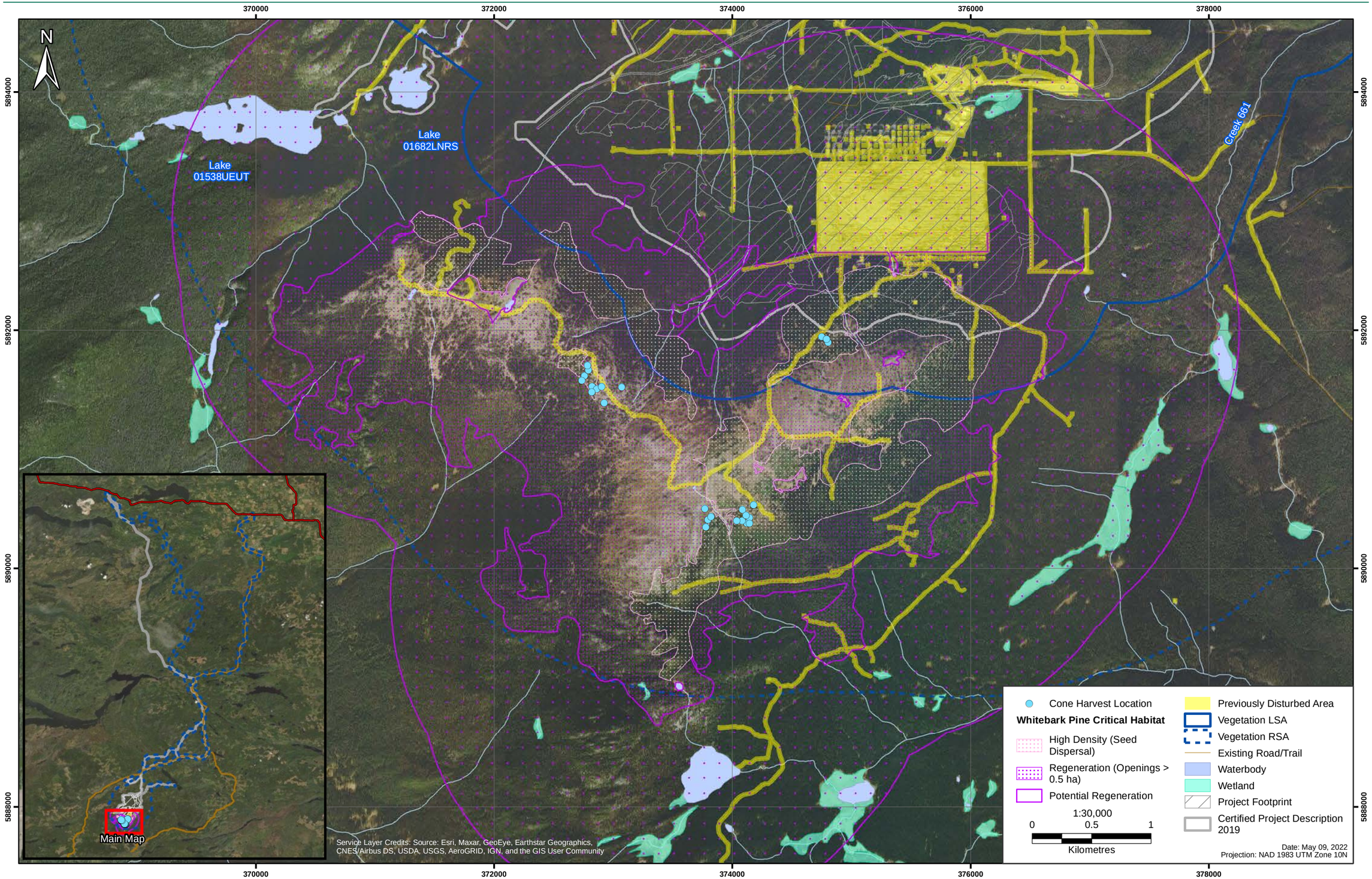


Figure 8.2-1: Whitebark Pine Cone Collection Locations

8.2.2 White Pine Blister Rust

Disease, principally whitepine blister rust, is one of the main threats to whitebark pine. To determine and monitor rust infection rates, and to identify environmental and stand-level characteristics over time that may indicate rust hazard levels (ECCC 2017), three health transects were established in 2013 with an additional two transects established in 2014 (Moody and Clason 2015) adjacent to cone collection areas using the protocols developed by the Whitebark Pine Ecosystem Foundation (Tomback et al. 2005). These transects were 50 m in length x 10 m wide;within the transects all whitebark pine taller than 1.4 m were measured (DBH), assessed for rust, and tagged with permanent metal tags for future remeasurement. These transects were established in stands where cone collections occurred to document current blister rust level but sampled all size classes of trees including regeneration. Only trees taller than DBH were used to determine rust infection levels as per protocols in Tomback et al. (2005). Clason and Moody (2013) estimated the number of trees infected with rust in 2012 (36%, n=100) and 2013 (28%, n=125), for an average infection rate of 32% for the two years. These transects will be remeasured every five years for the life of the mine as per the cycle used by others (Shepherd et al. 2018). These transects will be remeasured in 2022 to better develop the baseline summary for the site.

Whitebark pine screening rust trials were initiated using two separate screening programs to assist in intensive screening. Seed from one tree was sent to the United States Department of Agriculture (USDA) screening program in Coeur d'Alene in 2014, and seeds from four trees (30 per tree) were sent to the Ministry of Forest Lands and Natural Resource Operations (FLNRO) program at Kalamalka in 2016 (Moody and Clason 2016). Of the four trees screened at Kalamaka, the best tree (#4) showed only moderate results with 43% of all seedlings killed by rust; the poorest performing tree (#9) at Kalamalka had 88% of the seedlings killed by rust. The single tree sent for screening at Coeur d'Alene had 93% of seedlings susceptible to rust. Due to the low level of resistance identified in preliminary screening, expanded screening will be required to identify resistant stock for restoration plantings. To identify individuals with a high level of resistance an additional 15 trees will be selected for submission to rust screening programs to support recovery and reclamation work and additional trees will be screened in field based rust screening programs. Trees for screening will be identified from 100-Tree Surveys and rust transect remeasurements planned for 2022.

8.2.3 Transplantation

In the fall of 2012, twenty (20) whitebark pine seedlings were dug up opportunistically from areas of high potential impact from exploration activity (Moody and Clason 2016). These seedlings were over-wintered in Smithers, BC, before being transplanted to an offset area in summer 2013 (Figure 8.2-2). This offset area was selected as the presence of whitebark pine confirmed the suitability of the site, and large openings were present to facilitate transplant work. Of the original 20 seedlings excavated in 2012, 18 survived the winter in Smithers and were transplanted to site in 2013; 14 of these survived the 2013-14 winter and 2014 growing season.

8.2.4 Reclamation Trials

Reclamation trials were initiated in 2016 on Mount Davidson to determine the suitability of reclaimed material and soils for whitebark pine reclamation. Planting whitebark pine is proposed during mine reclamation on dry to mesic sites related to mine infrastructure that will be reclaimed in the Nechako Moist Very Cold Engelmann Spruce - Subalpine Fir (ESSFmv1) and the Nechako Moist Very Cold Engelmann Spruce - Subalpine Fir parkland (ESSFmv1p) biogeoclimatic units. Based on the results of the reclamation and rust screening trials, BW Gold will consider the reclamation potential of historic exploration areas in the ESSFmv1 and ESSFmv1p for future reclamation work (ERM 2018).

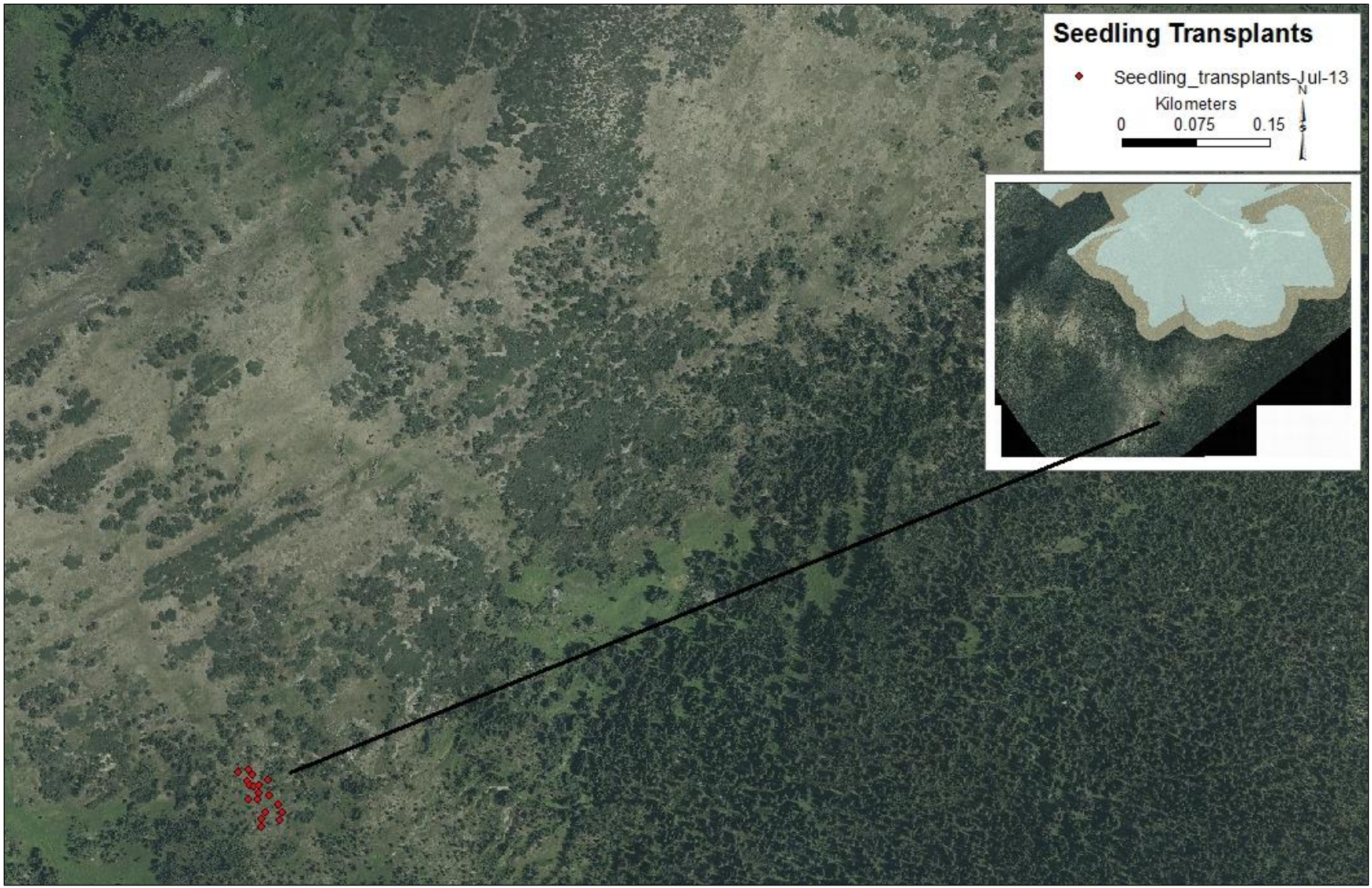


Figure 8.2-2: Seedling Transplant Locations

Whitebark pine are highly tolerant of harsh abiotic conditions and the development of guidelines for planting whitebark pine have improved survival rates (McCaughey et al. 2009). These guidelines include avoiding competition (overstory and understory), avoiding frost pockets and cool air pooling sites, moderate shade and wind protection, protect seedlings from snow creep and soil movement, plant large robust stock, provide adequate growing space and avoid other conifer species, and avoid dead standing snags subject to failure. Reclamation planting trials increase understanding of the survival rates and planting conditions suitable for whitebark pine establishment and inform site preparation. However, the identification of rust-resistant individuals is uncertain and mortality of planted stock due to blister rust is likely. The use of putatively rust-resistant whitebark pine stock will improve the probability of whitebark pine survival and is the principal restoration approach (Sniezko 2006); in practice this stock will be combined with trees of confirmed resistance, untested individuals, and natural recruitment to provide both a component of rust resistance and genetic diversity. Research exists to show that natural resistance in whitebark pine to white pine blister rust exists, and it is passed to the next generation (Hoff et al. 2001). However, it will take approximately 30 years for the establishment of mature cone producing trees.

Reclamation planting and white pine blister rust trials were initiated in 2016 at seven locations where some level of disturbance had occurred during exploration work; this work was not conducted at the offset area as utilized by during transplanting activities. All reclamation planting was conducted on exploration and drill pads that had been prepared for planting by turning soil and pulling soil and debris back onto the planting sites (Moody and Clason 2016). Friable mineral soil with a compoenent of organic soils was better suited to seedling planting than the heavily matted orgranic layer as the latter would not close properly around seedlings; thus turning and pulling soil with debris clearing was required to facilitate seedling planting. The planting density started with 3 to 5 m spacing between seedlings, but due to limited areas suitable for reclamation was reduced to 1 to 2 m. Moody and Clason (2016) also incorporated “nutcracker caches”, where two to three seedlings were planted in one spot to more closely resemble the natural clustered spatial pattern.

Twelve reclamation plots within Site 1 and Site 3 were established as trials on two slope positions on overburden or undisturbed soils (Figure 8.2-3). Survival and height growth of the seedlings will be used to assess whitebark pine suitability as a reclamation species on Mount Davidson. An ecosystem field form (FS882) was used to document each plot and provide comparable data over time. Generally, the plots were established on deactivated exploration roads or drill pads with overburden. Control plots were established in open subalpine meadows with similar aspect, elevation, moisture and slope positions; plots were all between 1,714 and 1,757m in elevation.

Visits were made to several reclamation sites during 2018 reclamation program (Avison 2018). Several sites of whitebark pine seedling plantings in the areas of highest elevation on Mount Davidson were visited. It was anecdotally observed that the specimens planted in disturbed (machine-reclaimed) areas seemed more robust and more likely to have survived than those planted in the undisturbed soil (Avison 2018). At the time of these observations, the seedlings had survived through two full seasons since their planting in September of 2016 (Photos 8.2-1 and 8.2-2 [extracted from Avison 2018 Photos 16 and 17]).

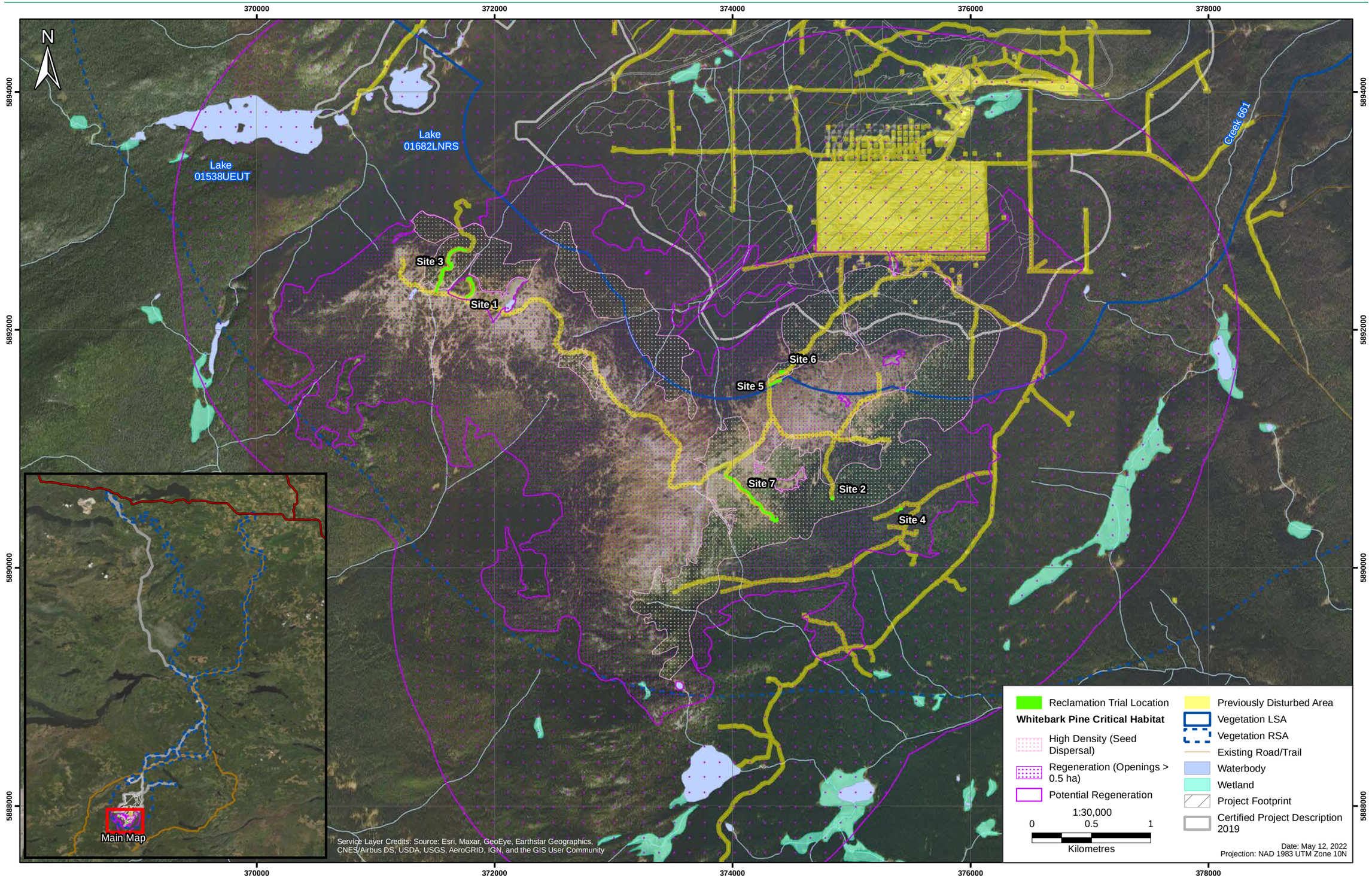


Figure 8.2-3: Reclamation Planting Trial Locations on Mount Davidson

Photo 8.2-1: A whitebark pine seedling planted in September of 2016 on Mount Davidson.

Photo 8.2-2: Whitebark pine specimens growing in a reclaimed trail on Mount Davidson.

9. MITIGATION MEASURES

This Section summarizes the measures to mitigate potential Project effects on whitebark pine. BW Gold has followed the environmental mitigation hierarchy of avoidance, minimization, and restoration and offsetting to identify mitigation measures (BC MOE 2014a, 2014b). Table 9-1 summarizes the whitebark pine mitigation and management measures that apply to all Project components and references specific measures identified in DS Condition 8.20 and BW Gold's Mitigations Table (EAC Condition 43; MT; November 20, 2020). Mitigations measure to address effects of dust and nitrogen deposition are described in the Air Quality and Dust Management Plan (AQDMP, Section 7). The following subsections describe the specific mitigation measures to address DS Conditions 8.20.1 to 8.20.4, namely:

> *8.20.1 – Requires the establishment of criteria to be used to evaluate the health of whitebark pine trees and for the selection of whitebark pine to be transplanted.*
>
> *8.20.2 – Requires the collection and preservation of seed from rust resistant or putatively resistant whitebark pine within the Designated Project area prior to vegetation clearing and use them for progressive reclamation pursuant to DS condition 8.19.*
>
> *8.20.3 – Requires identification of the locations to plant whitebark pine (*Pinus albicaulis*) in undisturbed areas within the Designated Project area prior to construction.*
>
> *8.20.4 – Requires the implementation of measures to support whitebark pine growth and use by Clark's nutcracker (*Nucifraga columbiana*).*

Whitebark pine mitigation is a complex endeavour as it requires actions at various scales and timelines ranging from seeking rust resistance in seedlings, restoring disturbed habitats, and maintaining ecosystem scale processes related to retaining healthy mature trees and ensuring Clark's nutcracker populations.

Table 9-1: Mitigation Measures for Whitebark Pine

Mitigation Table ID	Description	Hierarchy	Phase[1]
MT 5-4	Prior to Construction, develop fire management plans, including consideration of whitebark pine on Mount Davidson in suppression planning, and provision of information to the Wildfire Management Branch on whitebark pine distribution to help inform suppression efforts.	Avoid	Early works
MT 5-6	Implement the IPMP, including measures to reduce the introduction and spread of invasive plant species	Avoid	Early works, Construction, Operations, and Closure
MT 5-1	Provide orientation to workers on whitebark pine identification to avoid unplanned disturbance to whitebark pine.	Minimize	Early works and Construction[1]
MT 5-22	Reporting and onsite fire suppression of wildfires will reduce wildfire risks for whitebark pine.	Minimize	Early works, Construction and Operations
MT 5-23	If required in the event of a MPB outbreak, verbenone will be applied to whitebark pine trees that exhibit resistance to blister rust.	Minimize	Early works, Construction, Operations, and Closure
MT 5-16; DS 8.20.2	Collect whitebark pine cones to ensure sufficient seeds to support trials and to meet the overall reclamation objectives.	Restore	Early works, Construction and Operations

Mitigation Table ID	Description	Hierarchy	Phase[1]
MT 5-17	Whitebark Pine Blister Rust Monitoring: Conduct transects to monitor whitebark pine health and inform the identification of potential parent trees for cone collection and use of verbenone.	Restore	Early works, Construction and Operations
MT 5-18	Whitebark Pine Blister Rust Screening: Rust screening trials of seedlings to identify rust-resistant individual for planting and seedling production.	Restore	Early works, Construction and Operations
MT 5-19	Implement a RCP that describes reclamation of mine landforms using whitebark pine e.g., west waste rock dump in the context of the end land use objectives.	Restore	Closure
MT 5-21; DS 8.20.3	Transplantation of select healthy trees that are transplantable from impacted areas to undisturbed areas or designated reclamation areas, as will be described in the Reclamation and Closure Plan	Restore	Early works, Construction and Operations

Notes:

[1] Although there is approval for early mine works within the whitebark pine mapped critical habitat, no clearing of whitebark pine trees is planned for 2022 (Ryan Todd (Artemis) pers comm January 28, 2022).

