35. Summary and Conclusions

35.1 INTRODUCTION

The Application for an Environmental Assessment Certificate/Environmental Impact Statement (Application/EIS) for the proposed Brucejack Gold Mine Project (the Project) represents the application made by the Proponent, Pretium Resources Inc. (Pretivm), under the British Columbia (BC) *Environmental Assessment Act* (2002) and the federal *Canadian Environmental Assessment Act, 2012* (2012) for approval to proceed to the permitting stage for the Project.

Pretivm proposes to develop the Project, 65 kilometres (km) north-northwest of Stewart within the Regional District of Kitimat-Stikine. The Project is also located within the traditional territories claimed by Skii km Lax Ha and Tahltan Nation, and Nisga'a Nation has certain rights and interests in the Nass Area as defined in the *Nisga'a Final Agreement* (NLG, Province of BC, Government of Canada 1998). The BC Métis also have interests in the general region of the Project.

The proposed Project will use the long-hole open stoping method of underground mining to extract approximately 2,700 tonnes per day of gold- and silver-bearing ore, to be processed using conventional crushing, grinding, flotation, and gravity separation techniques. Waste rock and tailings will primarily be stored underground as backfill, but those that cannot be used as backfill will be deposited under water in Brucejack Lake. The overall surface footprint at the mine site and immediate infrastructure will be about 31 hectares (ha). Access to the Project will be by an existing 73-km-long access road from Highway 37. Power for the Project will be supplied via a new 55-km-long transmission line that will connect with the provincial grid at the Long Lake Hydro Project near Stewart. The life-of-mine is expected to be a minimum of 22 years, after an initial Construction phase projected to last two years. The Closure and Post-closure phases will extend over five years (i.e., two for Closure and a minimum of three years for Post-closure activities).

Part A of the Application/EIS provides an introduction and background to the assessment which includes an overview and description of the Project and its design, as well as a description of the public accountability undertaken, and the assessment process and methodology applied. Parts B, C, and D contain the actual effects assessments pertaining to the predictive studies, biophysical and human environments respectively. Part E addresses the interests of Aboriginal groups in particular. Environmental management plans, reporting procedures, and closure activities are dealt with in Part F of the Application/EIS, while Parts G and H round out the documentation with attention to other requirements (e.g., federal obligations) and a summary and conclusion chapter respectively.

In this Application/EIS, the Proponent has reported the findings of the assessment with respect to the potential effects of the Project on the baseline environmental, economic, social, heritage and health setting. The assessments have been broadly scoped and are comprehensive, and have followed the effects assessment methodology detailed in Chapter 6. The effects assessment reflects the feedback provided during the pre-Application/pre-EIS stage of the environmental assessment (EA) process by Skii km Lax Ha, Nisga'a Lisims Government, Tahltan, Métis, provincial and federal government agencies, and the public. Pretivm, in conducting the assessments, has been supported by technical specialists who have applied rigorous analytical procedures and expert professional judgement to the assessment analysis.

The EA process has been willingly adopted by Pretivm as a means of planning the Project in such a manner that it is possible to refine the layout and design to be as environmentally acceptable as possible while also maximizing the potential benefits of the Project. Through an iterative process of

interrogation and modification on the part of Pretivm, the EA Working Group[1] and other review participants, elements of the Project layout and design were revised and improved, as described in Chapter 4, Project Design and Alternatives Assessment.

Following the assessment methodology described in Chapter 6, the Proponent and its team have systematically identified issues of concern; scoped potential sources of effects and effects mechanisms and evaluated their potential to affect environmental, social, heritage, and health Valued Components (VCs); and assessed the capacity of various mitigation measures to prevent effects or, where not possible, to reduce them to acceptable levels. With mitigation measures applied, the Proponent has then determined the residual effects on the Project setting, and whether or not these residual effects are significant. Summaries of the effects assessments for environmental, social, health, and heritage VCs are provided in Chapters 7 through 25 of the Application/EIS. The assessment methodology was not applied to economic effects as the effects are predicted to be positive.

Predictive Studies were used to identify intermediate components that serve as pathways to receptor VCs and do not reflect the significance or otherwise of the predictive subject area effects.

The Proponent has been successful in either avoiding adverse effects entirely or reducing them to insignificance. For many potential effects, no residual effects are predicted once proposed mitigation measures are implemented. For other potential effects, although residual effects are predicted, these residual effects are rated **not significant**, as illustrated by the summary of assessment findings presented in Table 35.4-1.