"Early works construction" means the following activities undertaken within the area authorized in Permit M-246 (Approving Early Works Program): clearing, grubbing, ditching, and site levelling; construction of the Mine Access Road and mine site roads; and Plant site earthworks and sediment and erosion control works.

"Major works construction" means all construction activities beyond early works construction.

9.1 Transplanting and Criteria to Evaluate the Health of Trees

Commitment 5-21 in the Mitigation Table indicates that seedlings and saplings of whitebark pine will be salvaged and translocated from impacted areas to undisturbed areas.

To support this work, DS Condition 8.20.1 (CEA Agency 2019) requires the establishment of criteria to be used to evaluate the health of whitebark pine trees and for the selection of whitebark pine to be transplanted.

Evaluation of a whitebark pine tree to determine its overall health include the following criteria established by the Whitebark Pine Ecosystem Foundation (whitebarkfound.org):

- No symptoms to indicate that the tree actually or potentially has blister rust or hosts mountain pine beetles.
  - Trees have no apparent active or inactive cankers or pine beetle infestation.
  - Any dead branches or bark stripping is confined to a small portion of the tree (e.g., < 10%) and is likely to have resulted from mechanical damage.

For mature trees, the Healthy category signals the potential for cone production in the near future. If a tree has cankers, > 10% branch kill, heavy bark stripping, or pine beetle infestation, it is not considered healthy.

Criteria for selecting trees for transplanting include size and overall health. Only healthy trees and those small enough to dig up without damage will be selected for transplanting (seedlings and saplings). Only trees with no chlorotic foliage, foliage covering >25% of crown area (assessed in small trees is subjective), and no active rust infections will be considered for transplanting. Other indicators such as bark damage and other stressors may also exclude a seedling or sapling. Transplanting trees was trialed with moderate success (78% one-year survival (Clason and Moody 2015); however, it comes with high efforts and cost. Putting the effort and money into growing more trees from seed that are known or suspected to be rust resistant, and prepping and maintaining trial planting areas for anticipated climate/BGC subzone changes

is likely to have greater future value. Trees will not be considered for transplanting unless they are at risk during project construction, as trees not exposed to impact may be unduly harmed during transplant. No surveys of the project footprint for trees suitable for transplant have been conducted; thus no targets have been established.

No clearing or mine work is planned for whitebark pine habitat during 2022. Surveys will be conducted in summer 2022 to determine:

- The number of seedlings and saplings present in the Designated Project Area that will be disturbed;
- Which seedlings and saplints are healthy and available to transplant;
- Locations of un-disturbed habitat outside of the mine footpring for planting; and
- Set appropriate targets transplanting.

Results of 2022 surveys will be reported to ECCC and UFN/LDN and the final locations and number of whitebark pine seedlings and saplings to be salvaged will be communicated, along with a plan for replanting these seedlings. Consideration will be given in the plan to a phased approach to transplanting based on the mine development schedule.

9.2 Collection and Preservation of Seeds for Progressive Reclamation

DS Condition 8.20.2 (CEA Agency 2019) requires the collection and preservation of seed from rust resistant or putatively resistant whitebark pine within the Designated Project area prior to vegetation clearing and use them for progressive reclamation pursuant to DS condition 8.19.

9.2.1 Seed Collection

Given that masting cycle of whitebark pine trees is quite long – up to 6 years – a seed collection program is planned for early works so as to capture a masting year when it occurs. Yearly rapid surveys by a QP will identify if a masting year is occurring so that seed collection can be triggered. If trees are not masting, then no seed collection is planned, but if trees are masting, then seed collection will be conducted and stored for later use.

Collection and preservation of seed from putatively resistant whitebark pine has been initiated. Additional collection and preservation of seeds will occur from trees visually showing blister rust resistance (disease free trees within a stand where some trees are infected) and parent trees identified as blister rust-resistant through screening trials. Cone collection will follow the methods used by Clason and Moody (Clason and Moody 2014).

Two site visits will be required in years of seed collection: the first in July, to place cages over developing cones to reduce predation by Clark's nutcrackers and other wildlife; and the second in September-October, to retrieve the cages and cones.

Once 100 plus trees have been identified, cones will bed collected for three streams:

1. Cones from the superior 15 (best 15 of 100) trees on site to submit seed to the provincial rust screening program, these trees will be selected by a QP based on superior health and collections made when cones are present. Seed will be submitted to the provincial program for screening, a process that takes about five years, based on the results of this program we may return to select trees to make additional collections, as well as collect scion material to contribute to seed orchard development;
2. Cones to support field screening from all identified plus trees. These seeds will be collected from putatively resistant trees and used in field trials to determine rust resistance using local rust for natural infection. The successful plus trees from these trial demonstrating the highest levels of

resistance will be used for reclamation plantings. Since we are targeting a large number of plus trees for these trials, these collections will likely occur over several years as trees may produce cones out of synch (even with masting).

3. Cones to support progressive reclamation and reclamation trials. These cones may consist of surplus from rust screening or include additional cones from putatively resistant trees not selected as plus trees. These seedlings are required to test the efficacy of a range of ecological conditions created for progressive reclamation and reclamation trials.

For restoration purposes we will require collecting 78 cones for every 1,000 seedlings required for planting (Moody and Pigott 2021); based on a planting density of 500/ha we will collect 39 cones/ha of restoration area. Intensive rust screening results will generally be known in about 5-years post submission, and field screening results will likely require 10-years. Whitebark pine cones are best collected in mast years when the majority of trees have produced a cone crop. Collecting during these years permits a more selective cone harvest as cones are collected from the best trees and not simply the trees that happen to have cones. Masts occur along a relatively long timeline of 5-8 years; thus should be capitalized on when present.

We will initiate surveys to identify 'Plus Trees' described as the healthiest trees in the population; these trees will form the basis of cone collections for both intensive and field based rust screening. As screening progresses plus trees will be dropped from or elevated within the program; if a trees produces seedlings highly susceptible to rust infection it will be dropped from the program, likewise if a tree is highly resistant additional cone collections will be conducted. None of the trees submitted for intensive screening have shown to be highly resistant to blister rust thus at this point no additional collections from these trees are being conducted.

DS Condition 8.20.3 (CEA Agency 2019) requires identification of the locations to plant whitebark pine (*Pinus albicaulis*) in undisturbed areas within the Designated Project area prior to construction.

Seedlings will be grown at both nurseries experienced in whitebark pine production and in partnership with local First Nations who will develop a whitebark pine dedicated greenhouse operation.

Areas inside of the LSA that are identified as potential regeneration/recovery habitat (Figure 8.1-3) will be prioritized for transplantation. Areas for reclamation inside the LSA will be considered based on site suitability and potential success for this species; site factors such as well drained minereral soil with <30% coarse fragments, soil depth >30cm, mesic to submesic soil moisture regime, and an absence of detrimental factors such as frost heaving, late season snow presence, and cold air accumulation.

9.2.2 Reclamation with Whitebark Pine

The Reclamation and Closure Plan (RCP; BW Gold 2021a) details reclamation approaches specific to whitebark pine and Clark's nutcracker including the creation of drier sites that will support whitebark pine as a revegetation species. While competition from other tree species may preclude them from abundant growth, whitebark pine will be given opportunities to extend their range in the Project footprint contingent on the results of reclamation planting trials. This effort will be aided by the planned whitebark pine nursery and reclamation trials to determine optimal planting treatments with long-term maintenance and adaptive management measures informed by the reclamation research trials monitoring results. Approximately 50 ha of SBSmc3 02 and 03 site series are planned using glaciofluvial surface soil in the vicinity of the Freshwater Reservoir (FWR) and camp areas. These are drier and relatively low-density forested ecosystems where lichen and whitebark pine will be prioritized for revegetation based on research trial outcomes and caribou and Clark's nutcracker are expected to find foraging opportunities. Though lower elevation than core populations of whitebark pine, some ecosystems are suited to whitebark pine as they often exclude other species and present a low competition setting. Low elevation populations of whitebark

pine are not uncommon and frequently present on the shores of large lakes (e.g. Morice, Chilko, and Taseko), on eskers, and on serpentine soils; sites with these conditions may present a case of climate refugia where site factors limit competition as opposed to increasing elevation being a limiting factor.

In the higher-elevation sections of the mine, Tailings Storage Facilities (TSF) beaches, the tops of the Upper and Lower Waste stockpiles, ore stockpile footprints, and infrastructure areas are planned to provide 1,053 ha of the Nechako Moist Very Cold Engelmann Spruce - Subalpine Fir zone - 02 and 03 site series (ESSFmv1-02 and ESSFmv1-03), the majority of which (663 ha) are 03 site series occurring on TSF beaches. The ESSFmv1-03 site series is more densely forested with less lichen than the ESSFmv1-02 and is expected to provide abundant pine to support Clark's nutcracker. The ESSFmv1-02 is planned for 240 ha of the reclaimed area and will provide the best habitat for lichen, caribou, and whitebark pine. Although the areas presented here are indicative of a need for a very large seedling production campaign, the timeline of the Project to closure allows for progressive seed collections to be made over time to meet the seedling needs.

Progressive reclamation and associated research will be designed to guide future restoration work. Within this program, tree growth and health will be sampled. These studies will consider a range of site variables and consider rust impacts and nutcracker use in the experimental design, namely:

- Site variables – Seedlings will be planted over a range of site series as described above, and include consideration of factors such as insolation, cool air pooling, snow duration, and other site level variables.
- Research climate change adaptation – Seedlings will be planted below, at and above their current elevational limit on Mount Davidson to determine utility of local assisted migration along an elevational gradient. Sites will not only be selected based on elevation but will test establishment success on the range of existing ecosystems at multiple evations.
- Nutcracker features – As described in 9.3, features such as rocks and logs are common caching sites but also create suitable microsites by shading root collars, wind protection, thermal mass, and snow accumulation, the success of seedlings adjacent to such features will be evaluated in the context of object size and amount/type of protection provided.
- White pine blister rust – In addition to the 15 trees submitted to intensive rust screening, field based screening will occur with additional trees exposed to natural background levels of rust. For this phase of study seedlings from individual parent trees will be tagged and followed through time to document rust impacts. A more detailed field screening program is being developed which will include project layout, locations, and ecosystem units (Site Series) of trials and the prevalence of relevant variables such as alternate white pine blister rust hosts within these ecosystems (*Ribes spp).*

9.3 Measures to Support Whitebark Pine Growth and Use by Clark's Nutcracker

DS Condition 8.20.4 (CEA Agency 2019) requires the implementation of measures to support whitebark pine growth and use by Clark's nutcracker (*Nucifraga columbiana*).

According to the Recovery Strategy (ECCC 2017), the principal threats to whitebark pine to address are white pine blister rust, MPB, climate change, and fire or fire suppression. Therefore, to support whitebark pine growth and use by Clark's nutcracker, the following measures will be implemented:

- Increasing the frequency of trees that have resistance to white pine blister rust in undisturbed and reclaimed areas through rust screening and planting trials (Section 9.2);
- Creating conditions to reduce the effects of natural disturbances such as MPB, fire, and climate change on whitebark pine populations (Sections 9.3.1 to 9.3.3);

- Implementating stand enhancement practices such as thinning, pruning, and verbenone application to improve growth and retention of whitebark pine and whitebark pine stands for use by Clark's nutcrackers, these practices will mimic the effects of positive mixed-severity fire, limit the rate of loss of individual trees by removing rust infections where feasible, and limit mortality attributed to mountain pine beetle (Section 9.3.1 and 9.3.2);
- Monitoring Clark's nutcracker use of whitebark pine within the Project area (Section 10.2);
- Implementing adaptive management as necessary (Section 11.1); and
- Create conditions to encourage caching behaviour by Clark's nutcracker such as the placement of physical features (logs or rocks) to serve as visual caching cues in both regeneration habitat and reclamation sites.

9.3.1 Verbenone Treatments for Mountain Pine Beetle

If required in the event of an MPB outbreak, verbenone will be applied to whitebark pine trees that exhibit resistance to blister rust. These trees will be identified during 100-tree or other surveys of adjacent stands where cone collections and stand improvement practices will be implemented. Verbenone is moderately effective when beetle populations are at endemic levels (USDA 2009). Verbenone will be applied to whitebark pine plus trees when provincial aerial overview surveys (AOS) indicate the beetle population has reached a moderate level in the region (Government of BC 2021). As an anti-aggregation pheromone, it is deployed in small plastic pouches to help protect trees from MPB attack following the methods outlined in USDA 2009. If verbenone use is required, an increase in survival rate of whitebark pine is predicted (Perkins et al. 2011). Mountain pine beetle nearly exclusively attacks large trees that are also in the cone producting cohort, taking steps to limit beetle caused mortality of these trees will aid in ensuring a reliable food source for Clark's nutcrackers.

9.3.2 Fire and Fire Suppression

Fire and fire suppression are considered a low to moderate threat to whitebark pine stands (ECCC 2017). Trees can be destroyed by severe forest fires, and depending on site-specific factors, trees stressed by fire may be more susceptible to MPB.

Fire suppression threatens the whitebark pine populations by maintaining the competing, shade-tolerant fir and spruce populations that are less fire-adapted than the whitebark pine; however, mixed severity fires may create regeneration sites and retain mature trees (ECCC 2017). As a surrogate to mixed severity fire, managers may thin shade tolerant species from within stands to support the long-term presence of mature trees and in open stands support a self-replacing understory of whitebark pine. Thinning activities should be considered as a means to support resilient multi-aged stands well suited to support Clark's nutcracker populations. Adjacent stands should be surveyed for the suitability of this restoration action.

Fire requirements for recruitment are variable across the range and need to be considered within local contexts. Threats, such as the growth of competing shade-tolerant tree populations can be managed on site through mechanical means. Onsite fire suppression will be implemented to reduce the risk of wildfires to whitebark pine, including coordinating with local First Nations on historical methods used and coordinating and reporting suppression efforts with FLNRORD. In this way, fire suppression will support whitebark pine.

9.3.3 Climate Change

As climate has an overarching influence on vegetation, a changing climate will affect whitebark pine distributions and suitability in current ranges over time. Plant species will respond differentially, natural disturbance regimes may change, and insect- and pathogen-host dynamics will change (MFLNRO 2022). It is likely that the ESSFmv1 and ESSFmv1p BGC subzones will transition over time.

Creating conditions to reduce the effects of climate change on whitebark pine habitats requires an understanding of how well whitebark pine will grow in the changing ecosystems. Whitebark pine are highly tolerant of harsh abiotic conditions and advances in guidelines for planting whitebark pine have improved survival rates (McCaughey et al. 2009).

Reclamation planting trials increase understanding of the survival rates and planting conditions suitable for whitebark pine establishment and inform site preparation. Planting trials will be undertaken in new recovery areas consisting of transitional subzones and units predicted to replace the ESSFmv1/ESSFmvp subzones, as well as locations across the range of existing ecosystems at multiple elevations to determine utility of local assisted migration along an elevational gradient.

This includes higher elevation areas outside of the Project footprint in what is presently the ESSFmvp and is projected to transition to the ESSFmv1 by 2050 (Based on Wang et al. 2016). Planting areas will be determined from field surveys conducted in 2022.

The new recovery habitats are areas and activities focused on the propagation of white pine blister rust-resistant individuals for assisted migration to newly identified and available suitable habitat created by climate change. Site preparation, seedling selection, planting and monitoring methodology will follow those used for the restoration trials (Table 9-3; Section 8.2).

10. FOLLOW-UP PROGRAM AND ADDITIONAL BASELINE

The monitoring associated with the follow-up program is described in Section 10. Adaptive management and additional mitigation measure guidelines are described in Section 11. Visual monitoring of whitebark pine, including health, in reclaimed areas will be assessed as described in Table 10-1. Monitoring of Clark's nutcracker use in reclaimed areas will occur as described in Table 10-1, and adaptive management will be implemented as described in Table 11-1 (see Section 11). The follow-up program will evolve over time in response to the results of the monitoring program, changing conditions or development at the Project, updates to scientific methods, and through consultation and discussions with Indigenous groups, regulators or other stakeholders. Any updates made to the follow-up or adaptive management programs will be provided to the Agency and to the party or parties being consulted during the development within 30 days of the follow-up program being updated.

Conditions 2.5 and 2.6 in the federal DS identify requirement for follow-up programs:

> *"2.5 The Proponent shall, where a follow-up program is a requirement of a condition set out in this Decision Statement, have a Qualified Professional, where such a qualification exists for the subject matter of the follow-up program, determine, as part of the development of each follow-up program and in consultation with the party or parties being consulted during the development, the following information:*
>
> *2.5.1 the follow-up activities that must be undertaken by a qualified individual;*
>
> *2.5.2 the methodology, location, frequency, timing and duration of monitoring associated with the follow-up program;*
>
> *2.5.3 the scope, content, format and frequency of reporting of the results of the follow-up program;*
>
> *2.5.4 the levels of environmental change relative to baseline conditions that would require the Proponent to implement modified or additional mitigation measure(s), including instances where the Proponent may require Designated Project activities to be stopped; and*
>
> *2.5.5 the technically and economically feasible mitigation measures to be implemented by the Proponent if monitoring conducted as part of the follow-up program shows that the levels of environmental change referred to in condition 2.5.4 have been reached or exceeded.*
>
> *2.6 The Proponent shall update and maintain the follow-up and adaptive management information referred to in condition 2.5 during the implementation of each follow-up program in consultation with the party or parties being consulted during the development of each follow-up program."*

The DS Condition 8.20.5 also requires the Proponent to:

> *"develop and implement a follow-up program in consultation with Indigenous groups to determine the effectiveness of the mitigation measures included in the whitebark pine management plan. The Proponent shall apply conditions 2.9 and 2.10 when implementing the follow-up program. The follow-up program shall include:*
>
> *8.20.5.1 visual monitoring of populations of whitebark pine (Pinus albicaulis), including their health, within reclaimed areas at a minimum every five years; and*
>
> *8.20.5.2 monitoring of use of the reclaimed areas by Clark's nutcracker (*Nucifraga columbiana*) for the purpose of whitebark pine regeneration. Should the results of monitoring demonstrate that use of the reclaimed areas by Clark's nutcracker (*Nucifraga columbiana*) is not adequate, the Proponent shall implement additional mitigation measures."*

Table 10-1: Whitebark Pine Monitoring

Mitigation Measure	Monitoring Method	Frequency	Duration	Timing	Reporting
8.20.1 – The establishment of criteria to be used to evaluate the health of whitebark pine trees and for the selection of whitebark pine to be transplanted.					
Tree Health Monitoring	Establish and re-measure permanent monitoring transects (As described in Tomback et al. 2005). Determine if blister rust infection rates and other forest health agents, including MPB, are increasing or decreasing. Descriptive statistics and analysis will be conducted to characterize changes.	Every five years. Measurement may be decreased based upon trial results.	Until Closure	May-July[1]	Annual Report
Transplant Candidate Evaluations	Surveys of the Project footprint will be conducted to identify seedling or sapling candidates for transplanting. Only healthy trees and those small enough to dig up without damage will be selected for transplanting. Only trees with no chlorotic foliage, foliage covering >25% of crown area (assessed in small trees is subjective), and no active rust infections will be considered for transplanting. Other indicators such as bark damage and other stressors may also exclude a seedling or sapling.	Once in 2022	Prior to construction and clearing of whitebark pine	May-June	Annual Report
Transplant Success	Transplanted seedlings and saplings will be mapped and where feasible transplanted along transects to facilitate monitoring. Transplants will be monitored for mortality, health and growth, measure height, diameter, survival, and health for all transplanted individuals.	Every five years after establishment	Until Closure	Summer/Fall	Annual Report
8.20.2 – The collection and preservation of seed from rust resistant or putatively resistant whitebark pine within the Designated Project area prior to vegetation clearing and use them for progressive reclamation.					
100-Tree Surveys	100-Tree surveys will be conducted in at least ten whitebark pine stands to evaluate stand rust levels and identify plus trees for cone collections.	Once unless rust resistance levels are low from blister rust screening and the identification of additional plus is required	Year-one but may be reactivated if additional plus trees are required	May-July	Annual Report
Cone Surveys	The plus trees identified above will be evaluated for cone presence to determine if a mast crop is present and cone collection is triggered. If 30 plus trees are producing a minimum of 20 cones each, cone collection will be triggered.	Annually until a cone collection has been made from all plus trees	Until a cone collection has been made from all plus trees	May-June for collections in that year; September for collections in the subsequent year.	Annual Report
Cone Collection and Seedling Propagation	Assess if seed collection was sufficient to meet seedling production needs for rust screening and reclamation trials. Seeds from each plus tree will be inventoried following collections, a minimum of 150 filled seeds from each tree are required for use in each of intensive and field based screening, and reclamation research.	Following cone surveys	Until closure, monitoring of seed amounts will vary as the program progresses	November	Annual Reclamation Report
Intensive Blister Rust Screening	Monitor growth, health, rust impacts and causes of death to the seedlings over time. Screening will identify rust-resistant individuals for propagation. Monitoring and analysis will be conducted by the USDA and/or FLNRORD within their screening programs.	Annually once initiated. Seed must be collected, seedlings produced and exposed to rust to initiate program. Earliest time of inoculation is 2024.	Until Closure or until screening results are known	June-September	Annual Report
Field-based Blister Rust Screening	Monitor growth, health, rust impacts and causes of death to the seedlings over time. Screening will identify rust-resistant individuals for propagation. Monitoring and analysis will be based on endemic rust levels.	Annually once initiated. Seed must be collected, seedlings produced and exposed to rust to initiate program. Earliest time of inoculation is 2024. The timeline for re-measurement may be decreased based upon trial results.	Until Closure or until screening results are known	June-September	Annual Report
8.20.3 – The identification of the locations to plant whitebark pine (*Pinus albicaulis*) in undisturbed areas within the Designated Project area prior to construction.					
Seedling Production	Monitor growth and health. Seedling assessments (height, diameter, survival, and health) will determine successful production of seedlings.	Bi-annually	Until seedlings are planted out.	Spring/Fall	Annual Report
Seedling Planting	Monitor growth and health. Seedling assessments will track mortality, health, and growth. Each seedling will be measured (height, diameter, survival, and health) at establishment to provide baseline data for comparison and analysis against future measurements.	Annually until establishment and every five years after	Until Closure	Summer/Fall	Annual Report
8.20.4 – The implementation of measures to support whitebark pine growth and use by Clark's nutcracker (*Nucifraga columbiana*)[2]					
Seedling Planting Trials	Seedling measurements at each plot will track mortality, health, and growth. Each seedling will be measured (height, diameter, survival, and health) at establishment to provide baseline data for comparison and analysis against future measurements. The seedling planting trials will be used to assess the effectiveness of whitebark pine to meet reclamation objectives.	Annually until establishment and every five years after	Until Closure	Summer/Fall	Annual Reclamation Report

Mitigation Measure	Monitoring Method	Frequency	Duration	Timing	Reporting
Planting Trials for Climate Change	Complete an ecosystem full plot assessment (using an FS882 data card). Seedling measurements at each plot will track mortality, health, and growth. Each seedling will be measured (height, diameter, survival, and health) at establishment to provide baseline data for comparison and analysis against future measurements. The seedling planting trials will be used to assess the efficacy of whitebark pine within changing ecosystems caused by climate change.	Every five years after establishment	Until Closure	Summer/Fall	Annual Reclamation Report
Natural Stand Enhancement	Stands where enhancement actions occur such as thinning, pruning, and verbenone application will be monitored for success of each practice. Surveys of candidate stands are still required to develop this program but monitoring will be targeted to the efficacy of each treatment such as – Thinned Stands – growth increment of whitebark pine, recruitment of all species; Pruned Trees – healthy tree or reinfection by rust; Verbenone Application – does tree remain unimpacted by mountain pine beetle. Fixed radius 11.28 m plots will be established to assess stand composition for enhancement treatments, during treatment pre and post treatment assessments will be conducted.	Every five years for thinning and pruning, annually for verbenone application. For thinning a pre and post treatment stand composition plot will be established and measured.	Until Closure	Fall	Annual Report
Clark's Nutcracker Use of Reclamation Features	Monitoring physical caching cues established in reclamation research and progressive reclamation areas. These cues will include features such as rocks and logs. A subset of these features will be unplanted during trials and monitored for natural recruitment due to Clark's nutcracker caching.	Every five years after establishment	Until Closure	Summer-Fall	Annual Report and WMMP
Clark's Nutcracker Use of Current Disturbed and Undisturbed Habitat	Monitoring using Before-After-Control-Impact (BACI) format (See Section 10.1), including reclaimed areas. Methods will include point counts (50) and playback surveys (20) of Clark's nutcracker. Survey methods will be based on RIC (1999) Inventory Methods for Forest and Grassland Songbirds, Version 2.0., paired with ARUs (set for an appropriate recording distance) and survey transects. Lorenz and Sullivan (2010) will be used to guide surveys and they will be timed to align with cone crop availability. Passive sampling of cone feeding and seed caching will occur in conjunction with whitebark pine surveys, trials, and assessments	Before sampling will occur prior to clearing of whitebark pine trees. After sampling will occur every three years until Closure.	Before sampling: Pre-Construction, Early Works, and Construction. After sampling: Operations and Closure	Early Summer during breeding season and Fall, when cone crops are ready	WMMP

Notes:

The metrics, triggers and associated responses to Normal, Low, Moderate, and High level effects are provided in Table 11-1: Adaptive Management Triggers for Potential Effects on Whitebark Pine.

[1] Tomback et al. 2005

[2] Supporting growth and use by Clark's nutcrackers includes practices to enhance current habitat and improve habitat for the post-closure setting.

The monitoring program is summarized in Table 10-1, and includes methods, frequency, duration, timing and reporting requirements. The monitoring program will be reviewed every year and updated to take into account new Traditional Knowledge and feedback, updates to the Recovery Strategy (ECCC 2017), results of reclamation trials, and scientific literature. Monitoring will be directed by a Qualified Professional and undertaken by trained monitors, including Indigenous monitors.

10.1 Whitebark Pine

Whitebark pine specific surveys are key for successfully documenting whitebark pine presence and health, as well as facilitating other management actions such as prioritizing cone collections, monitoring, and expectations of restoration success (ECCC 2017).

Tree health monitoring for blister rust will determine if blister rust infection rates are increasing or decreasing. This monitoring will also assess the status of other forest health agents, including MPB. Descriptive statistics and analysis will be conducted to characterize magnitude and significance of effects. Tree health monitoring will be conducted every five years while the mine is operating between May and July until Closure.

The following survey procedures are recommended by ECCC (2017) for field monitoring blister rust levels.

1. The 100-Tree Survey is a rapid assessment meant to identify and assess rust levels or trees suitable for cone collections (Moody and Pigott 2021). In general, this survey is intended to gain insights on the general condition of a stand to ensure cone collections reflect the healthiest stand cohort. Methods consist of visually surveying 100 trees with cone collections made from the healthiest cohort in the stand. This method is typically used during cone collections to quantify local rust levels.
2. The Whitebark Pine Ecosystem Foundation has developed a broadly accepted means of establishing health monitoring transects to determine baseline health levels and to facilitate change-monitoring into the future (Tomback et al. 2005) (www.whitebarkfound.org/wp-content/uploads/2013/10/Methods-for-Surveying-and-Monitoring-Whitebark-Pine-for-Blister-Rustx.pdf). Establishing these transects within or adjacent to a workzone may aid in the management of whitebark pine for several reasons including:
    - Aid in prioritizing trees for cone collections (healthiest trees in the most infected stands);
    - Allow for early detection of pest increases;
    - Develop realistic restoration success goals (without resistant stock can we expect restoration to be more successful than trends observed in local stands?);
    - Allow for targeted trend-based management; and
    - Prioritize management actions where needed most (when transects are established across a broad landscape).

Permanently marked transects are established along a 50 m length, with 5 m strips on either side. Along the transect, all trees greater than 1.4 m tall have height and diameter (DBH) recorded and are tagged for future monitoring. Health attributes are documented for all whitebark pine; including status of blister rust, mountain pine beetle, or other agents. To assist with remeasurement, standard protocols should be followed, such as always tagging trees on a given side or always sampling trees on the upper side of the transect (Tomback et al 2005). Five permanent transects were established by Moody and Clason in 2013 and 2014.

Whitebark pine produces cone crops on a masting cycle, years of large crops followed by years of cone failures. Based on the results of the 100-Tree Surveys, plus trees will be identified and monitored for cone crops to be collected from during mast years. Masts are generally unpredictable but tend to follow a trend

of a true mast year followed by several dearths, followed by moderate cone crops until a subsequent mast year. Whitebark pine cones require two-years to mature thus cones mature in one year were initiated the previous spring; surveys can occur in the first year of cone productions to direct cone collections in the following year or in early spring to guide collections of the year.

Monitoring of cone crops will inform several aspects of this plan including associated cone collections and as a variable within Clark's nutcracker monitoring. Cone monitoring should occur early each September during other environmental monitoring to determine the number of cones present for Clark's nutcracker feeding and to determine the number of developing cones to determine the potential for a cone collection the following year. During years of cone collections this monitoring may happen concurrent to collections.

Seedling planting trials will be monitored by measuring seedlings at each plot to track mortality, health, and growth. Height, diameter, survival, and health of each seedling will be measured at establishment to provide baseline data for comparison and analysis against future measurements. The seedling planting trials will be used to assess the effectiveness of whitebark pine to meet reclamation objectives.
The number of plots will depend on the number of healthy parent trees identified and consist of enough plots for statistical verification. Transplanted individuals will be monitored for mortality, health and growth, height, diameter, survival, and health will be measured for all transplanted individuals.

Monitoring for reclamation trials, seedling planting trials, and transplanted individuals will occur every five years thereafter until the trajectory of survivorship and results of trials are established, after which timeline for re-measurement may be decreased based upon trial results.

10.2 Clark's Nutcracker

Federal Condition 8.20.5.2 (CEA Agency 2019) requires a monitoring program specific to Clark's nutcracker:

> *"monitoring of use of the reclaimed areas by Clark's nutcracker (Nucifraga columbiana) for the purpose of whitebark pine regeneration. Should the results of monitoring demonstrate that use of the reclaimed areas by Clark's nutcracker (Nucifraga columbiana) is not adequate, the Proponent shall implement additional mitigation measures."*

Clark's nutcrackers will be monitored to assess their use of whitebark pine in the Project area, and results will be integrated into adaptive management measures as described in the Wildlife Mitigation and Monitoring Plan (WMMP), Section 4.7. Details of the monitoring program are as follows:

- Will be designed as a Before-After-Control-Impact (BACI) study:
  - Before sampling will occur prior to clearing of whitebark pine trees and will continue for the duration of the Construction period.
  - After sampling will occur every three years (more or less, with consideration to timing of mast crops) during the Operations and Closure periods.
  - Sampling will consider the presence of cone crops as Clark's nutcrackers are highly mobile and will abandon sites when cones are absent or have been completely harvested, these surveys will document cone densities and cone feeding status (not uncommon for nutcrackers to feed and then abandon an area).
  - Control sites will be located in whitebark pine/Clark's Nutcracker habitat in a nearby high elevation area.
  - Impact sites will be located on Mount Davidson, within and outside of whitebark pine management areas.

- Specific permanent plot locations will be located in control and impact areas during the first year of study (2022).
- Before sampling will occur in 2022 and 2023, and then additional sampling will occur every five years during operations.
- Surveys of 'placed visual features' for new germinants indicative of Clark's nutcracker caching will be conducted every three years.
- Acoustic Recording Units (ARUs) and remote cameras will be utilised within the permanent plot locations and impact areas. One ARU will be placed in each plot over the growing season (spring to fall).
- Methods will include point counts (50) and playback surveys (20) of Clark's nutcracker, based on RIC (1998) *Inventory Methods for Forest and Grassland Songbirds, Version 2.0,* and transect surveys as described in Tomback (2005). Survey timing will align with cone crop availability to Clark's nutcracker.
- Results and analysis reported in the WMMP report.

10.3 2022 Work and Surveys

- To support the implementation of this plan and the development of future iterations of the WPMP, surveys and potential work triggered by these surveys will be conducted in 2022 to inform potential management approaches. For example if a large cone crop is observed in early 2022, a cone collection program may be initiated in summer-fall 2022. Work and surveys for 2022 include: Surveys of adjacent stands outside of the project footprint on Mount Davidson with a component of whitebark pine to determine the suitability of ecosystem restoration to support long-term persistence of mature whitebark pine and conversely Clark's nutcracker as per 9.3.2. This will be done using a minimum of five 11.28 m fixed radius plots in each stand to determine stand species and structural composition to determine whitebark pine density, basal area, competition levels, and corresponding thinning needs. The results of these surveys may also be used to:
- Survey of construction footprint to determine the number of seedlings and saplings suitable for transplant as per 9.1. This will be done using five 11.28 m fixed radius plots across each footprint polygon to determine the density of high vigour whitebark pine seedlings and saplings suited to transplant. Since vigour is being assessed in a single sampling period, we define high vigour as: no chlorotic foliage, foliage covering >25% of crown area (assessed in small trees is subjective), and no active rust infections. Other indicators such as bark damage and other stressors may also exclude a seedling or sapling from being classified as highly vigorous.
- 100-Tree Surveys of at least ten stands (1000 trees) to identify the best plus trees for use in rust screening trials. These plus trees (target 100) will form the basis of cone collections for the region and will be the trees surveyed for cone crops over-time.
- Survey of conelets in late spring/early summer to determine if a cone collection is warranted in 2022 as per 9.2.
- Survey of conelets in later summer/early fall to determine if a cone collection is warranted in 2023 as per 9.2.
- Surveys to identify areas for field trials including priority areas for transplants and field rust screening with additional areas for field trials related to ecological site factors.
- Based on the results of these surveys, more comprehensive rust screening and field trial plans will be developed based on the confirmation of planting sites, plus trees for cone collections, and description of stands regarding rust and competition levels.

11. EVALUATION AND ADAPTIVE MANAGEMENT

Adaptive management triggers and responses are provided in Table 11-1 and are based on the mitigation actions required by DS Conditions 8.20.1 to 8.20.4 (CEA Agency 2019). Adaptive management actions will be determined on a site- and species-specific basis in consultation with regulators and Indigenous Groups.

Table 11-1: Adaptive Management Triggers for Potential Effects on Whitebark Pine.

Metric	Normal		Low Level		Medium Level		High Level	
	Trigger	Action/Response	Trigger	Action/Response	Trigger	Action/Response	Trigger	Action/Response
Health of transplanted seedlings	Mortality rates of less than 50%[1]; Acceptable effort and cost.	No Action	Mortality rates greater than 50-60%; High effort and cost.	Change approach from transplanting to a seedling production/ planting program. Transplanting is a novel method; trigger thresholds are arbitrary and based on operational utility of activity				
Health of seedlings in intensive white pine blister rust screening program	5-Year rust related mortality <25%; or on advice of pathologists. Triggers for screening are based on approximate levels used in provincial rust screening program.	Collect additional cones from parent trees.	5-Year rust related mortality >25%; or on advice of pathologists. Triggers for screening are based on approximate levels used in provincial rust screening program.	Do not collect additional cones from parent trees unless advised by pathologists				
Health of seedling in field-based white pine blister rust screening program	10-Year rust related mortality <15%. Triggers for screening are based on approximate levels used in provincial rust screening program.	Collect additional cones from parent trees.	10-Year rust related mortality >15%. Triggers for screening are based on approximate levels used in provincial rust screening program.	Do not collect additional cones from parent trees to support reclamation and restoration programs.				
Health of seedlings in field based reclamation trials (non-rust health)	5-Year non-rust related mortality <25% attributed to site factors (excludes browsing, insects, etc.)	Broadly apply site treatments from trials across reclamation areas if statistically supported.	5-Year non-rust related mortality range of 25-50% attributed to site factors (excludes browsing, insects, etc.)	Limit application of treatments from trials across reclamation areas (<25% of area)	5-Year non-rust related mortality >50% attributed to site factors (excludes browsing, insects, etc.)	Remove reclamation trial treatment from reclamation plans, as 50% site driven mortality coupled with rust mortality will hamper mitigation success.		
Health of Seedlings in Climate Change planting studies	5-Year non-rust related mortality <25%	Sites may be suitable for assisted migration due to climate change	5-Year non-rust related mortality between 25-50%	Further study to determine if sites may be suited to assisted migration. Studies should include factors such as annual growth rates and vigour compared to other sites.	5-Year non-rust related mortality >50%.	Remove sites from climate change assisted migration trials.		

Metric	Normal		Low Level		Medium Level		High Level	
	Trigger	Action/Response	Trigger	Action/Response	Trigger	Action/Response	Trigger	Action/Response
Quality of collected seed[2]	Majority of seeds (more than 80%) are good quality. A typical whitebark weight is 8/g (range from 7-10/g) with a high percentage of filled cavities with mature embryos >80% filled).	No action.	Seeds were collected from healthy parents and are a mixture of typical weight and lower weight seeds >8 seeds per gram and <80% filled embryo cavities.	▪ Review of parent tree health; ▪ Try post collection air separation which will remove empty and partially empty seeds and improve retained seedlot quality.	Seeds are mostly moderate quality (most are less than >10/g and have immature embryos <60%	▪ Review of parent tree health and age; review of stand age (some young or poorly stocked stands may have poor pollination) consider new locations for seed collection. ▪ Larger, high density mature stands ensure adequate pollination, genetic diversity, and higher seed quality; ▪ ensure the best genetics are being perpetuated. Apply excessive air separation to seeds to extract highest quality seeds.	Majority of seeds are small (>12/g) and poor quality (<40% filled).	▪ Notify Indigenous groups and regulators. ▪ Consider new mitigations in consultation with Indigenous groups and ECCC, such as: 1. Consider new seed sources. 2. Consider mixing seeds from natural local stands, stands within seed transfer limits and seed orchards (if online), which are managed to provide high quality and disease resistant seed. Apply excessive air separation to seeds to extract highest quality seeds.
Mountain Pine Beetle	Evidence of MPB in less than <1% of trees sampled.	No action.	N/A	N/A	Evidence of MPB in 1 to 5% of live trees sampled.	▪ Apply verbenone to trees in affected areas. ▪ Apply verbenone to all parent trees in rust screening program	Evidence of MPB in >5% of trees sampled.	▪ Apply verbenone to trees in affected areas. ▪ Evaluate if changes are required to monitoring program. ▪ Implement new mitigation measures.
Clark's Nutcracker use	No change in Clark's nutcracker abundance as determined through regional monitoring and informed using historical population data (e.g. eBird, BBS, or BBA data)	No change to monitoring and mitigation.	A trend of fewer Clark's nutcrackers following construction of the mine in the Impact block.	▪ Inform Indigenous groups and regulators through regular reporting schedule. ▪ Continue monitoring program. ▪ Identify new mitigation measures (See WMMP, Section 4).	Confirmed fewer Clark's nutcrackers following the construction of the mine. A difference of 20% will be used as a threshold determined through statistical analysis.	▪ Inform Indigenous Groups and regulators through annual WMMP Report. ▪ Continue monitoring program. ▪ Evaluate and discuss if new mitigation measures are feasible. ▪ Implement new mitigation measures if necessary. Establish monitoring at regional level to determine if trends are localized.	Confirmed fewer Clark's nutcrackers following the construction of the mine, but more than 20% difference.	▪ Notify Indigenous groups and regulators. ▪ Evaluate if changes are required to monitoring program. ▪ Implement new mitigation measures. Establish monitoring at regional level to determine if trends change.

[1] *Based on average seedling survival rates of 42% (Izlar 2007).*

[2] *Based on health defined by Bulkley Valley Research Centre (n.d.).*

12. DOCUMENTATION AND RECORD KEEPING

12.1 Quality Assurance and Quality Control

Standard operating procedures (SOPs) will be established for environmental data collection as needed. SOPs cover all aspects of data collection, data processing, data QA/QC, and data management. SOPs will include duplicate sampling, relevant blanks, chain-of-custody procedures, and record keeping. SOPs will be reassessed and updated when necessary. Sampling personnel will have necessary training and accreditation.

Data analysis will be conducted using established and standardized workflows, and results will be crosschecked and validated. The annual reports will include detailed descriptions of the analytical methods, including the relevant validation and QA/QC procedures and results. The QA/QC program will be reviewed and updated annually to continuously improve the effectiveness and reliability of the WPMP to detect mine-related effects on whitebark pine habitats.

12.2 Records

The EM will be responsible for data management. Monitoring data will be entered into an electronic database and have quality control checks completed upon receipt of results. Data will be entered into a standard format that allows for data reporting and analyses. Data and data comparisons will be stored in a single file format for each type of survey or monitoring activity. Monitoring data will be stored, at a minimum, for 25 years following the end of decommissioning of the Project and will be made available for review upon request.

13. REPORTING AND RECORD KEEPING

13.1 Documentation

BW Gold's EM is responsible for data management, reporting and records for the Project. All mitigation and monitoring activities relevant to the WPMP will be documented and stored digitally. As required by DS Condition 12.1 (CEA Agency 2019), records will be maintained for 25 years following the end of the decommissioning of the Project. BW Gold will provide the aforementioned records to the Agency upon demand within a timeframe specified by the Agency.

Documentation relevant to the WPMP includes:

- Details of mitigation actions implemented: dates, personnel, photos, and communications;
- Monitoring results: raw survey data and meta data (dates, times, personnel, photos), analyses, figures, maps, internal, and external reports;
- Incident reports (e.g., wildfire); and
- Adaptive management actions and outcomes.