35.2 SUMMARY OF PUBLIC CONCERNS AND MITIGATION

Appendix 3-J of Chapter 3, Information Distribution and Consultation, contains a table summarizing issues raised by local governments, tenure holders, stakeholders, and the public[2] during the pre-Application/ pre-EIS phase, and the Proponent's responses and mitigations to address those concerns, in accordance with Section 14 of the EIS Guidelines for the Project. There are no outstanding public concerns.[3]

35.3 SUMMARY OF ABORIGINAL CONSULTATION, IMPACTS ON RIGHTS AND INTERESTS, AND MITIGATION

Tables 3-E1 through 3-E4 in Appendix 3-E of Chapter 3, Information Distribution and Consultation, summarize the comments, issues, and concerns raised by Aboriginal groups during the pre-Application/ pre-EIS phase, and the Proponent's responses and mitigations to address those concerns, in accordance with Section 14 of the EIS Guidelines for the Project. There are no outstanding Aboriginal concerns.[4] The following sections summarize the impacts on Aboriginal rights and interests (Sections 35.3.1, 35.3.2, and 35.3.4), and the impacts on Nisga'a interests and treaty rights (Section 35.3.3).

35.3.1 Skii km Lax Ha

Table 35.3-1 summarizes the assessment of impacts of Project components and activities on the exercise of Skii km Lax Ha Aboriginal rights (Chapter 26, Assessment of Asserted or Established Aboriginal Rights

[1] The EA Working Group is a forum for discussion and resolution of technical issues associated with the proposed Project, as well as providing technical advice to the BC EAO and CEA Agency, who remain ultimately responsible for determining significance. It comprises representatives of provincial, federal, and local government, and Aboriginal groups.
[2] The "public" includes local governments, stakeholders, tenure and license holders, and members of the public.
[3] An approach to addressing outstanding public concerns is described in Chapter 3 (Section 3.7.2.1).
[4] An approach to addressing outstanding Aboriginal concerns is described in Chapter 3 (Section 3.5.3.1).

and Interests). The assessment concluded an overall low impact on Skii km Lax Ha fishing, hunting and trapping, and gathering rights.

Table 35.3-1. Summary of Impacts on Skii km Lax Ha Rights and Interests and Mitigation

Link to Valued Components	Adverse Impacts on Rights and Interests	Mitigation and Commitments	Outstanding Issues
Climate (Chapter 12)	No adverse impacts on Skii km Lax Ha fishing, hunting, trapping or gathering rights	Fuel and energy efficiency. Complete re-vegetation during closure, for any area cleared of vegetation.	none
Surface Water Quality (Chapter 13)	No adverse impacts on Skii km Lax Ha fishing rights	Implementation of ML/ARD Management Plan (Section 29.10), Waste Rock Management Plan (Section 29.18), Tailings Management Plan (Section 29.15), Water Management Plan (Section 29.19), Aquatic Effects Monitoring Plan (Section 29.3). Collection and treatment of seepage from underground workings. Use of best management practices to minimize sediment entry to waterbodies. Dust suppression on roads. Implementation of Soils Management Plan (Section 29.13).	none
Aquatic Resources - Primary and Secondary Producers (Chapter 14)	No adverse impacts on Skii km Lax Ha fishing rights	Implementation of ML/ARD Management Plan (Section 29.10), Waste Rock Management Plan (Section 29.18), Water Management Plan (Section 29.19), Aquatic Effects Monitoring Plan (Section 29.3). Use of best management practices to minimize sediment entry to waterbodies. Dust suppression on roads. Implementation of Soils Management Plan (Section 29.13).	none
Fish Habitat (Chapter 15)	No adverse impacts on Skii km Lax Ha fishing rights	Use of best management practices to minimize sediment entry to waterbodies; Adhere to Fisheries and Oceans Canada's (DFO's) operational statements; Adhere to appropriate construction operating window for instream work and the Soils Management Plan (Section 29.13); Riparian re-vegetation; Dust suppression on roads; Site isolation; Water quality maintenance.	none
Fish - Dolly Varden, BulL Trout, Coho salmon, Sockeye salmon, Chinook salmon (Chapter 15)	No adverse impacts on Skii km Lax Ha fishing rights	Use of best management practices to minimize fish mortality with construction machinery. Use of best management practices to minimize sediment entry to waterbodies. Adhere to DFO's operational statements. Adhere to appropriate construction operating window for instream work. Site isolation. Controlled access. Implement of no fishing policy for employees and contractors. Soils Management Plan (Section 29.13). Riparian re-vegetation. Dust suppression on roads. Water quality maintenance.	none
Rare plants and lichens and rare plant and lichen habitat (Chapter 16)	No adverse impacts to Skii km Lax Ha gathering rights	Avoidance, minimize clearing areas and implement biodiversity strategy.	none

(continued)

Table 35.3-1. Summary of Impacts on Skii km Lax Ha Rights and Interests and Mitigation (continued)