13.2 Reporting

13.2.1 Annual Report

Whitebark pine mitigation and monitoring will be included in the annual report and will summarize activities completed in the previous year which may include:

- Inventory and delineation of whitebark pine stands – maps and descriptions of forests in terms of density and volumes for whitebark pine stand polygons;
- Health monitoring if completed in that year;
- Reporting on cone collections if completed in that year and recommendations on future cone collection;
- Seedling production totals;
- Seedling planting trials – maps, data summaries, statistical analysis, and discussion of trial results;
- Translocation planting – identification of translocation survival rates and recommendations to increase survival rates;
- Blister rust screening trials - general maps of trial location, grids of stock locations, analysis, and descriptions of trial monitoring;
- Clark's nutcracker survey results, if conducted;
- Any additional measures such as verbenone use, stand treatments, and future work plans; and
- Adaptive management, follow-up actions, and future plans.

13.2.2 Federal Decision Statement Annual Reporting and Information Sharing

DS Conditions 2.11, 2.12, and 2.13 set out annual reporting requirements related to the implementation of conditions in the DS. Condition 2.14 sets out information sharing requirements related to the annual reports. Reporting will commence when BW Gold begins to implement the conditions set out in the DS. Requirements in DS Conditions 2.11 to 2.14 are presented below.

DS Condition 2.11 requires:

> *"The Proponent [BW Gold] shall, commencing in the reporting year during which the Proponent begins the implementation of the conditions set out in this Decision Statement, prepare an annual report that sets out:*
>
> *2.11.1 the activities undertaken by the Proponent in the reporting year to comply with each of the conditions set out in this Decision Statement;*
>
> *2.11.2 how the Proponent complied with condition 2.1;*
>
> *2.11.3 for conditions set out in this Decision Statement for which consultation is a requirement, how the Proponent considered any views and information that the Proponent received during or as a result of the consultation, including a rationale for how the views have, or have not, been integrated;*
>
> *2.11.4 the information referred to in conditions 2.5 and 2.6 for each follow-up program;*
>
> *2.11.5 the results of the follow-up program requirements identified in conditions 3.14, 3.15, 3.16, 4.5, 5.5, 6.11, 6.12, 6.13, 6.14, 8.18.6, 8.20.5, 8.21, and 8.22 if required;*
>
> *2.11.6 any update made to any follow-up program in the reporting year;*
>
> *2.11.7 any modified or additional mitigation measures implemented or proposed to be implemented by the Proponent, as determined under condition 2.9 and rationale for why mitigation measures were selected pursuant to condition 2.5.4; and*
>
> *2.11.8 any change(s) to the Designated Project in the reporting year."*

DS Condition 2.12 requires:

> *"The Proponent [BW Gold] will provide the draft annual report to Indigenous groups, no later than June 30 following the reporting year to which the annual report applies. BW Gold will consult Indigenous groups on the content and findings in the draft annual report."*

DS Condition 2.13 requires:

> *"The Proponent [BW Gold], in consideration of any comments received from Indigenous groups pursuant to condition 2.12 shall revise and submit to the Agency [Impact Assessment Agency of Canada] and Indigenous groups a final annual report, including an executive summary in both official languages, no later than September 30 following the reporting year to which the annual report applies."*

DS Condition 2.14 requires:

> *"The Proponent [BW Gold] shall publish on the Internet, or any medium which is publicly available, the annual reports and the executive summaries referred to in conditions 2.11 and 2.13, the offsetting plan(s) referred to in condition 3.11, the compensation plan referred to in condition 8.18 and, if required, condition 5.3, the whitebark pine management plan referred to in condition 8.20, the communication plans referred to in conditions 6.15 and 10.5, the reports related to accidents and malfunctions referred to in conditions 10.4.2 and 10.4.3, the schedules referred to in conditions 11.1 and 11.2, and any update(s) or revision(s) to the above documents, upon submission of these documents to the parties referenced in the respective conditions. The Proponent shall keep these documents publicly available for 25 years following the end of decommissioning of the Designated Project. The Proponent shall notify the Agency and Indigenous groups of the availability of these documents within 48 hours of their publication."*

DS Condition 2.15 requires:

> *"When the development of any plan is a requirement of a condition set out in this Decision Statement, the Proponent [BW Gold] shall submit the plan to the Agency and to Indigenous groups prior to construction, unless otherwise required through the condition."*

Pursuant to Condition 2.11 BW Gold shall, commencing in the reporting year during which the Project begins the implementation of the conditions set out in this Decision Statement, prepare an annual report that sets out:

- The activities undertaken by the Proponent in the reporting year to comply with each of the conditions set out in this Decision Statement;
- How the Proponent complied with condition 2.1;
- For conditions set out in this Decision Statement for which consultation is a requirement, how the Proponent considered any views and information that the Proponent received during or as a result of the consultation, including a rationale for how the views have, or have not, been integrated;
- The information referred to in conditions 2.5 and 2.6 for each follow-up program;
- The results of the follow-up program requirements identified in conditions 3.14, 3.15, 3.16, 4.5, 5.5, 6.11, 6.12, 6.13, 6.14, 8.18.6, 8.20.5, 8.21, and 8.22 if required;
- Any update made to any follow-up program in the reporting year; and
- Any modified or additional mitigation measures implemented or proposed to be implemented by the Proponent, as determined under condition 2.9 and rationale for why mitigation measures were selected pursuant to condition 2.5.4.

The draft annual report will by provided to Indigenous groups no later than June 30 following each reporting year. BW Gold submit a final Annual Report to the Impact Assessment Agency of Canada and Indigenous groups by September 30 following each reporting year.

Pursuant to DS Condition 2.14, BW Gold will publish the annual reports and the executive summaries referred to in DS conditions 2.11 and 2.13 and this Plan and any update(s) or revision(s) to these documents on the Project website. BW Gold will keep these documents publicly available for 25 years following the end of decommissioning of the Project. BW Gold will notify the Agency and Indigenous groups of the availability of these documents within 48 hours of their publication.

14. QUALIFIED PROFESSIONALS

This management plan has been prepared and reviewed by the following qualified professionals:

Prepared by:

Lis Rach, BSc., EP
Consultant II, Scientist

Prepared by:

Randy Moody, MSc., RPBio

Reviewed by:

Wade Brunham
Partner

15. REFERENCES

Definitions of the acronyms and abbreviations used in this reference list can be found in the Acronyms and Abbreviations Section.

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APPENDIX A CONCORDANCE WITH CANADIAN ENVIRONMENTAL ASSESSMENT AGENCY DECISION STATEMENT (APRIL 2018)

Appendix A: Concordance with Environmental Assessment Decision Statement (April 2018)

Condition	Description	Location in Plan
Condition 2.3 (Consultation)	The Proponent shall, where consultation is a requirement of a condition set out in this Decision Statement: 2.3.1 provide a written notice of the opportunity for the party or parties being consulted to present their views and information on the subject of the consultation; 2.3.2 provide all information available and relevant on the scope and the subject matter of the consultation and a period of time agreed upon with the party or parties being consulted, not less than 15 days, to prepare their views and information; 2.3.3 undertake a full and impartial consideration of all views and information presented by the party or parties being consulted on the subject matter of the consultation; 2.3.4 strive to reach consensus with Indigenous groups; and 2.3.5 advise the party or parties being consulted on how the views and information received have been considered by the Proponent including a rationale for why the views have, or have not, been integrated. The Proponent shall advise the party or parties in a time period that does not exceed the period of time taken in 2.3.2.	Section 5
Condition 2.4 (Consultation)	The Proponent shall, where consultation with Indigenous groups is a requirement of a condition set out in this Decision Statement, determine and strive to reach consensus with each Indigenous group regarding the manner by which to satisfy the consultation requirements referred to in condition 2.3, including: 2.4.1 the methods of notification; 2.4.2 the type of information and the period of time to be provided when seeking input; 2.4.3 the process to be used by the Proponent to undertake impartial consideration of all views and information presented on the subject of the consultation; and 2.4.4 the period of time and the means by which to advise Indigenous groups of how their views and information were considered by the Proponent.	Draft WPMP provided to Indigenous groups for review and comment.
Condition 2.5 (Follow-up and Adaptive Management)	The Proponent shall, where a follow-up program is a requirement of a condition set out in this Decision Statement, have a Qualified Professional, where such a qualification exists for the subject matter of the follow-up program, determine, as part of the development of each follow-up program and in consultation with the party or parties being consulted during the development, the following information: 2.5.1 the follow-up activities that must be undertaken by a qualified individual; 2.5.2 the methodology, location, frequency, timing and duration of monitoring associated with the follow-up program; 2.5.3 the scope, content, format and frequency of reporting of the results of the follow-up program; 2.5.4 the levels of environmental change relative to baseline conditions that would require the Proponent to implement modified or additional mitigation measure(s), including instances where the Proponent may require Designated Project activities to be stopped; and	Section 11

Condition	Description	Location in Plan
	2.5.5 the technically and economically feasible mitigation measures to be implemented by the Proponent if monitoring conducted as part of the follow-up program shows that the levels of environmental change referred to in condition 2.5.4 have been reached or exceeded.	
Condition 2.6 (Follow-up and Adaptive Management)	The Proponent shall update and maintain the follow-up and adaptive management information referred to in condition 2.5 during the implementation of each follow-up program in consultation with the party or parties being consulted during the development of each follow-up program.	Section 11
Condition 2.7 (Follow-up and Adaptive Management)	The Proponent shall provide a draft of the follow-up programs referred to in conditions 3.14, 3.15, 3.16, 4.5, 5.5, 6.11, 6.12, 6.13, 6.14, 8.18.6, 8.20.5, 8.21, and 8.22, if required, to the party or parties being consulted during the development of each follow-up program for a consultation period of up to 60 days prior to providing follow-up programs pursuant to condition 2.8.	Section 11.2
Condition 2.8 (Follow-up and Adaptive Management)	The Proponent shall provide the follow-up programs referred to in conditions 3.14, 3.15, 3.16, 4.5, 5.5, 6.11, 6.12, 6.13, 6.14, 8.18.6, 8.20.5, 8.21, and 8.22, if required, to the Agency and to the party or parties being consulted during the development of each follow-up program prior to the implementation of each follow-up program. The Proponent shall also provide any update(s) made pursuant to condition 2.6 to the Agency and to the party or parties being consulted during the development of each follow-up program within 30 days of the follow-up program being updated.	Section 11.2
Condition 2.9 (Follow-up and Adaptive Management)	The Proponent shall, where a follow-up program is a requirement of a condition set out in this Decision Statement: 2.9.1 conduct the follow-up program according to the information determined pursuant to condition 2.5; 2.9.2 undertake monitoring and analysis to verify the accuracy of the environmental assessment as it pertains to the particular condition and/or to determine the effectiveness of any mitigation measure(s); 2.9.3 determine whether modified or additional mitigation measures are required based on the monitoring and analysis undertaken in accordance with condition 2.9.2; and 2.9.4 if modified or additional mitigation measures are required pursuant to condition 2.9.3, develop and implement these mitigation measures in a timely manner and monitor them in accordance with condition 2.9.2.	Section 11
Condition 2.10 (Follow-up and Adaptive Management)	Where consultation with Indigenous groups is a requirement of a follow-up program, the Proponent shall discuss the follow-up program with Indigenous groups and determine, in consultation with Indigenous groups, opportunities for their participation in the implementation of the follow-up program, including the analysis of the follow-up results and whether modified or additional mitigation measures are required, as set out in condition 2.9.	Section 11
Condition 2.11 (Annual Reporting)	The Proponent shall, commencing in the reporting year during which the Proponent begins the implementation of the conditions set out in this Decision Statement, prepare an annual report that sets out: 2.11.1 the activities undertaken by the Proponent in the reporting year to comply with each of the conditions set out in this Decision Statement; 2.11.2 how the Proponent complied with condition 2.1; 2.11.3 for conditions set out in this Decision Statement for which consultation is a requirement, how the Proponent considered any	Section 13.2

Condition	Description	Location in Plan
	views and information that the Proponent received during or as a result of the consultation, including a rationale for how the views have, or have not, been integrated; 2.11.4 the information referred to in conditions 2.5 and 2.6 for each follow-up program; 2.11.5 the results of the follow-up program requirements identified in conditions 3.14, 3.15, 3.16, 4.5, 5.5, 6.11, 6.12, 6.13, 6.14, 8.18.6, 8.20.5, 8.21, and 8.22 if required; 2.11.4 any update made to any follow-up program in the reporting year; 2.11.7 any modified or additional mitigation measures implemented or proposed to be implemented by the Proponent, as determined under condition 2.9 and rationale for why mitigation measures were selected pursuant to condition 2.5.4; and 2.11.8 any change(s) to the Designated Project in the reporting year.	
Condition 2.12 (Annual Reporting)	The Proponent shall provide a draft annual report referred to in condition 2.11 to Indigenous groups, no later than June 30 following the reporting year to which the annual report applies. The Proponent shall consult Indigenous groups on the content and findings in the draft annual report.	Section 13.2
Condition 2.13 (Annual Reporting)	The Proponent, in consideration of any comments received from Indigenous groups pursuant to condition, 2.12 shall revise and submit to the Agency and Indigenous groups a final annual report, including an executive summary in both official languages, no later than September 30 following the reporting year to which the annual report applies.	Section 13.2
Condition 2.14 (Information Sharing)	The Proponent shall publish on the Internet, or any medium which is publicly available, the annual reports and the executive summaries referred to in conditions 2.11 and 2.13, the offsetting plan(s) referred to in condition 3.11, the compensation plan referred to in condition 8.18 and, if required, condition 5.3, the whitebark pine management plan referred to in condition 8.20, the communication plans referred to in conditions 6.15 and 10.5, the reports related to accidents and malfunctions referred to in conditions 10.4.2 and 10.4.3, the schedules referred to in conditions 11.1 and 11.2, and any update(s) or revision(s) to the above documents, upon submission of these documents to the parties referenced in the respective conditions. The Proponent shall keep these documents publicly available for 25 years following the end of decommissioning of the Designated Project. The Proponent shall notify the Agency and Indigenous groups of the availability of these documents within 48 hours of their publication.	Section 13.1
Condition 8.19 (Wildlife and species at risk)	The Proponent shall conduct progressive reclamation of areas disturbed by the Designated Project. In doing so the Proponent shall identify, in consultation with Indigenous groups, Environment and Climate Change Canada and other relevant authorities, plant species native to the Designated Project area to use for revegetation as part of progressive reclamation, including whitebark pine (*Pinus albicaulis*) and other conifers suitable to create habitat for southern mountain caribou (*Rangifer tarandus caribou*) and other species of interest to Indigenous groups.	Section 2
Condition 8.20 (Wildlife and species at risk)	The Proponent shall develop, prior to construction and in consultation with Indigenous groups, Environment and Climate Change Canada and other relevant authorities, a whitebark pine management plan to mitigate effects from the Designated Project on whitebark pine (*Pinus albicaulis*) and its critical habitat. The Proponent shall implement the plan during all phases of the Designated Project consistent with any applicable recovery strategy related	Section 9.1

Condition	Description	Location in Plan
	to whitebark pine (*Pinus albicaulis*). As part of the whitebark pine management plan, the Proponent shall: 8.20.1 establish criteria to be used to evaluate the health of whitebark pine trees and for the selection of whitebark pine (*Pinus albicaulis*) to be transplanted;	
	8.20.2 collect and preserve whitebark pine (*Pinus albicaulis*) rust-resistant seeds within the Designated Project area prior to vegetation clearing and use them for progressive reclamation pursuant to condition 8.19;	Section 9.2
	8.20.3 identify the locations to plant whitebark pine (*Pinus albicaulis*) in undisturbed areas within the Designated Project area prior to construction;	Section 9.3
	8.20.4 implement measures to support whitebark pine (*Pinus albicaulis*) growth and use by Clark's nutcracker (*Nucifraga columbiana*);	Section 9.3
	8.20.5 develop and implement a follow-up program in consultation with Indigenous groups to determine the effectiveness of the mitigation measures included in the whitebark pine management plan. The Proponent shall apply conditions 2.9 and 2.10 when implementing the follow-up program. The follow-up program shall include: 8.20.5.1 visual monitoring of populations of whitebark pine (*Pinus albicaulis*), including their health, within reclaimed areas at a minimum every five years; and	Section 10
	8.20.5.2 monitoring of use of the reclaimed areas by Clark's nutcracker (*Nucifraga columbiana*) for the purpose of whitebark pine regeneration. Should the results of monitoring demonstrate that use of the reclaimed areas by Clark's nutcracker (*Nucifraga columbiana*) is not adequate, the Proponent shall implement additional mitigation measures	Section 10

APPENDIX B ECOSYSTEMS DESCRIPTIONS

(AMEC 2013)

Annex 3.1
Ecosystems Descriptions

1.0 ECOSYSTEM DESCRIPTIONS

Table 1-1: Biogeoclimatic (BGC) Units in the Project Area

BGC Code	BGC Name
SBSdk	Dry Cool Sub-Boreal Spruce subzone
SBSdw3	Stuart Dry Warm Sub-Boreal Spruce variant
SBSmc2	Babine Moist Cold Sub-Boreal Spruce variant
SBSmc3	Kluskus Moist Cold Sub-Boreal Spruce variant
ESSFmv1	Nechako Moist Very Cold Engelmann Spruce-Subalpine Fir variant
ESSFmv1p*	Nechako Moist Very Cold Engelmann Spruce-Subalpine Fir Parkland variant
BAFAun	Undifferentiated Boreal Altai Fescue Alpine Subzone

Note: *The ESSFmv1p is transitional to the West Chilcotin Very Dry Very Cold Engelmann Spruce = Subalpine Fir Parkland variant (ESSFxv1p). As a result, the parkland (ESSFmv1p) unit was described using the ESSFxv1p ecosystem codes; BGC = Biogeoclimatic

1.1 Dry Cool Sub-Boreal Spruce subzone

SBSdk/81/SW Saskatoon – Slender wheatgrass (n=0)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSdk	81	SW	Saskatoon – Slender wheatgrass
Assumed Modifiers: m, s, w			
Mapped Modifiers: c, ch, ck, ct, f, fk, ft, fw, g, h, k, ks, s, sw, t, w			
Mapped Structural Stages: 3, 4, 5, 6, 7			

This at risk (red-listed) non-forested ecosystem is restricted to the middle and upper portions of steep south-facing slopes. These sites have a xeric to subxeric soil moisture regime (SMR) and are subject to frequent drought. Soil nutrient regime (SNR) ranges from medium to very rich. Soils are shallow with a medium to moderately course texture. Surficial material is morainal, colluvial or morainal over bedrock. The calcareous-loving Rocky Mountain juniper (*Juniperus scopulorum*) is one of the few sprawling shrubs in the ecosystem, along with the occasional prickly rose (*Rosa acicularis*) and Saskatoon berry (*Amelanchier alnifolia*). The grassland comprises mostly slender wheatgrass (*Elymus trachycaulus*), junegrass (*Koeleria macrantha*), and timothy (*Phleum pratense*) along with kinnikinnick (*Arctostaphylos uva-ursi*), showy aster (*Eurybia conspicua*), and purple peavine (*Lathyrus nevadensis*). Red-stemmed feather-moss (*Pleurozium schreberi*) is the most commonly encountered bryophyte in this ecosystem.

SBSdk/82/BW Sandberg's bluegrass – Slender wheatgrass (n= 0)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSdk	82	BW	Sandberg's bluegrass - Slender wheatgrass
Assumed modifiers: d, m, w		**Mapped Modifiers**: n/a	

These red- listed grasslands are generally restricted to south-facing slopes. They are subjected to seasonal droughts, and are known to provide critical wildlife range. Soils are deep, fine to medium textured, with a SMR ranging from subxeric to submesic, and a SNR from rich to very rich. The surficial material is morainal or lacustrine. Common snowberry (*Symphoricarpos albus*) sometimes contributes to a very sparse shrub layer. These grasslands are primarily composed of Kentucky, Pacific, and interior bluegrass (*Poa pratensis*; *Poa gracillima*; *Poa interior*). Slender wheatgrass (*Elymus trachycaulus*), blue wildrye (*Elymus glaucus*), and spreading needlegrass (*Achnatherum richardsonii*) are other commonly encountered graminoids in this ecosystem. Eudicots include western meadowrue (*Thalictrum occidentale*), purple peavine (*Lathyrus nevadensis*), and fireweed (*Epilobium angustifolium*).

SBSdk/01/SP *Hybrid white spruce - Purple peavine (n=6)*

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSdk	01	SP	Hybrid white spruce - Purple peavine
Assumed Modifiers: d, j, m			
Mapped Modifiers: c, ch, ck, ct, f, fk, ft, fw, g, h, k, ks, s, sf, sw, t, w			
Mapped Structural Stages: 3, 4, 5, 6, 7			

This ecosystem was documented from the mid-slopes of gentle inclines to level ground. Sites comprise glaciolacustrine, glaciofluvial or morainal deposits with a soil moisture regime (SMR) ranging from mesic to sub-hygric, and a soil nutrient regime (SNR) from medium to rich. Drainage is moderately well to well. The tree canopy is populated primarily by lodgepole pine (*Pinus contorta* var. *latifolia*) and white spruce (*Picea glauca*), and a few trembling aspen (*Populus tremuloides*). The shrub layer can be poorly developed and somewhat variable in composition among sites, but Sitaka alder (*Alnus viridis* subsp. *sinuata*), prickly rose (*Rosa acicularis*), soopolallie (*Shepherdia canadensis*), and white spruce (*Picea glauca*) are major contributors. The herb layer comprises mostly twinflower (*Linnaea borealis*), bunchberry (*Cornus canadensis*), dwarf blueberry (*Vaccinium caespitosum*), and showy aster (*Eurybia conspicua*). Step moss (*Hylocomium splendens*), and red-stemmed feather-moss (*Pleurozium schreberi*) are the most commonly encountered forest floor mosses.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-12-G027		×	✓	×
T-12-V028		×	×	✓
T-12-F029		×	×	✓
T-13-002G	TL-main	✓	×	×
T-13-033G	TL-main	✓	×	×
T-13-035G	TL-main	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

SBSdk/02/LJ *Lodgepole pine - Juniper – Ricegrass (n= 3)*

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSdk	02	LJ	*Lodgepole pine - Juniper – Ricegrass*
Assumed Modifiers: j, r, s			
Mapped Modifiers: c, ch, sk, sw, v, vs, vw, w, ws, wv			
Mapped Structural Stages: 3, 5, 6, 7			

The LJ site series occurs on the upper to mid portions of moderate slopes. The soils are coarse-textured, shallow, rapidly drained, and have a xeric SMR and a poor SNR. Surfical material is typically morainal or glaciofluvial. Lodgepole pine (*Pinus contorta* var. *latifolia*) was the only tree documented in the tree layer. Common snowberry (*Symphoricarpos albus*), prickly rose (*Rosa acicularis*), Saskatoon berry (*Amelanchier alnifolia*), common juniper (*Juniperus communis*), paper birch (*Betula papyrifera*), and trembling aspen (*Populus tremuloides*) are significant components of the shrub layer. The sparse herb layer comprises kinnikinnick (*Arctostaphylos uva-ursi*), creamy peavine (*Lathyrus ochroleucus*), and blue wildrye (*Elymus glaucus*). Clad lichens (*Cladonia* sp.) or red-stemmed feather-moss (*Pleurozium schreberi*) cover up to 35% of the forest floor at some sites. Lesser amounts of pelt lichens (*Peltigera* sp.), haircap moss (*Polytrichum* sp.), and Iceland-moss lichens (*Cetraria* sp.) were recorded in the moss layer at most sites.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-12-G026	TL-Mills	✓	×	×
T-12-G212		×	×	✓
T-12-G226		×	×	✓

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

SBSdk/03/LC Lodgepole pine-Feather-moss–Cladina (n=1)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSdk	03	LC	*Lodgepole pine-Feather-moss–Cladina*
Assumed Modifiers: c, d, j			
Mapped Modifiers: c, cw, f, h, k, kf, ks, m, r, s, sw, v, w, ws, wv			
Mapped Structural Stages: 3, 4, 5, 6, 7			

The SBSdk/03/LC ecosystem occurs on level ground, as well as on the upper portions and crests of gentle slopes on glaciofluvial deposits. The soils are generally deep, coarse-textured, the SMR is sub-xeric, and SNR very poor to poor. Unlike the 02 site series in this BDG subzone, the moss layer of the 03 site series is dominated by mosses, not lichens. The tree layer is primarily lodgepole pine (*Pinus contorta* var. *latifolia*) with some hybrid white spruce (*Picea glauca* x *engelmanni*), and trembling aspen (*Populus tremuloides*). Soopolallie (*Shepherdia canadensis*), prickly rose (*Rosa acicularis*), and lodgepole pine (*Pinus contorta* var. *latifolia*) occupy the shrub layer, and kinnikinnick (*Arctostaphylos uva-ursi*), and twinflower (*Linnaea borealis*) the herb layer.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-13-032G	TL-main	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

SBSdk/04/DS Douglas fir - Soopolallie – Feather-moss (n= 0)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSdk	04	DS	*Douglas fir-Soopolallie-Feather-moss*
Assumed Modifiers: m, s, w			
Mapped Modifiers: nil			
Mapped Structural Stages: 3, 6			
This ecosystem occurs on warm aspects with a gentle to significant incline. Sites have medium-textured, well draining soils, and shallow morainal or colluvial deposits over bedrock. The soils have a sub-xeric to sub-mesic SMR, and a medium SNR. The canopy is dominated by Douglas fir (*Pseudotsuga menziesii*) with lesser amounts of hybrid white spruce (*Picea glauca* x *engelmannii*), and subalpine fir (*Abies lasiocarpa*). The shrub layer comprises mostly soopolallie (*Shepherdia canadensis*), birch-leaved spirea (*Spiraea betulifolia*), prickly rose (*Rosa acicularis*), and Douglas fir (*Pseudotsuga menziesii*). The poorly developed herb layer lacks (*Arctostaphylos uva-ursi*) but has some grasses such as blue wildrye (*Elymus glaucus*), western fescue (*Festuca occidentalis*), and forbs like twinflower (*Linnaea borealis*).			

SBSdk/05/SF Hybrid white spruce – Spirea – Feather-moss (n=6)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSdk	05	SF	*Hybrid white spruce – Spirea – Feather-moss*
Assumed Modifiers: d, j, m			
Mapped Modifiers: c, f, h, k, m, s			
Mapped Structural Stages: 3, 4, 5, 6, 7			

In this portion of the SBSdk subzone the white spruce – Spirea – Feather-moss site association occurs from mid slope to crests of shallow to moderately sloped inclines with various aspects. Surficial material is glaciolacustrine or morainal. Soils are moderately well to well drained with a sub-mesic to mesic SMR, and a poor to medium SNR. White spruce (*Picea glauca*) and lodgepole pine (*Pinus contorta* var. *latifolia*) are the largest contributors to the tree canopy, with small amounts of trembling aspen (*Populus tremuloides*), hybrid white spruce (*Picea engelmannii* x *glauca*), and paper birch (*Betula papyrifera*). The shrub layer is poorly to moderately developed with soopolallie (*Shepherdia canadensis*), Sitka alder (*Alnus viridis* subsp. *sinuata*), and prickly rose (*Rosa acicularis*) being the primary components. The herbaceous layer comprises bunchberry (*Cornus canadensis*), pine-grass (*Calamagrostis rubescens*), blue wildrye (*Elymus glaucus*), wild sarsaparilla (*Aralia nudicaulis*), and showy aster (*Eurybia conspicua*). Red-stemmed feather-moss (*Pleurozium schreberi*) covers up to 35% of the forest floor at some plots.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-12-G209		×	×	✓
T-12-G211		×	×	✓
T-12-G216		×	×	✓
T-13-001G	TL-main	✓	×	×
T-13-004G	TL-main	✓	×	×
T-13-006V	TL-main	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

SBSdk/06/ST *Hybrid white spruce – Twinberry - Coltsfoot (n=6)*

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSdk	06	ST	*Hybrid white spruce– Twinberry - Coltsfoot*
Assumed Modifiers: d, j, m			
Mapped Modifiers: c, ch, f, fs, ft, fw, g, h, m, s, sf, t			
Mapped Structural Stages: 3, 4, 5, 6, 7			

This common and widespread ecosystem occurs on a wide range of gradients and aspects on upland sites with morainal, lacustrine or eolian surficial material. Soils are moderately fine to moderately coarse with mesic to sub-hygric SMR, and medium to very rich SNR. White spruce (*Picea glauca*) and trembling aspen (*Populus tremuloides*) are the largest contributors to the tree canopy. The well developed shrub layer comprises a mixture of prickly rose (*Rosa acicularis*), highbush-cranberry (*Viburnum edule*), black twinberry (*Lonicera involucrata*), trembling aspen (*Populus tremuloides*), spruce (*Picea* spp.), soopolallie (*Shepherdia canadensis*), and Sitka alder (*Alnus viridis* subsp. *sinuata*). A large diversity of plants can be found in the herb layer in this wide-ranging ecosystem including twinflower (*Linnaea borealis*), fireweed (*Epilobium angustifolium*), showy aster (*Eurybia conspicua*), bunchberry (*Cornus canadensis*), yarrow (*Achillea millefolium*), spreading needlegrass (*Achnatherum richardsonii*), fringed brome (*Bromus ciliatus*), great northern aster (*Canadanthus modestus*), and Sitka columbine (*Aquilegia formosa*). Red-stemmed feather-moss (*Pleurozium schreberi*), and ragged-moss (*Brachythecium* sp.) are but a few of the mosses encountered in the well developed moss layer at these sites.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-12-G024	TL-Mills	✓	×	×
T-12-G089		×	✓	×
T-12-G228		×	×	✓
T-12-G235	FWSS	✓	×	×
T-12-G236	FWSS	✓	×	×
T-13-003G	TL-main	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

SBSdk/08/CD Black cottonwood - Dogwood - Prickly rose (n= 1)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSdk	08	CD	*Black cottonwood - Dogwood - Prickly rose*
Assumed Modifiers: a, c, d, j			
Mapped Modifiers: t			
Mapped Structural Stages: 5, 6, 7			

This black cottonwood (*Populus trichocarpa*) ecosystem is found on active lower fluvial terraces adjacent to large watercourses. Soils are coarse and well drained but active flooding results in a hygric SMR, and rich to very rich SNR. In addition to black cottonwood, Engelmann spruce (*Picea engelmannii*) can be found in the tree canopy. The well-developed shrub layer comprises black twinberry (*Lonicera involucrata*), thimbleberry (*Rubus parviflorus*), red-osier dogwood (*Cornus stolonifera*), highbush-cranberry (*Viburnum edule*), and prickly rose (*Rosa acicularis*). The sparse herbaceous layer consists of oak fern (*Gymnocarpium dryopteris*), cow-parsnip (*Heracleum maximum*), violets (*Viola* sp.), western meadowrue (*Thalictrum occidentale*), and stinging nettle (*Urtica dioica*). The moss layer is absent in these ecosystems.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-12-G208		×	×	✓

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

1.2 Stuart Dry Warm Sub-Boreal Spruce variant

SBSdw3/81/SW Saskatoon – Slender wheatgrass (n= 1)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSdw3	81	SW	*Saskatoon – Slender wheatgrass*
Assumed Modifiers: m, s, w			
Mapped Modifiers: c, w, sw, w, ws, wv			
Mapped Structural Stages: 3			

This ecosystem occurs on significant slope with warm aspects with a thin veneer of colluviums over bedrock. The soils are silty-textured, shallow, with a xeric SMR, and a poor SNR. Saskatoon berry (*Amelanchier alnifolia*), common juniper (*Juniperus communis*), some low-growing trembling aspen (*Populus tremuloides*), and prickly rose (*Rosa acicularis*) each contribute to a weakly well developed shrub layer. Needlegrass (*Achnatherum* sp.) is the dominate graminoids in this ecosystem, followed closely by brome (*Bromus* sp.), bluegrass (*Poa* sp.), slender wheatgrass (*Elymus trachycaulus*), and spike trisetum (*Trisetum spicatum*). The most common eudicot contributor to the herbaceous layer is yarrow (*Achillea millefolium*), and small bedstraw (*Galium trifidum*).

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-12-G214		×	×	✓

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

SBSdw3/82/BW Bluegrass – Slender wheatgrass (n= 0)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSdw3	82	BW	*Bluegrass – Slender wheatgrass*
Assumed Modifiers: none			
Mapped Modifiers: none			
Mapped Structural Stages: null			
The SBSdw3/82 is a grassland community typically occurring on south or south-west facing slopes. Site conditions are such that grasses out-compete regenerating trees resulting in a non-forested graminoid-dominated community. Soils are deep, fine to medium texture, and well-drained with a SMR ranging from subxeric to submesic, and a SNR from rich to very rich. The surficial material is morainal or lacustrine. Common snowberry (*Symphoricarpos albus*) sometimes contributes to a very sparse shrub layer. These grasslands are primarily composed of Kentucky, Pacific, and interior bluegrass (*Poa pratensis*; *Poa gracillima*; *Poa interior*). Slender wheatgrass (*Elymus trachycaulus*), blue wildrye (*Elymus glaucus*), and spreading needlegrass (*Achnatherum richardsonii*) are other commonly encountered graminoids in this ecosystem. Eudicots include western meadowrue (*Thalictrum occidentale*), purple peavine (*Lathyrus nevadensis*), and fireweed (*Epilobium angustifolium*).			

SBSdw3/01/SP Hybrid white spruce - Douglas-fir – Pinegrass (n= 2)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSdw3	01	SP	*Hybrid white spruce - Douglas-fir – Pinegrass*
Assumed Modifiers: d, j, m			
Mapped Modifiers: c, ck, ct, f, fk, h, k, kg, s, w			
Mapped Structural Stages: 3, 4, 5, 6, 7			

This ecosystem occurs on deep soils, at the mid- to lower slope position of gentle inclines, or on level ground. The soils are medium-textured and moderately well drained with a mesic SMR, and medium SNR. Surficial material is morainal or glaciofluvial. Lodgepole pine (*Pinus contorta* subsp. *longifolia*), and subalpine fire (*Abies lasiocarpa*) dominate the forest canopy. Prickly rose (*Rosa acicularis*), birch-leaved spirea (*Spiraea betulifolia* subsp. *lucida*), highbush-cranberry (*Viburnum edule*), Sitka alder (*Alnus viridis* subsp. *sinuata*), black twinberry (*Lonicera involucrata*), and thimbleberry (*Rubus parviflorus*) are important contributors to the shrub layer. Bunchberry (*Cornus canadensis*), twinflower (*Linnaea borealis*), heat-leaved arnica (*Arnica cordifolia*), queen's cup (*Clintonia uniflora*), and strawberry (*Fragaria virginiana*) comprise much of the herb layer. Much of the forest floor at these sites are often covered in red-stemmed feather-moss (*Pleurozium schreberi*), and knight's plume (Ptilium *crista-castrensis*).

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-13-014G	TL-main	✓	×	×
T-13-026G	TL-main	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

SBSdw3/02/DC Douglas-fir - Lodgepole pine – Cladonia (n= 0)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSdw3	02	DC	*Douglas-fir - Lodgepole pine – Cladonia*
Assumed Modifiers: c, d, w			
Mapped Modifiers: cw, s, sw, v, w			
Mapped Structural Stages: 3, 4, 5, 6, 7			
This ecosystem occurs on the upper slopes, and crests of significant inclines with a warm southerly aspect. The coarse-textured soils are rapidly draineing and have a sub-xeric SMR, and a poor SNR. Sites have shallow colluvial veneers. Douglas fir (*Pseudotsuga menziesii*) dominates the sparse tree canopy, with lesser amounts of hybrid white spruce (*Picea glauca* x *engelmannii*). Birch-leaved spirea (*Spiraea betulifolia* subsp. *lucida*), prickly rose (*Rosa acicularis*), and Saskatoon berry (*Amelanchier alnifolia*) fill-out a sparse shrub layer. The forest floor has a moderate cover of kinnikinnick (>5%; *Arctostaphylos uva-ursi*), and a moderate to well-developed lichen layer comprising grey reindeer lichen (*Cladina rangiferina*), and apple pelt (*Peltigera malacea*).			

SBSdw3/03/LC Lodgepole pine - Feather-moss – Cladina (n= 2)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSdw3	03	LC	*Lodgepole pine - Feather-moss – Cladina*
Assumed Modifiers: c, d, j			
Mapped Modifiers: cs, ct, f, h, ks, s, sw, t, v, w			
Mapped Structural Stages: 3, 4, 5, 6, 7			

This ecosystem occurs at the crests of moderate to steep slopes with weathered bedrock or colluvial surficial material. The coarse-textured soils have a sub-xeric SMR, and a very poor SNR. The tree canopy is of pure lodgepole pine (*Pinus contorta* var. *latifolia*). The shrub layer comprises mostly soopolallie (*Shepherdia canadensis*), birch-leaved spirea (*Spiraea betulifolia*), lodgepole pine (*Pinus contorta* var. *latifolia*), and prickly rose (*Rosa acicularis*). Kinnikinnick (*Artostaphylos uva-ursi*) is a common element of the herbaceous layer along with bunchberry (*Cornus canadensis*), twinflower (*Linnaea borealis*), and dwarf blueberry (*Vaccinium caespitosum*). The well-developed moss layer comprises grey reindeer lichen (*Cladina rangiferina*), Red-stemmed feather-moss (*Pleurozium schreberi*), and wavy-leaved moss (*Dicranum polysetum*).

Plot Number	Project Component	LSA	RSA	outside RSA
T-12-G202	TL-main	✓	×	×
T-13-023G	TL-main	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

SBSdw3/04/SR Hybrid white spruce - Douglas-fir – Ricegrass (n= 9)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSdw3	04	SR	*Hybrid white spruce - Douglas-fir – Ricegrass*
Assumed Modifiers: c, d, j			
Mapped Modifiers: c, k, ks, mw, s, sw, t, vk, w			
Mapped Structural Stages: 3, 4, 5, 6, 7			

The hybrid white spruce – Douglas-fir – Ricegrass ecosystem occurs on a wide variety of slope positions and gradients in the project area as well as on level ground. The sites comprise a blanket of morainal or glaciofluvial material. Soils have a sub-mesic to mesic SMR, and poor to medium SNR. Hybrid white spruce (*Picea engelmannii* x *glauca*) or trembling aspen (*Populus tremuloides*) can dominate the tree canopy layer, with lesser amounts of lodgepole pine (*Pinus contorta* var. *latifolia*), subalpine fir (*Abies lasiocarpa*) and Douglas-fir (*Pseudotsuga menziesii*). The shrub layer is very well developed with Saskatoon berry (*Amelanchier alnifolia*), soopolallie (*Shepherdia canadensis*), prickly rose (*Rosa acicularis*), highbush cranberry (*Viburnum edule*), Mountain alder (*Alnus incana*), and various tree species being important elements. Bilberry (*Vaccinium caespitosum*), wild sarsaparilla (*Aralia nudicaulis*), kinnikinnick (*Arctostaphylos uva-ursi*), Queen's cup (*Clintonia uniflora*), bunchberry (*Cornus canadensis*), showy aster (*Eurybia conspicua*), and American vetch (*Vicia americana*) contribute to a species rich herb layer. Red-stemmed feather-moss (*Pleurozium schreberi*) or (*Hylocomium splendens*) carpet over half of the forest floor at some plots.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-12-G204	TL-main	✓	×	×
T-12-G205	TL-main	✓	×	×
T-12-G207	TL-main	✓	×	×
T-13-009F	TL-Stellako	✓	×	×
T-13-010G	TL-Stellako	✓	×	×
T-13-011G	TL-Stellako	✓	×	×
T-13-012G	TL-Stellako	✓	×	×
T-13-021G	TL-main	✓	×	×

T-13-024F	TL-main	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

BSdw3/05/BF Lodgepole pine - Black spruce – Feather-moss (n= 0)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSdw3	05	BF	*Lodgepole pine - Black spruce – Feather-moss*
Assumed Modifiers: d, j, m			
Mapped Modifiers: ct, f			
Mapped Structural Stages: 3, 4, 5, 6, 7			
This ecosystem can be found on gentle slopes or on level ground, with deep coarse- to fine-textured soils on morainal, fluvial, or lacustrine deposits. The SMR is sub-mesic to sub-hygric, and the SNR is usually very poor. The forest canopy is predominantly lodgepole pine (*Picea contorta* subsp. *latifolia*), and black spruce (*Picea mariana*). The shrub layer comprises prickly rose (*Rosa acicularis*), kinnikinnick (*Shepherdia canadensis*), black twinberry (*Lonicera involucrata*), birch-leaved spirea (*Spiraea betulifolia*), and Saskatoon berry (*Amelanchier alnifolia*). Bunchberry (*Cornus canadensis*), twinflower (*Linnaea borealis*), dwarf blueberry (*Vaccinium caespitosum*), and fireweed (*Epilobium angustifolium*) are common herbaceous plants. The well-developed moss layer comprises red-stemmed feather-moss (*Pleurozium schreberi*), and wavy-leaved moss (*Dicranum polysetum*).			

SBSdw3/06/SS Hybrid white spruce - Pink spirea - Prickly rose (n= 0)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSdw3	06	SS	*Hybrid white spruce - Pink spirea - Prickly rose*
Assumed Modifiers: d, f, j			
Mapped Modifiers: c, f, g, kc, t, w			
Mapped Structural Stages: 3, 4, 5, 6, 7			
The hybrid white spruce – pink spirea – prickly rose site series occurs on gentle slopes or on level ground with deep, moderately fine to fine textured soils, and lacustrine surficial material. The SMR is sub-hygric, and the SNR is medium. The forest canopy is a mix of lodgepole pine (*Pinus contorta* var. *latifolia*), and trembling aspen (*Populus tremuloides*). The shrub layer is occupied by pink spirea (*Spiraea douglasii* subsp. *menziesii*), prickly rose (*Rosa acicularis*), and Sitka alder (*Alnus viridis* subsp. *sinuata*), while the herb layer consists mostly of bunchberry (*Cornus canadensis*), twinflower (*Linnaea borealis*), and dwarf blueberry (*Vaccinium caespitosum*). Like the 05 site series above, the 06 site series has a well-developed moss layer. Bryophytes include red-stemmed feather-moss (*Pleurozium schreberi*), knight's plume (*Ptilium crista-castrensis*), and silver-edge pelt (*Peltigera aphthosa*).			

SBSdw3/07/ST Hybrid white spruce – Twinberry (n= 5)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSdw3	07	ST	*Hybrid white spruce – Twinberry*
Assumed Modifiers: d, f, g			
Mapped Modifiers: c, f, fk, k, kc, ms, s, t, w			
Mapped Structural Stages: 3, 4, 5, 6, 7			

This site series occurs on the upper to middle portions of gentle to moderately steep slopes, and on flat ground. The soil is deep, fine-textured and has a mesic to sub-hygric SMR, and a medium to rich SNR. Hybrid white spruce (*Picea engelmannii* x *glauca*), and trembling aspen (*Populus tremuloides*) fill-out the tree canopy. Pink spirea (*Spiraea douglasii* subsp. *menziesii*) is noticeably absent from the shrub layer, which is occupied by the seemingly ubiquitous black twinberry (*Lonicera involucrata*), Sitka alder (*Alnus viridis*), highbush-cranberry (*Viburnum edule*), common snowberry (*Symphoricarpos albus*), Saskatoon berry (*Amelanchier alnifolia*), and spruce (*Picea engelmanni* x *glauca*). Bluejoint reedgrass (*Calamagrostis canadensis*), cow-parsnip (*Heracleum maximum*), showy aster (*Eurybia conspicua*), Queen's cup (*Clintonia uniflora*), bunchberry (*Cornus canadensis*), palmate coltsfoot (*Petasites frigidus* var. *palmatus*), twinflower (*Linnaea borealis*), trailing raspberry (*Rubus pubescens*), and fringed aster (*Symphyotrichum ciliolatum*) are found in the robust herb layer. The moss layer includes step moss (*Hylocomium splendens*), knight's plume (*Ptilium crista-castrensis*), red-stemmed feather-moss (*Pleurozium schreberi*), and leafy mosses (*Mnium* spp.).

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-12-G201	TL-main	✓	×	×
T-12-G203	TL-main	✓	×	×
T-12-G218		×	×	✓
T-13-007G	TL-Stellako	✓	×	×
T-13-008G	TL-Stellako	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

SBSdw3/08/SO Hybrid white spruce - Oak fern (n= 2)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSdw3	08	SO	*Hybrid white spruce - Oak fern*
Assumed Modifiers: c, d, j			
Mapped Modifiers: c, f, k, s, t			
Mapped Structural Stages: 2, 3, 4, 5, 6, 7			

This ecosystem is distributed at the base of moderate to steep north-facing aspects in depressions or gullies with fluvial surficial material. The soils are coarse, imperfectly to poorly drained and have a sub-hygric/hygric SMR, and a medium to very rich SNR. The tree layer consists of hybrid white spruce (*Picea engelmannii* x *glauca*), Douglas-fir (*Pseudotsuga menziesii*), and balsam poplar (*Populus balsamifera*). The shrub layer has mountain alder (*Alnus incana*), highbush-cranberry (*Viburnum edule*), black twinberry (*Lonicera involucrata*), and prickly rose (*Rosa acicularis*). The herb layer supports extensive oak fern (*Gymnocarpium dryopteris*) populations, in addition to lesser amounts of wild sarsaparilla (*Aralia nudicaulis*), field horsetail (*Equisetum arvense*), and common miterwort (*Mitella nuda*). Red-stemmed feather-moss (*Pleurozium schreberi*), knight's plume (*Ptilium crista-castrensis*), electrified cat's-tail moss (*Rhytidiadelphus triquetrus*), and leafy mosses (*Mnium* spp.) carpet much of the forest floor.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-12-G206	TL-main	✓	×	×
T13-027G	TL-main	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

1.3 Babine Moist Cold Sub-Boreal Spruce variant

SBSmc2/01/SB Hybrid white spruce – Huckleberry Sub-mesic (n=9)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSmc2	01	SB	*Hybrid white spruce – Huckleberry Sub-mesic*
Assumed Modifiers: d, j, m			
Mapped Modifiers: c, ch, ck, ct, cw, f, k, ks, r, s, sw, w			
Mapped Structural Stages: 3, 4, 5, 6, 7			

The sandy loamy soils of these ecosystems have a sub-mesic to mesic SMR, and a medium to rich SNR. This ecosystem tends to have a south-westerly exposure in the project area on a variety of grades and slope positions. Lodgepole pine (*Pinus contorta* var. *latifolia*), hybrid white spruce (*Picea galuca* x *engelmannii*), and trembling aspen (*Populus tremuloides*), and subalpine fire (*Abies lasiocarpa*) dominate the forest canopy. Black huckleberry (*Vaccinium membranaceum*), subalpine fire (*Abies lasiocarpa*), Sitka alder (*Alnus viridis* subsp. *sinuata*), and prickly rose (*Rosa acicularis*) are some common elements of the shrub layer while fireweed (*Epilobium angustifolium*), showy aster (*Eurybia conspicua*), Canada dogwood (*Cornus Canadensis*), and twinflower (*Linnaea borealis*) dominate the herbaceous layer. Knight's plume (*Ptilium crista-castrensis*) and red-stemmed feather-moss (*Pleurozium schreberi*) occupy much of the moss layer.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-12-V045		×	×	✓
T-12-G046		×	×	✓
T-12-G047		×	×	✓
T-13-015G	TL-Main	✓	×	×
T-13-016G		×	✓	×
T-13-017G	TL-Main	✓	×	×
T-13-062G	AIR	✓	×	×
T-13-066G	AIR	✓	×	×
T-13-071V	AIR	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

SBSmc2/02/PH Lodgepole pine - Huckleberry – Cladonia (n= 1)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSmc2	02	PH	*Lodgepole pine - Huckleberry – Cladonia*
Assumed Modifiers: c, d, j			
Mapped Modifiers: ct, cw, k, kg, r, s, sw, t, w			
Mapped Structural Stages: 3, 4, 5, 6, 7			
This ecosystem occurs on level sites with deep, well-draining, coarse–textured, glaciofluvial terraces, and on upper to crest positions with shallow soils on colluvial or morainal veneers over bedrock. This ecosystem experiences significant moisture deficits throughout the growing seasons. Sites are typically well-drained or water-shedding resulting in very dry and nutrient poor conditions. The sparse tree canopy almost exclusively comprises lodgepole pine (*Pinus contorta* var. *latifolia*). The list of plant in the shrub layer includes lodgepole pine (*Pinus contorta* var. *latifolia*), hybrid white spruce (*Picea engelmannii* x *glauca*), and black huckleberry (*Vaccinium membranaceum*). The moss layer is dominated by lichens (*Cladonia* spp.; *Cladina* spp.) and red-stemmed feather moss (*Pleurozium schreberi*).			

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-12-G215		×	×	✓

SBSmc2/03/BM Black spruce - Lodgepole pine – Feather-moss (n= 1)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSmc2	03	BM	*Black spruce - Lodgepole pine – Feather-moss*
Assumed Modifiers: d, j, m			
Mapped Modifiers: c, ck, s, w			
Mapped Structural Stages: 3, 4, 5, 6, 7			

This site association occurs on mid, lower or level site positions on cool aspects. Parental material is morainal or rarely fluvial veneers. Soils have a very poor to poor SNR, and submesic to mesic SMR. Unlike most other variants in this BGC variant, black spruce (*Picea mariana*) is always present in this ecosystem, although these trees are often stunted. Lodgepole pine (*Pinus contorta* var. *latifolia*), and hybrid white spruce (*Picea glauca* x *engelmannii*) complete the tree canopy. Lodgepole pine (*Pinus contorta* subsp. *longifolia*), subalpine fire (*Abies lasiocarpa*), soopolallie (*Shepherdia canadensis*), and common juniper (*Juniperus communis*) are found in the shrub layer. Canada dogwood (*Canada dogwood*), fireweed (*Epilobium angustifolium*), dwarf blueberry (*Vaccinium caespitosum*), and creeping-snowberry (*Gaultheria hispidula*) occupy the herb layer. Over half of the forest floor can be carpeted with one species, feather-mosses (*Pleurozium schreberi*).

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-13-065G	AIR	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

SBSmc2/04/HB Hybrid white spruce - Huckleberry -Dwarf blueberry (n= 3)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSmc2	04	HB	*Hybrid white spruce - Huckleberry -Dwarf blueberry*
Assumed Modifiers: d, j, m			
Mapped Modifiers: c, ch, ck, k, ks, r, s, w			
Mapped Structural Stages: 2, 3, 4, 5, 6, 7			

This ecosystem was documented on level ground and crests with colluvial or glaciofluvial surficial material. The soils are medium- to coarse-textured with a submesic to mesic SMR, and a medium SNR. The canopy is dominated by hybrid white spruce (*Picea glauca* x *engelmannii*) and lodgepole pine (*Pinus contorta* var. *latifolia*). Lodgepole pine (*Pinus contorta* var. *latifolia*) also filled out much of the shrub layer along with Sitka alder (*Alnus viridis* subsp. *sinuata*), soopolallie (*Shepherdia canadensis*), and raspberries (*Rubus idaeus*). Purple reedgrass (*Calamagrostis purpurascens*), twinflower (*Linnaea borealis*), and bilberry (*Vaccinium caespitosum*) significantly contribute to the herb layer. The well-developed moss layer comprises red-stemmed feather-moss (*Pleurozium schreberi*), knight's plum (*Ptilium crista-castrensis*), and step moss (*Hylocomium splendens*).

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-13-063G	AIR	✓	×	×
T-13-067G	AIR	✓	×	×
T-13-070G	AIR	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

SBSmc2/05/TC Hybrid white spruce - Twinberry – Coltsfoot (n= 1)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSmc2	05	TC	*Hybrid white spruce - Twinberry – Coltsfoot*
Assumed Modifiers: d, j, m			
Mapped Modifiers: ct, ck			
Mapped Structural Stages: 5, 6, 7			

The 05 site series in this BGC variant is known to occur on gentle slopes at the mid to lower slope position as well as at the toe of the slope. The landform is typically morainal, fluvial, or colluvial. Soils are variable in texture with a sub-hygric SMR, and a medium to rich SNR. The tree canopy is dominate by white spruce (*Picea glauca*), trembling aspen (*Populus tremuloides*), lodgepole pine (*Pinus contorta* var. *latifolia*), with a few subalpine fir (*Abies lasiocarpa*) individuals occurring at some sites. The shrub layer is dominated by thimbleberry (*Rubus parviflorus*), highbush-cranberry (*Viburnum edule*), and black twinberry (*Lonicera involucrata*). Trailing raspberry (*Rubus pubescens*), bunchberry (*Cornus canadensis*), fireweed (*Epilobium angustifolium*), heart-leaved arnica (*Arnica cordifolia*), and mountain sweet-cicely (*Osmorhiza berteroi*) are commonly encountered plants of the herbaceous layer. Common bryophytes in this ecosystem include red-stemmed feather-moss (*Pleurozium schreberi*), knight's plum (*Ptilium crista-castrensis*), and step moss (*Hylocomium splendens*).

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-12-G229		×	×	✓

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

SBSmc2/06/SO Hybrid white spruce - Oak fern (n= 0)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSmc3	06	SO	*Hybrid white spruce - Oak fern*
Assumed Modifiers: d, j, m			
Mapped Modifiers: c, k, ks, s			
Mapped Structural Stages: 3, 4, 5, 6, 7			
This ecosystem is distributed on cool northerly aspects in the study area, typically on morainal, lacustrine, or colluvial landforms. Soils are moderately well-drained with a mesic SMR, and a rich to very rich SNR. The tree canopy is dominate by hybrid white spruce (*Picea glauca* x *engelmannii*), and lesser amounts of subalpine fir (*Abies lasiocarpa*). Black gooseberry (*Ribes lacustre*), thimbleberry (*Rubus parviflorus*), black huckleberry (*Vaccinium membranaceum*), and devil's (*Oplopanax horridus*) can be found in the shrub layer. Oak fern (*Gymnocarpium dryopteris*) is an abundant and diagnostic fern for this ecosystem. Red-stemmed feather-moss (*Pleurozium schreberi*), knight's plum (*Ptilium crista-castrensis*), common leafy liverwort (*Barbilophozia lycopodioides*), and step moss (*Hylocomium splendens*) contribute to a well-developed moss layer.			

SBSmc2/07/BF Hybrid white spruce - Scrub birch – Feather-moss (n= 0)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSmc2	07	BF	*Hybrid white spruce - Scrub birch – Feather-moss*
Assumed Modifiers: d, j, m			
Mapped Modifiers: none			
Mapped Structural Stages: 7			
This uncommon ecosystem often occurs along the edges of wetlands on flat ground or on the lower slopes and toes of gentle slopes. The landform is typically morainal. Soils are imperfectly drained with a sub-hygric to hygric SMR, and a poor SNR. The tree layer comprises a mixture of white spruce (*Picea glauca*), hybrid white spruce (*Picea engelmannii* x *glauca*), and lodgepole pine (*Pinus contorta* var. *latifolia*). Black huckleberry (*Vaccinium membranaceum*), and black twinberry (*Lonicera involucrata*) help to fill in a sparse shrub layer, while bunchberry (*Cornus canadensis*), purple peavine (*Lathyrus nevadensis*), bluejoint (*Calamagrostis canadensis*), heart-leaved arnica (*Arnica cordifolia*), and Indian hellebore (*Veratrum viride*) populate a well-developed herbaceous layer. Glow moss (*Aulacomnium palustre*), leafy mosses (*Mnium* spp.), and (*Pleurozium schreberi*) are reportedly commonly encountered in the moss layer.			

SBSmc2/08/ST Hybrid white spruce - Twinberry - Oak fern (n= 0)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSmc2	08	ST	*Hybrid white spruce - Twinberry - Oak fern*
Assumed Modifiers: d, j, m			
Mapped Modifiers: c, ck			
Mapped Structural Stages: 3, 4, 5, 6, 7			
This ecosystem occurs on the lower portions of gentle slopes or in depressions on fluvial landforms. The soil is deep, medium–textured, and of a medium SNR, but is poorly aerated because of water saturation. The canopy is dominated by hybrid white spruce (*Picea glauca* x *engelmannii*). Bearberry honeysuckle (*Lonicera involucrata*) dominates the shrub layer, and western oak fern (*Gymnocarpium dryopteris*), and horsetail fern (*Equisetum* spp.) the herbaceous layer. Red-stemmed feather-moss (*Pleurozium schreberi*), and step-moss (*Hylocomium splendens*) are common mosses in this ecosystem.			

SBSmc2/09/SD *Hybrid white spruce – Devil's club (n=2)*

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSmc2	09	SD	*Hybrid white spruce – Devil's club*
Assumed Modifiers: d, j, m			
Mapped Modifiers: none			
Mapped Structural Stages: 6, 7			

The SBSmc2/09/SD ecosystem was documented on the lower portions of gentle slopes. Soils are deep (>1m), medium textured and poorly aerated with subhygric SMR and rich to very rich SNR. Subalpine fir (*Abies lasiocarpa*) is the dominate component of the tree canopy, but shares the understory with Devil's club (*Oplopanax horridus*), and green alder (*Alnus viridis*). The herb layer comprises mostly ferns (*Gymnocarpium dryopteris*; Athyrium filix-femina), but a diversity of other plants were recorded at these plots including Canada dogwood (*Cornus canadensis*), kidney-leaved violoet (*Viola renifolia*), and false Solomon's seal (*Maianthemum racemosum*). The bryophyte layer ranges from almost lacking to covering over half of the forest floor. Red-stemmed feather-moss (*Pleurozium schreberi*) and knight's plum (*Ptilium crista-castrensis*) are the most abundant bryophytes.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-13-018G	TL-main	✓	×	×
T-13-019G	TL-main	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

SBSmc2/10/SH Hybrid white spruce – Horsetail (n=0)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSmc2	10	SH	*Hybrid white spruce – Horsetail*
Assumed Modifiers: d, j, m			
Mapped Modifiers: ct, g			
Mapped Structural Stages: 5, 6, 7			
This heavily vegetated ecosystem occurs on flat ground or in depressions next to water courses or wetlands in the SBSmc2 BGC variant. The soils are deep, of a medium texture, and of a moderate to rich SNR. Like the above ecosystem, the soil is often saturated and poorly aerated. The forest canopy is dominated by hybrid white spruce (*Picea glauca* x *engelmannii*). The diverse shrub layer comprises bearberry honeysuckle (*Lonicera involucrata*), and devil's club (*Oplopanax horridus*), and the herbaceous layer five-leaved bramble (*Rubus pedatus*), western oak-fern (*Gymnocarpium dryopteris*), and common horsetail (*Equisetum arvense*). Red-stemmed feather-moss (*Pleurozium schreberi*), and knight's plume (*Ptilium crista-castrensis*) are commonly encountered bryophytes in this ecosystem.			

1.4 Kluskus Moist Cold Sub-Boreal Spruce variant

SBSmc3/01/SB Spruce Engelmann x white – Huckleberry (n=12)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSmc3	01	SB	*Spruce Engelmann x white – Huckleberry*
Assumed Modifiers: d, j, m			
Mapped Modifiers: c, ch, ck, cr, cs, ct, cw, f, g, h, k, ks, r, sf, t, w			
Mapped Structural Stages: 3, 4, 5, 6, 7			

The SBSmc3/01/SB generally occurs on gentle mid to level slope site positions. The parental material is variable and occurs on morainal, colluvial and glaciofluvial. Soils are moderately - well to well drained. The SMR is mesic, and the SNR medium. The dominant tree species are lodgepole pine (*Pinus contorta* var. *latifolia*), hybrid white spruce (*Picea engelmanni* x *glauca*), and subalpine fir (*Abies lasiocarpa*). Black huckleberry (*Vaccinium membranaceum*), and prickly rose (*Rosa acicularis*) are common in the shrub layer, while bunchberry (*Cornus canadensis*), twinflower (*Linnaea borealis*) are common elements of the herbaceous layer. Red-stemmed feather-moss (*Pleurozium schreberi*), knight's plume (*Ptilium crista-castrensis*), step moss (*Hylocomium splendens*), and pelt lichens (*Peltigera* sp.) cover large portions of the forest floor.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-11-7114	MS	✓	×	×
T-11-G032	MS	✓	×	×
T-11-G048	MS	✓	×	×
T-11-G062	MS	✓	×	×
T-11-G063	MS	✓	×	×
T-11-V020	MS	✓	×	×
T-11-V026	MS	✓	×	×
T-12-F003		×	✓	×

T-12-G032		×	×	✓
T-12-G223	TL-Main	✓	×	×
T-12-G240	FWSS	✓	×	×
T-12-V004		×	×	✓

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

SBSmc3/02/LJ Lodgepole pine - Juniper - Dwarf Blueberry (n= 6)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSmc3	02	LJ	*Lodgepole pine - Juniper - Dwarf Blueberry*
Assumed Modifiers: c, j, s			
Mapped Modifiers: ct, h, hs, k, r, s, sw, t, vw, w			
Mapped Structural Stages: 33, 5, 6, 7			

This ecosystem occurs on the upper slopes of moderate inclines with shallow, rapidly drained soils over bedrock that have xeric SMR, and poor SNR. Plots are dominated by lodgepole pine (*Pinus contorta* var. *latifolia*) in the tree layer, and common juniper (*Juniperus communis*), prickly rose (*Rosa acicularis*) and buffalo-berry (*Shepherdia canadensis*) in the shrub layer. Common understorey herbs include Canada dogwood (*Cornus canadensis*), heart-leaved arnica (*Arnica cordifolia*), and crowberry (*Empetrum nigrum*). Common mosses include red-stemmed feather-moss and heron's-bill moss. Frequently encountered lichens include cladonia lichens (*Cladonia* spp.), foam lichens (*Stereocaulon* spp.), and pelt lichens (*Peltigera* spp.).

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-12-G066	MS	✓	×	×
T-11-G045	MS	✓	×	×

T-11-V022	MS	✓	×	×
T-11-G007	MS	✓	×	×
T-11-V025	MS	✓	×	×
T-11-V018	MS	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

SBSmc3/03/LF Lodgepole pine - Feather-moss – Cladina (n=39)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSmc3	03	LF	*Lodgepole pine - Feather-moss – Cladina*
Assumed Modifiers: c, d, j			
Mapped Modifiers: c, ch, ck, cr, ct, g, h, k, kg, ks, r, s, sw, t, w			
Mapped Structural Stages: 3, 4, 5, 6, 7			

The 03 site series occurs on various site positions (crest, upper, mid and level) of gentle to moderately steep slopes with generally poor SNR, and xeric to sub-xeric SMR. Rapidly drained undulating, hummocky and ridged glaciofluvial and morainal veneers are most common. Lodgepole pine (*Pinus contorta* var. *latifolia*) dominates the tree canopy, although percent cover at some plots is low. Buffalo-berry (*Shepherdia canadensis*), lodgepole pine (*Pinus contorta* var. *latifolia*), and prickly rose (*Rosa acicularis*) are common elements of the shrub layer. These sites are typified by the presence of kinnikinnick (*Arctostaphylos uva-ursi*) in the herb layer, but Canada dogwood (*Cornus canadensis*), twinflower (*Linnaea borealis*), and dwarf blueberry (*Vaccinium caespitosum*) are also common in the herb layer. Lesser gren reindeer lichen (*Cladina* mitis), red-stemmed feather-moss (*Pleurozium schreberi*), step moss (*Hylocomium splendens*), and heron's-bill moss (*Dicranum* spp.) are common ground-cover lichens and bryophytes.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-12-G062	MS	✓	×	×
T-12-G064	MS	✓	×	×

T-12-G065	MS	✓	×	×
T-11-G046	MS	✓	×	×
T-11-G049	MS	✓	×	×
T-11-G051		×	✓	×
T-11-V017	MS	✓	×	×
T-11-V024	MS	✓	×	×
T-11-V027	MS	✓	×	×
T-12-G232	FWSS	✓	×	×
T-12-G234	MS	✓	×	×
T-12-G001		×	✓	×
T-12-G006		×	×	✓
T-12-G009		×	×	✓
T-12-G031		×	×	✓
T-12-V049		×	×	✓
T-12-V083		×	×	✓
T-12-G220	TL-Main	✓	×	×
T-12-G224	TL-Main	✓	×	×
T-13-034G	TL-Main	✓	×	×
T-13-054G	FWSS	✓	×	×
T-13-057G	FWSS	✓	×	×
T-13-059V	FWSS	✓	×	×
T-13-061G	FWSS	✓	×	×
T-13-087G	MS	✓	×	×
T-13-088F	MS	✓	×	×
T-13-094G	MS	✓	×	×
T-13-106G	TL-Mills	✓	×	×
T-13-114G	MS	✓	×	×
T-13-122G	MS	✓	×	×
T-13-123G	MS	✓	×	×
T-13-124G	MS	✓	×	×
T-13-127F	MS	✓	×	×
T-13-129G	MS	✓	×	×

T-13-132G	MS	✓	×	×
T-13-133G	MS	✓	×	×
T-13-136G	MS	✓	×	×
T-13-139V	MSAR	✓	×	×
T-13-142G	FSR	✓	×	×

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SBSmc3/04/SS Hybrid white spruce - Huckleberry – Soopolallie (n= 3)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSmc3			
Assumed Modifiers: d, m			
Mapped Modifiers: c, ch, ck, cr, cs, cw, g, h, hr, k, ks, s, sw, w			
Mapped Structural Stages: 3, 5, 6, 7			

This ecosystem occurs on typically occurs on steep slopes with either warm or a cool aspects at mid to upper slope positions but can also occur on gentle slopes on upper site positions. The soil is well drained with a submesic SMR, and a poor to medium SNR. The surficial material is either undulating glaciofluvial or morainal veneers. Lodgepole pine (*Pinus contorta* var. *latifolia*) dominates the forest canopy, but shares it with black (Picea mariana), and white spruce (*Picea glauca*). As the ecosystem name implies, soopolallie (*Shepherdia canadensis*) is a common component of the shrub layer. Canada dogwood (*Cornus canadensis*), and twinflower (*Linnaea borealis*) are frequently encountered herbaceous plants. The forest floor is covered primarily in step moss (*Hylocomium splendens*), red-stemmed feather-moss (*Pleurozium schreberi*), and pelt lichen (Peltigera sp.).

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-12-G010		×	×	✓
T-12-G221	TL-Main	✓	×	×
T-12-G233	FWSS	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

SBSmc3/05/BH Black spruce - Huckleberry – Spirea (n=11)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSmc3	05	BH	*Black spruce - Huckleberry – Spirea*
Assumed Modifiers: d, j, m			
Mapped Modifiers: c, ch, ck, ct, cw, h, k, s, t, w, x			
Mapped Structural Stages: 3, 4, 5, 6, 7			

This site association occurs on moderate to gentle inclines and a multiple positions on slopes. It is associated with medium-textured moderately-well drained soils with submesic to mesic SMR and a poor to medium SNR. The surficial material is a morainal or glaciofluvial veneer. Lodgepole pine (*Pinus contorta* subsp. *longifolia*), hybrid white spruce (*Picea engelmanni* x *glauca*) and subalpine fir (*Abies lasiocarpa*) account for most of the tree layer. Labrador tea (*Rhododendron groenlandicum*), lodgepole pine (*Pinus contorta* subsp. *longifolia*), spruce (*Pinus* spp.), and soopolallie (*Shepherdia canadensis*) are common in the shrub layer. In the herb layer, common species include bunchberry (*Cornus canadensis*), one-sided wintergreen (*Orthilia secunda*), five-leaved bramble (*Rubus pedatus*), the ubiquitously boreal twinflower (*Linnaea borealis*), and crowberry (*Empetrum nigrum*). The well-developed moss layer is dominated by red-stemmed feather-moss (*Pleurozium schreberi*), knight's plume (*Ptilium crista-castrensis*), and step moss (*Hylocomium splendens*). Black spruce (*Picea mariana*), and peat-moss (*Sphagnum* spp.) are notably absent, indicating low nutrient inputs to this site.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-11-7113	MS	✓	×	×
T-13-030G	TL-main	✓	×	×
T-13-050F	FWSS	✓	×	×
T-13-051G	FWSS	✓	×	×
T-13-055G	FWSS	✓	×	×
T-13-072G	AIR	✓	×	×
T-13-093G	MS	✓	×	×
T-13-097G	MS	✓	×	×
T-13-104F	TL-Mills	✓	×	×

T-13-107G	TL-Mills	✓	×	×
T-13-120G	MS	✓	×	×

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SBSmc3/06/BF Black spruce - Lodgepole pine – Feather-moss (n= 8)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSmc3	06	BF	*Black spruce - Lodgepole pine – Feather-moss*
Assumed Modifiers:			
Mapped Modifiers:			
Mapped Structural Stages:			

This ecosystem occurs on gentle inclines at mid to lower slope positions. The surficial material is undulating morainal, fluvial, or glaciofluvial, and the soils are deep, imperfectly drained and of a medium-texture. The soil is seasonally moist with a sub-hygric to hygric SMR, and a poor to medium SNR. Lodgepole pine (*Pinus contorta* var. *latifolia*) is an omnipresent component of the tree canopy, and spruce (*Picea mariana*; *Picea glauca* x *engelmannii*) are present at most sites. Labrador tea (*Rhododendron groenlandicum*) is a component of the shrub layer at most sites, but tree species such as black spruce (*Picea mariana*), and subalpine fir (*Abies lasiocarpa*) are also significant components of this layer at many plots . The herbaceous layer comprises primarily bilberry (*Vaccinium caespitosum*), twinflower (*Linnaea borrealis*), crow berry (*Empetrum nigrum*), and Canada dogwood (*Cornus canadensis*). Red-stemmed feather moss (*Pleurozium schreberi*), and step moss (*Hylocomium splendens*) are common bryophytes that carpet the forest floor.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-12-G030		×	×	✓
T-12-G088	TL-Main	✓	×	×
T-12-G230	FWSS	✓	×	×
T-12-G231	FWSS	✓	×	×

T13-041G	TL-main	✓	×	×
T13-043G	TL-main	✓	×	×
T13-052G	FWSS	✓	×	×
T13-138G	MSAR	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

SBSmc3/07/ST Spruce Engelmann x white – Twinberry (n= 4)

Biogeoclimatic Unit	Site Series	Map Code	Name
SBSmc3			
Assumed Modifiers: d, j, m			
Mapped Modifiers: 6, c, cg, ck, ct, cw, f, g, gk, h, s, t, w			
Mapped Structural Stages: 2, 3, 4, 5, 6, 7			

This diverse ecosystem is generally found on the lower slopes of gentle inclines with morainal surficial material. The soils are imperfectly drained and have a hygric to sub-hygric SMR, and a rich SNR. Hybrid white spruce (*Picea glauca* x *engelmannii*) is the dominant tree in the canopy and shrub layers. Twinberry honeysuckle (*Lonicera involucrata*), and black gooseberry (*Ribes lacustre*) are also found in the moderately well developed shrub layer. Interestingly, oak fern (*Gymnocarpium dryopteris*) has a very high cover at one of these sites. Mitrewort (*Mitella nuda*), palmate coltsfoot (*Petasites frigidus* var. *palmatus*), clasping twistedstalk (*Streptopus amplexifolius*), stiff clubmoss (*Lycopodium annotinum*), and heart-leaved arnica (*Arnica cordata*) are prominent components of the herbaceous layer, while step moss (*Hylocomium splendens*) and knight's plume (*Ptilium crista-castrensis*) account for the majority of the moss layer.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-11-G035	MS	✓	×	×
T-11-V023	MS	✓	×	×

T13-134G	TL-main	✓	×	×
T13-141G	TL-main	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

1.5 Nechako Moist Very Cold Englemann Spruce-Subalpine Fir Variant

ESSFmv1/01/FR Subalpine Fir - Rhododendron – Feather-moss (n=33)

Biogeoclimatic Unit	Site Series	Map Code	Name
ESSFmv1	01	FR	*Subalpine Fir - Rhododendron – Feather-moss*
Assumed Modifiers: d, j, m			
Mapped Modifiers: c, ch, ck, cs, ct, cw, g, gk, h, hs, k, ks, s, sw, w			
Mapped Structural Stages: 3, 4, 5, 6, 7			

This ecosystem is found from mid-slope to crests of gentle to moderate gradients. Soils are mostly morainal, but some glaciofluvial terrain was documented at this ecosystem. The soils are medium-textured and well-drained with a submesic to mesic SMR, and a poor to medium SNR. Subalpine fir (*Abies lasiocarpa*) is by far the most abundant tree species in the canopy at most sites. Engelmann spruce (*Picea engelmannii*), and lodgepole pine (*Pinus contorta* var. *latifolia*) are also present at most sites. White-flowered rhododendron (*Rhododendron albiflorum*) is the most common shrub at most sites followed by black huckleberry (*Vaccinium membranaceum*), and subalpine fire (*Abies lasiocarpa*). Five-leaved bramble (*Rubus pedatus*), and blueberries (*Vaccinium scoparium*, *V. caespitosum*) are consistently the most common forest floor forb. This ecosystem is often carpeted with red-stemmed feather-moss (*Pleurozium schreberi*), and heron's-bill moss (*Dicranum* sp.).

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-11-7106		×	✓	×
T-11-7111	MS	✓	×	×

T-11-G005	MS	✓	×	×
T-11-G008	MS	✓	×	×
T-11-G024	MS	✓	×	×
T-11-G028	MS	✓	×	×
T-11-G029	MS	✓	×	×
T-11-G038	MS	✓	×	×
T-11-G039	MS	✓	×	×
T-11-G041	MS	✓	×	×
T-11-G043	MS	✓	×	×
T-11-G076	MS	✓	×	×
T-11-V001		×	✓	×
T-11-V003	MS	✓	×	×
T-11-V005	MS	✓	×	×
T-11-V011	MS	✓	×	×
T-11-V013	MS	✓	×	×
T-11-V016	MS	✓	×	×
T-11-V037	MS	✓	×	×
T-12-G015	MS	✓	×	×
T-12-G020	MS	✓	×	×
T-12-G040		×	×	✓
T-12-G043		×	×	✓
T-12-G077	MS	✓	×	×
T-12-V072	MS	✓	×	×
T-12-V074	MS	✓	×	×
T-13-075G	MS	✓	×	×
T-13-078G	MS	✓	×	×
T-13-079G	MS	✓	×	×
T-13-081V	MS	✓	×	×
T-13-082G	MS	✓	×	×
T-13-083G	MS	✓	×	×
T-13-111G	MS	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

ESSFmv1/02/LC Lodgepole pine - Huckleberry – Cladina (n=10)

Biogeoclimatic Unit	Site Series	Map Code	Name
ESSFmv1	02	LC	*Lodgepole pine - Huckleberry – Cladina*
Assumed Modifiers: c, d, j			
Mapped Modifiers: h, hs, hv, k, ks, r, rs, s, sw, t, v, vw, w			
Mapped Structural Stages: 3, 5, 6, 7			

This site series is found on the crests site positions on shallow, morainal veneers, and on level glaciofluvial terraces and hummocks. Soils are rapidly drained with poor to very poor SNR. Lodgepole pine dominates the forest canopy. The mountain pine beetle has killed all but a few pine trees resulting in stands of dead trees. Subalpine fir (*Abies lasiocarpa*), lodgepole pine (*Pinus contorta* var. *latifolia*), and Engelmann spruce (*Picea engelmannii*) create a sparse to moderate canopy. Regenerating trees make up a large part of the shrub layer along with lesser amounts of white-flowered rhododendron (*Rhododendron albiflorum*), black huckleberry (*Vaccinium membranaceum*), and dwarf blueberry (*Vaccinium caespitosum*). Crowberry (*Empetrum nigrum*) is the most common plant in the herb layer followed by bunchberry (*Cornus canadensis*). Reindeer lichen (*Cladina* sp.) carpets significant portions of the forest floor, with lesser amounts of heron's-bill moss (*Dicranum* sp.), and red-stemmed feather-moss (*Pleurozium schreberi*).

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-11-G002		×	✓	×
T-11-G030		✓	×	×
T-11-G034	MS	✓		
T-11-G054		×	✓	×
T-11-G069	MS	✓	×	×
T-11-G070	MS	✓	×	×
T-11-G072	MS	✓	×	×
T-11-V002	MS	✓	×	×
T-12-V013		×	×	✓
T-12-V055	MS	✓	×	×
T-12-V078	MS	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

ESSFmv1/03/FF Subalpine Fir - Huckleberry – Feather-moss (n=16)

Biogeoclimatic Unit	Site Series	Map Code	Name
ESSFmv1	03	FF	*Subalpine Fir - Huckleberry – Feather-moss*
Assumed Modifiers: d, j, m			
Mapped Modifiers: c, ch, ck, cs, ct, cw, f, gk, h, hs, k, ks, r, s, sw, w			
Mapped Structural Stages: 3, 4, 5, 6, 7			

This ecosystem was documented on a wide variety of sites on mid-, and upper-slopes as well as on crests, and on level ground. Most of the sites are on gentle slopes while 6 occur on moderately steep slopes with south-east or north-west aspects. Most of the surficial material is glaciofluvial or morainal, but some colluvium was documented. Soils are mostly well drained and sub-mesic, and of poor SNR. The canopy at most sites largely comprises subalpine fir (*Abies lasiocarpa*). Lodgepole pine (*Pinus contorta* var. *latifolia*), and some Engelmann spruce (*Picea engelmannii*) are found at many sites. Lodgepole pine is more common in young or mature seral stages. The mountain pine beetle has devastated the pine forests in the Project area leaving vast stands of standing dead pine. The result is open canopy forests with dense regeneration of subalpine fir and various shrubs. Lodgepole pine, and subalpine fir share the understorey among white-flowered rhododendron (*Rhododendron albiflorum*), and black huckleberry (*Vaccinium membranaceum*). Crowberry (*Empetrum nigrum*), and bunchberry (*Cornus canadensis*) are the most prolific components of the herb layer. The forest floor is often carpeted with large populations of red-stemmed feather-moss (*Pleurozium schreberi*), heron's-bill moss (*Dicranum* sp.), and some common leafy liverwort (*Barbilophozia lycopodioides*).

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-11-7112	MS	✓	×	×
T-12-G016	MS	✓	×	×
T-12-G021	MS	✓	×	×

T-12-G071	MS	✓	×	×
T-12-V076	MS	✓	×	×
T-12-G079	MS	✓	×	×
T-12-G080	MS	✓	×	×
T-11-G001		×	✓	×
T-11-G027	MS	✓	×	×
T-11-G057		×	✓	×
T-11-G058	MS	✓	×	×
T-11-G061	MS	✓	×	×
T-11-G071	MS	✓	×	×
T-11-G074	MS	✓	×	×
T-11-G075	MS	✓	×	×
T-11-V030	MS	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

ESSFmv1/04/FG Subalpine Fir - Huckleberry – Gooseberry (n=12)

Biogeoclimatic Unit	Site Series	Map Code	Name
ESSFmv1	04	FG	*Subalpine Fir - Huckleberry – Gooseberry*
Assumed Modifiers: d, j, m			
Mapped Modifiers: c, ch, ck, cs, ct, g, gk, h, hs, k, ks, s, sw, w			
Mapped Structural Stages: 2, 3, 5, 6, 7			

ESSFmv1/04 sites occur on the lower to middle parts of moderate to gentle slopes. Soils are moderately well to imperfectly drained with sub-hygric to hygric SMR and medium to rich SNR. The canopy is predominately composed of subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*). The former shares the shrub layer with white rhododendron (*Rhododendron albiflorum*), black gooseberry (*Ribes lacustre*), and black huckleberry (*Vaccinium membranaceum*). Oak ferns (*Gymnocarpium dryopteris*) cover up to 30% of the forest floor at many sites, while Sitka valerian (*Valeriana sitchensis*), or three-leaved foam flower (*Tiarella trifoliate*) are dominant component of the herbaceous layer at other sites. The most common mosses are step moss (*Hylocomium splendens*), red-stemmed feather-moss (*Pleurozium schreberi*), heron's-bill moss (*Dicranum* sp.), knight's plume (*Ptilium crista-castrensis*), and leafy moss (*Mnium* sp.).

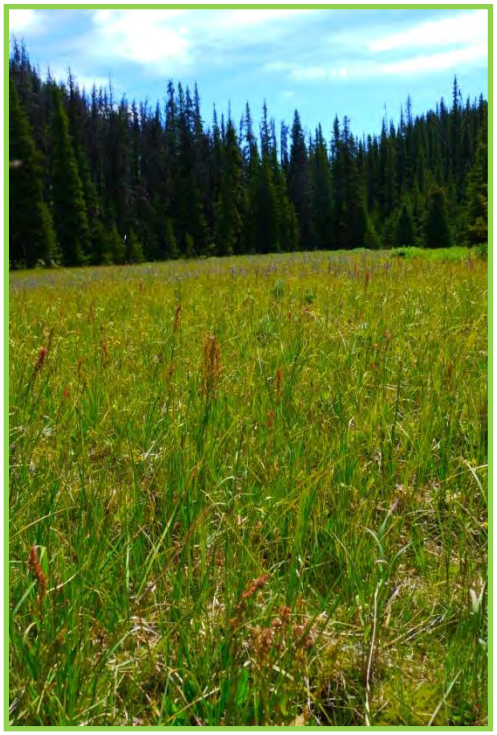
Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-12-G019	MS	✓	×	×
T-12-G075	MS	✓	×	×
T-11-G025	MS	✓	×	×
T-11-G044	MS	✓	×	×
T-11-G047	MS	✓	×	×
T-11-G068	MS	✓	×	×
T-11-V033	MS	✓	×	×
T-11-V034	MS	✓	×	×
T13077G	MS	✓	×	×
T13108G	MS	✓	×	×
T13109G	MS	✓	×	×

T13112G	MS	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

ESSFmv1/00/VG Sitka valerian - globeflower moist meadow (n= 1)

Biogeoclimatic Unit	Site Series	Map Code	Name
ESSFmv1	00	VG	*Sitka valerian - globeflower moist meadow*
Assumed Modifiers: dm			
Mapped Modifiers: none			
Mapped Structural Stages: 2a			



The VG ecosystem is a diverse spring seepage herbaceous meadow with imperfectly drained and nutrient rich soils. They have sandy/silty soils on lacustrine surfical material. Spring-seepage ecosystems occur on mineral seeps, but do not meet the criteria of the Canadian Wetland Classification System (NWWG 1988). Mountain monkshood (*Aconitum delphiniifolium*), large-leaved avens (*Geum macrophyllum*), and green sorrel (*Rumex acetosa*) are common herbaceous forbs, and common haircap moss (*Polytrichum commune*), glow moss (*Aulacomnium palustre*) andapple-moss (*Philonotis* sp.) contribute to a well-developed bryophyte layer.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
R-12-G024	MS	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

1.6 Nechako Moist Very Cold Englemann Spruce - Subalpine Fir Parkland / West Chilcotin Very Dry Very Cold Englenmann Spruce - Subalpine Fir ParklandTransition

ESSFxvp1/00/FB Subalpine fir - Dwarf blueberry - Dicranum parkland (n=0)

Biogeoclimatic Unit	Site Series	Map Code	Name
ESSFmv1p / ESSFxvp1	00	FB	*Subalpine fir - Dwarf blueberry - Dicranum parkland*
Assumed Modifiers: d, j, m			
Mapped Modifiers: hs, s, sw, w			
Mapped Structural Stages: 3, 6			
This FB ecosystem typically occurs on warm aspects, and is characterised by intermittent clumps of subalpine fir (*Abies lasiocarpa*), and whitebark pine (*Picea albicaulis*). Grouse-berry (*Vaccinium scoparium*), altai fescue (*Festuca altaica*), and mountain sagewort (*Artemisia norvegica*) are very common, low vascular plants. Heron's-bill moss (*Dicranum* sp.), red-stemmed feather-moss (*Pleurozium schreberi*), and reindeer lichens (*Cladonia* sp.) occupy the gaps in the patches of vascular plants in this parkland community.			

ESSFxvp1/00/FC Altai fescue - Cladonia lichen grassland (n=0)

Biogeoclimatic Unit	Site Series	Map Code	Name
ESSFmv1p / ESSFxvp1	00	FC	*Altai fescue - Cladonia lichen grassland*
Assumed Modifiers: d, j, m			
Mapped Modifiers: cs, cw, hs, k, s, w			
Mapped Structural Stages: 2b			
This ecosystem is found on gentle slopes with sub-mesic to mesic, deep, medium textured soils. Altai fescue (*Festuca altaica*) and lichens dominate this tree-less ecosystem. Mountain sagewort (*Artemisia norvegica*), and alpine bistort (*Bistorta vivipara*) are common herbs. The lycopod (*Diphasiastrum alpinum*), bryophyte (*Dicranum* sp), and lichen (*Cladonia* sp.) layer is very well developed.			

ESSFxvp1/00/FH Subalpine fir - Indian hellebore (n= 2)

Biogeoclimatic Unit	Site Series	Map Code	Name
ESSFmv1p / ESSFxvp1	00	FH	*Subalpine fir - Indian hellebore*
Assumed Modifiers: none			
Mapped Modifiers: k, s			
Mapped Structural Stages: 3, 6, 7			

The subalpine fir - Indian hellebore ecosystem occurs gentle mid slope positions where the soils are hygric, poorly draining, with a rich SNR. Surficial material is typically morainal. Subalpine fir (*Abies lasiocarpa*) skirts the perimeter of small Indian hellebore (*Veratrum viride*) / Sitka valerian (*Valeriana sitchensis*) glades. The moss layer is moderately well developed with a diverse assemblage of species including leafy moss (*Rhizomnium* sp.), glow moss (*Aulacomnium palustre*), hook-moss (*Drepanocladus* sp.), and green-tongue liverwort (*Marchantia polymorpha*).

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-11-G023		×	✓	×
T-11-G067	MS	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

ESSFxvp1/00/FM Subalpine fir - Heather parkland (n= 1)

Biogeoclimatic Unit	Site Series	Map Code	Name
ESSFmv1p / ESSFxvp1	00	FM	*Subalpine fir - Heather parkland*
Assumed Modifiers: d, j, m			
Mapped Modifiers: ks, s			
Mapped Structural Stages: 3, 6			

This parkland like ecosystem was documented mid-slope on fairly level ground. Surficial material comprises a morainal veneer, and the thin and patchy soil has a mesic SMR and medium SNR. The site is characterized by krumholtz islands of subalpine fire (*Abies lasiocarpa*) that provide some shelter for a few hardy crowberry (*Empetrum nigrum*), and yellow mountain-heather (*Phyllodoce glanduliflora*). Dicranum moss (*Dicranum* sp.) and common leafy liverwort (*Barbilophozia lycopodioides*) together cover almost half the site.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-11-G017		×	✓	×

This ecosystem occurs on cool aspects, of gentle slopes with a complex micro-topography. The soil is medium-textured, and deep. Stunted subalpine firs (*Abies lasiocarpa*) are skirted by a heather (*Phyllodoce* spp.) understory. Altai fescue (*Fescue altaica*) and dwarf blueberry (*Vaccinium caespitosum*) are often present along with a significant cover of heron's-bill moss (*Dicranum* sp.), and reindeer lichen (*Cladonia* sp.).

ESSFxvp1/00/KC Kinnikinnick – Cladonia (n=1)

Biogeoclimatic Unit	Site Series	Map Code	Name
ESSFmv1p / ESSFxvp1	00	KC	*Kinnikinnick – Cladonia*
Assumed Modifiers: m, s			
Mapped Modifiers: none			
Mapped Structural Stages: 2d			

This ecosystem occurs on upper slopes with shallow and rapidly drained soils resulting in very xeric and very poor SNR. Sites occur on morainal veneers and with are. Vegetation at these sites comprise mostly a low cover of scrub birch (*Betula nana*), and kinnikinnick (*Arctostaphylos uva-ursi*). Exposed rocks are covered in foam lichens (*Stereocaulon* sp.), ballroom dervish (*Cetraria nivalis*), and reindeer lichen (*Cladonia* sp.).

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-11-G080	MS	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

ESSFxvp1/00/MH Mountain-heather - Slender hawkweed (n=2)

Biogeoclimatic Unit	Site Series	Map Code	Name
ESSFmv1p / ESSFxvp1	00	MH	*Mountain-heather - Slender hawkweed*
Assumed Modifiers: none			
Mapped Modifiers: gs, k, ks, s			
Mapped Structural Stages: 2d			

This cool, north-easterly facing heather-meadow is found mid-slope on gentle topography where late snow melt occurs. Soils are deep, with 35-70% coarse fragments, and have a variable moisture regime from submesic to sub-hygric SMR, and a medium to rich SNR. Surficial material is morainal. Most of these sites are carpeted in yellow mountain-heather, (*Phyllodoce glanduliflora*), heron's-bill moss (*Dicranum* sp.), arctic willow (*Salix arctica*), or pink mountain-heather (*Phyllodoce empetriformis*). However, some hardy subalpine firs (*Abies lasiocarpa*) persist in these ecosystems.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
R-11-G025		×	✓	×
T-11-G079		×	✓	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

ESSFxvp1/00/ ML White mountain-avens – Lichen (n=0)

Biogeoclimatic Unit	Site Series	Map Code	Name
ESSFmv1p / ESSFxvp1	00	ML	*White mountain-avens – Lichen*
Assumed Modifiers: none			
Mapped Modifiers: none			
Mapped Structural Stages: 1b, 2a			
This windswept ecosystem occurs on dry, exposed rounded ridge-tops at high elevation. The site comprises a thin morainal veneer over rock, and is acted upon by frost. A limited winter snowpack drains rapidly when melted. The xeric soils support a low cover of white mountain-avens (*Dryas integrifolia*), arctic willow (*Salix arctica*), alpine bistort (*Bistorta vivipara*), spiked wood-rush (*Luzula spicata*), and reindeer lichen (*Cladonia* sp.).			

ESSFxvp1/00/PC Subalpine fir / whitebark pine - Crowberry parkland (n=4; Mine site)

Biogeoclimatic Unit	Site Series	Map Code	Name
ESSFmv1p / ESSFxvp1	00	PC	*Subalpine fir / whitebark pine - Crowberry parkland*
Assumed Modifiers: d, j, m			
Mapped Modifiers: c, cs, g, k, ks, r, s, sw, v, w			
Mapped Structural Stages: 3, 6			

This site series is distinguished from the FM site association by the presence of whitebark pine (*Pinus albicaulis*) in the tree layer, and crowberry (*Empetrum nigrum*) in the herb layer. It is distributed on deep medium-textured soils often on cool aspects and, on gentle slopes. Subalpine fir (*Abies lasiocarpa*) covers just over half of the ecosystem, with lesser amounts of lodgepole pine (*Pinus contorta* var. *latifolia*), Engelmann spruce (*Picea engelmannii*), and white bark pine (*Abies lasiocarpa*). Dwarf blueberry (*Vaccinium caespitosum*), common juniper (*Juniperus communis*), and scrub birch (*Betula nana*) are present in the shrub layer. Heron's-bill moss (*Dicranum* sp.) carpet much of the glades, along with common leafy liverwort (*Barbilophozia lycopodioides*), and red-stemmed feather-moss (*Pleurozium schreberi*).

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-11-G022		×	✓	×
T-11-G081	MS	✓	×	×
R-11-G006	MS	✓	×	×
R-11-G010	MS	✓	×	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

ESSFxvp1/00/SF Scrub birch - Altai fescue shrub steppe (n=3)

Biogeoclimatic Unit	Site Series	Map Code	Name
ESSFmv1p / ESSFxvp1	00	SF	*Scrub birch - Altai fescue shrub steppe*
Assumed Modifiers: d, j, m			
Mapped Modifiers: cs, ks, s, v, w			
Mapped Structural Stages: 3a			

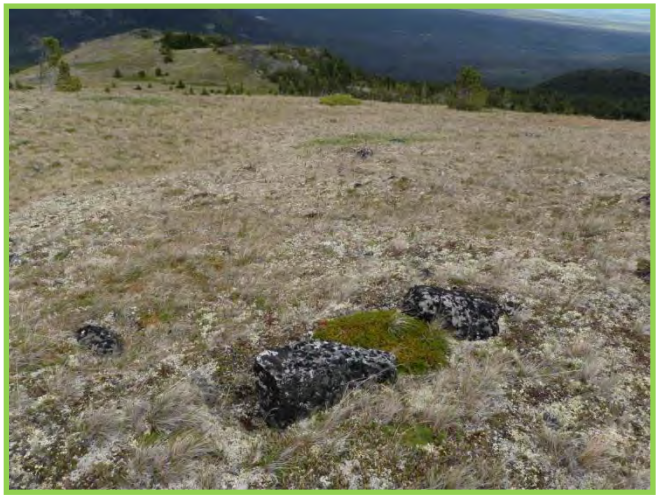
About 80% of this scrub-steppe ecosystem is covered with one species, scrub birch (*Betula nana*). This ecosystem occupies a variety of slope positions from gentle mid slopes to moderately steep slopes. The surficial material consists of a thin veneer of coarse well-draining morainal deposits. The SMR is sub-mesic, and SNR is poor. The well-developed moss layer predominantly comprises heron's-bill moss (*Dicranum* sp.), but the seemingly ubiquitous red-stemmed feather-moss (*Pleurozium schreberi*), and common leafy liverwort (*Barbilophozia lycopodioides*) are also present. A few subalpine fir (*Abies lasiocarpa*), and lodgepole pine (*Pinus contorta* var. *latifolia*) are present in the shrub layer.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-11-G065	MS	✓	×	×
T-11-V010		×	✓	×
T-11-V041		×	✓	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

ESSFxvp1/00/TW Two-toned sedge - Dwarf snow willow (n=1)

Biogeoclimatic Unit	Site Series	Map Code	Name
ESSFmv1p / ESSFxvp1	00	TW	*Two-toned sedge - Dwarf snow willow*
Assumed Modifiers: d, j, m			
Mapped Modifiers: none			
Mapped Structural Stages: 2d			



This high-elevation low-shrub tundra community occurs on sub-mesic, crest positions. Aspects are gentle, and the soils are deep, medium-textured, and moderately well-draining. The predominant shrub is (*Salix nivalis*). Black-and-white sedge (*Carex albonigra*), spiked wood-rush (*Luzula spicata*), mountain sagewort (*Artemisia norvegica*), and alpine bistort (*Bistorta vivipara*) emerge though a moderately well-developed bryophyte, lichen, and lycopod layer.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-11-V029		×	✓	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

ESSFxvp1/00/VG Sitka valerian - globeflower moist meadow (n=2)

Biogeoclimatic Unit	Site Series	Map Code	Name
ESSFmv1p / ESSFxvp1	00	VG	*Sitka valerian - globeflower moist meadow*
Assumed Modifiers: none			
Mapped Modifiers: gs, s, w			
Mapped Structural Stages: 2d			

The "Sitka valerian - globeflower moist meadow" site association occurs on seepages at mid to lower portions of concave slopes. The parental material is often a lacustrine veneer over morainal deposits. The SMR are often sub-hygric, and the SNR medium to rich. Globeflower (*Trollius albiflorus*), Sitka valerian (*Valeriana sitchensis*), and arrow-leaved groundsel (*Senecio triangularis*) are common components of the herbaceous layer.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-11-G021		×	✓	×
T-11-G005		×	✓	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

ESSFxvp1/00/WK Whitebark pine krummholz (n=0)

Biogeoclimatic Unit	Site Series	Map Code	Name
ESSFmv1p / ESSFxvp1	00	WK	*Whitebark pine krummholz*
Assumed Modifiers: none			
Mapped Modifiers: k, kv, s, w			
Mapped Structural Stages: 3			
The "whitebark pine krummholz" site association occurs on moderate to steep slopes with a southeast to western aspects and on ridge-tops. The soil is dry, shallow, and coarse-textured. The vegetation comprises mostly a shrub layer of stunted whitebark pine (*Pinus albicaulis*), and a continuous cover of subalpine fir (*Abies lasiocarpa*), disrupted by a mosaic of small alpine meadows.			

ESSFxvp1/00/WW Whitebark pine - white mountain-avens (n= 0)

Biogeoclimatic Unit	Site Series	Map Code	Name
ESSFmv1p / ESSFxvp1	00	WW	*Whitebark pine - white mountain-avens*
Assumed Modifiers: none			
Mapped Modifiers: ck, cw, h, hs, k, ks, rs, s, v			
Mapped Structural Stages: 3, 6			
This ridge-crest ecosystem is found on morainal veneers over rock. Xeric SMR conditions persist due to shallow, coarse-textured soils. Whitebark pine (*Pinus albicaulis*) is the main tree species, while Altai fescue (*Fescue altaica*) and white mountain-avens (*Dryas octopetala*) dominate the herb layer. Lesser green reindeer lichen (*Cladina mitis*) and foam lichen (*Stereocaulon* sp.) are very common elements of the moss layer in this WW site type.			

1.7 Undifferentiated Boreal Altai Fescue Alpine

BAFAun/00/FC Altai fescue - Cladonia grassland (n=2)

Biogeoclimatic Unit	Site Series	Map Code	Name
BAFAun	00	FC	*Altai fescue - Cladonia grassland*
Assumed Modifiers:			
Mapped Modifiers: none			
Mapped Structural Stages: 2b			

This high-elevation gently sloping alpine grassland occurs mid-slope on deep soils. The soils have a poor SNR, mesic SMR, and comprise 35-70% coarse fragments. The ecosystem is dominated by Altai fescue (*Festuca altaica*), pink mountain heather (*Phyllodoce empetriformis*), yellow-mountain-heather (*Phyllodoce glanduliflora*), and four-angled mountain-heather (*Cassiope tetragona*). A rich humus layer is covered by a well-developed bryophyte and lycopod layer comprising heron's-bill moss (*Dicranum* sp.), foam lichens (*Stereocaulon* sp.), and alpine club-moss (*Diphasiastrum alpinum*).

Plot Number	LSA Project Component	LSA	RSA	outside RSA
R-11-G001		×	✓	×
T-11-G015		×	✓	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

BAFAun/00/FH Subalpine Fir - Heather krummholz (n=1)

Biogeoclimatic Unit	Site Series	Map Code	Name
BAFAun	00	FH	*Subalpine Fir - Heather krummholz*
Assumed Modifiers:			
Mapped Modifiers: none			
Mapped Structural Stages: 3			

This sub-xeric to mesic high-elevation *Fescue* grassland occurs on shallow morainal surficial material consisting of 35-70% coarse fragments. The grassland is interrupted by exposed rocks, and small islands of scrub birch (*Betula nana*), and heather (e.g. *Phyllodoce empetriformis*; and *Phyllodoce glanduliflora*). It has a well-developed lichen, bryophyte, and lycopod layer comprising reindeer lichen (*Cladina* sp.), dicranum moss (*Dicranum* sp.), and alpine club-moss (*Diphasiastrum alpinum*).

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-11-V009		×	✓	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

BAFAun/00/FW Altai fescue - dwarf snow willow (n=2)

Biogeoclimatic Unit	Site Series	Map Code	Name
BAFAun	00	FW	*Altai fescue - dwarf snow willow*
Assumed Modifiers:			
Mapped Modifiers: none			
Mapped Structural Stages: 2			

The FW site association was found on gentle to moderate slopes, over somewhat dry, poor to medium soils with 35-70% coarse fragments. Altai fescue (*Festuca altaica*) and dwarf snow willow (*Salix nivalis*) dominate, along with Iceland-moss lichens (*Cetraria nivalis*), and haircap moss (*Polytrichum* sp.). The surface tends to be a complex of concave and convex areas. Convex areas are sparsely vegetated with lichens and willow. Subalpine fir (*Abies lasiocarpa*) and heath (*Phyllodoce* sp.) tree islands as well as rock outcrops interrupt the grassland.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-11-7107		×	✓	×
T-11-G013		×	✓	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

BAFAun/00/HL Heather - Lichen meadow (Dry heath meadow) (n=1)

Biogeoclimatic Unit	Site Series	Map Code	Name
BAFAun	00	HL	*Heather - Lichen meadow (Dry heath meadow)*
Assumed Modifiers:			
Mapped Modifiers: k			
Mapped Structural Stages: 2			

The HL site association occurs on poor well-drained soil comprises more than 70% coarse fragments. Late lingering snow provides plants with much needed soil moisture during the summer months on these steeply sloped, south-easterly facing communities. The vegetation is dominated by yellow mountain-heather (*Phyllodoce glanduliflora*), which covers 55% of some sites. A few krummholz whitebark pine (*Pinus albicaulis*), and subalpine fir (*Abies lasiocarpa*) can become established in this ecosystem.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-11-G011		×	✓	×

Note: S = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

BAFAun/00/HM Mountain-heather (n=1)

Biogeoclimatic Unit	Site Series	Map Code	Name
BAFAun	00	HM	*Mountain-heather*
Assumed Modifiers:			
Mapped Modifiers: none			
Mapped Structural Stages: none identified			

This ecosystem occurs at the crest of gentle slopes with a south-easterly aspect. The soils are course, well draining with a sub-xeric SMR, and a poor SNR. The surficial material is weathered bedrock and shows signs of cryoturbation. There is a high cover of four-angled mountain-heather (*Cassiope tetragona*), and fescue (*Fescue* sp.). Alpine club-moss (*Diphasiastrum alpinum*), crowberry (*Empetrum nigrum*), and scrub birch (*Betula nana*) hug the wind-swept soil.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-11-G016		×	✓	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

BAFAun/00/SF Scrub birch - Altai fescue shrub steppe (n=3)

Biogeoclimatic Unit	Site Series	Map Code	Name
BAFAun	00	SF	*Scrub birch - Altai fescue shrub steppe*
Assumed Modifiers:			
Mapped Modifiers: none			
Mapped Structural Stages: 3			

This ecosystem occurs from mid-slope to crest on gentle inclines. The SMR is sub-xeric to mesic, and the SNR is poor. Vascular plant diversity is quite low, with scrub birch (*Betula nana*) covering up to 85% of some sites. Altai fescue (*Festuca altaica*), is by far the most common herbaceous vascular plant. Red-stemmed feather-moss (*Pleurozium schreberi*), heron's-bill moss (*Dicranum* sp.), clad lichens (*Cladonia* sp.), foam lichens (*Stereocaulon* sp.), haircap moss (*Polytrichum* sp.), and ragged paperdoll (*Cetraria nivalis*) represent most of the non-vascular plants occurring in the ecosystem.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-11-V006		×	✓	×
T-11-V007		×	✓	×
R-11-G003		×	✓	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

BAFAun/00/WM Wet seepage meadows (n=3)

Biogeoclimatic Unit	Site Series	Map Code	Name
BAFAun	00	WM	
Assumed Modifiers:			
Mapped Modifiers: none			
Mapped Structural Stages: 2			

These wet seepage meadows occur on the lower-slopes of gentle inclines. Surficial material is a thin veneer of imperfectly draining morainal deposits. The SMR is hygric, and the SNR is rich. Seepage from late snowmelt and a hummocky micro-topography have a large effect on the composition of the plant community. Altai fescue (*Festuca altaica*), mountain sagewort (*Artemisia norvegica*), arctic willow (*Salix arctica*), dwarf snow willow (Salix nivalis), and small-flowered wood-rush (*Luzula piperi*) occur on the dry hummocks, and subalpine daisy (*Erigeron peregrinus*) and glow moss (*Aulacomnium palustre*) occupy much of the wet hollows in between the hummocks.

Plot Number	LSA Project Component	LSA	RSA	outside RSA
T-11-G012		×	✓	×
T-11-G014		×	✓	×
R-11-G002		×	✓	×

Note: MS = Mine Site; MSAR: Minesite Access Road; TL-main = Transmission Line main; TL-Mills = Transmission Line Mills Ranch Re-route; TL-Stellako = Transmission Line Stellako Re-route; FSR = Kluskus Forest Service Road; AIR = Airstrip; and FWSS = Fresh Water Supply System

1.8 Non-Vegetated, Sparsely Vegetated and Anthropogenic

Cliff/00/CL

A steep, vertical or overhanging rock face.

Cultivate Field/00/CF

A flat or gently rolling, non-forested, open area that is subject to human agricultural practices which often result in long-term soil and vegetation changes.

Exposed soils/00/ES

This classification applies to any area of recently exposed soil caused by mud slides, debris torrents, avalanches, and anthropogenic disturbances from water pipeline, road, or transmission line construction.

Gravel Pit/00/GP

An area exposed through the removal of sand and gravel.

Lake/00/LA

A naturally occurring static body of water, greater than 2 m deep in some portion and larger than 50 ha. The boundary for the lake is the natural high water mark.

Mine/00/MI

This polygon circumscribes the limits of areas that are un-vegetated because of the extraction of mineral ore from the proposed Blackwater Mine.

Moraine/00/MN

This un-vegetated landform consists of un-stratified glacial till. It takes a variety of shapes on the landscape including plains, mounds, and ridges.

Pond/00/PD

A 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).

River/00/RI

A watercourse formed when water flows between continuous, definable banks. The flow may be intermittent or perennial.

Rock/00/RO

These units delineate the boundaries of gentle to steep bedrock escarpments, and bedrock outcrops. They have very little to no soil, and a sparse vegetative cover comprising very little vascular plants.

Rural/00/RW

Any area in which residences and other human developments are scattered and intermingled with forest, range, farmland, and native vegetation or cultivated crops.

Road surface/00/RZ

A road surface is defined as any area cleared and compacted for the purpose of transporting goods and services by vehicles.

Talus/00/TA

Talus occurs at the base of steep, rocky slopes, and comprises colluvial angular rock fragments of any size.

Urban/00/UR

An area in which residences and other human development form an almost continuous covering of the landscape. These areas include cities, towns, subdivisions, commercial and industrial parks, and similar developments both inside and outside city limits.