Link to Valued Components	Adverse Impacts on Rights and Interests	Mitigation and Commitments	Outstanding Issues
Economic and Culturally Important Plants (Chapter 16)	No adverse impacts to Skii km Lax Ha gathering rights	N/A	none
Alpine Ecosystems (Chapter 16)	No adverse impacts to Skii km Lax Ha gathering rights	Minimize loss; restoration.	none
Parkland Ecosystems (Chapter 16)	No adverse impacts to Skii km Lax Ha gathering rights	N/A	none
Floodplain Ecosystems (Chapter 16)	No adverse impacts to Skii km Lax Ha gathering rights	Minimize loss and adaptively manage effects through an ecosystem based approach.	none
Forested Ecosystems (Chapter 16)	No adverse impacts to Skii km Lax Ha gathering rights	Minimize loss and adaptively manage effects through an ecosystem based approach.	none
Wetland Function (Chapter 17)	No adverse impacts to Skii km Lax Ha gathering rights	Invasive species management, vegetation management, soil management measures along roadways, transportation and access management for the exploration road, wetland monitoring, and environmental effects management and monitoring.	none
Wetland Extent (Chapter 18)	No adverse impacts to Skii km Lax Ha gathering rights	N/A	none
Mountain goat (Chapter 18)	No adverse impacts to Skii km Lax Ha hunting rights	Road access limited to employees with no public access and regional monitoring. Practising the current BC Guidelines for air traffic near mountain goat habitat. Participate in regional monitoring program.	none
Moose (Chapter 18)	No adverse impacts to Skii km Lax Ha hunting rights	Traffic and road management, snow clearing protocol (gaps in snowbanks), regional monitoring and avoid building infrastructure near moose travel networks. Minimize development of new roads, control access on existing project roads and regional monitoring.	none
Grizzly bear (Chapter 18)	No adverse impacts to Skii km Lax Ha hunting rights	Reduced speed limits, employee education, shuttling staff to the site to limit traffic, and regional monitoring. Yielding to wildlife, signage along roads, and vegetation management at identified wildlife crossings. Participate in regional monitoring program. Restricting road access, gates at bridge crossings to deter trespassers, and regional monitoring. Waste management protocol, and planting less attractive roadside vegetation.	none
Bats (Chapter 18)	No adverse impacts to Skii km Lax Ha hunting rights	N/A	none
American marten (Chapter 18)	No adverse impacts to Skii km Lax Ha hunting rights	Waste Management Protocol and prohibiting entry into infrastructure.	none

(continued)

Table 35.3-1. Summary of Impacts on Skii km Lax Ha Rights and Interests and Mitigation (completed)

Link to Valued Components	Adverse Impacts on Rights and Interests	Mitigation and Commitments	Outstanding Issues
Hoary marmot (Chapter 18)	No adverse impacts to Skii km Lax Ha hunting rights	N/A	none
Migratory birds - terrestrial and waterfowl (Chapter 18)	No adverse impacts to Skii km Lax Ha hunting rights	N/A	none
Raptors (Chapter 18)	No adverse impacts to Skii km Lax Ha hunting rights	N/A	none
Western toad (Chapter 18)	No adverse impacts to Skii km Lax Ha hunting rights	Amphibian tunnels and culverts, monitoring, and management plans and adaptive management.	none

35.3.2 Tahltan Nation

Table 35.3-2 summarizes the assessment of impacts of Project components and activities on the exercise of Tahltan Aboriginal rights (Chapter 26, Assessment of Asserted or Established Aboriginal Rights and Interests). The assessment concluded an overall negligible to low impact on Tahltan fishing, hunting and trapping, and gathering rights.

Table 35.3-2. Summary of Impacts on Tahltan Rights and Interests and Mitigation

Link to Valued Components	Adverse Impacts on Rights and Interests	Mitigation and Commitments	Outstanding Issues
Climate (Chapter 12)	No adverse impacts on Tahltan fishing, hunting, trapping or gathering rights	Fuel and energy efficiency. Complete re-vegetation during closure, for any area cleared of vegetation.	none
Surface Water Quality (Chapter 13)	No adverse impacts on Tahltan fishing rights	Implementation of ML/ARD Management Plan (Section 29.10), Waste Rock Management Plan (Section 29.18), Tailings Management Plan (Section 29.15), Water Management Plan (Section 29.19), Aquatic Effects Monitoring Plan (Section 29.3). Collection and treatment of seepage from underground workings. Use of best management practices to minimize sediment entry to waterbodies. Dust suppression on roads. Implementation of Soils Management Plan (Section 29.13).	none
Aquatic Resources - Primary and Secondary Producers (Chapter 14)	No adverse impacts on Tahltan fishing rights	Implementation of ML/ARD Management Plan (Section 29.10), Waste Rock Management Plan (Section 29.18), Water Management Plan (Section 29.19), Aquatic Effects Monitoring Plan (Section 29.3). Use of best management practices to minimize sediment entry to waterbodies. Dust suppression on roads. Implementation of Soils Management Plan (Section 29.13).	none

(continued)

Table 35.3-2. Summary of Impacts on Tahltan Rights and Interests and Mitigation (continued)

Link to Valued Components	Adverse Impacts on Rights and Interests	Mitigation and Commitments	Outstanding Issues
Fish Habitat (Chapter 15)	No adverse impacts on Tahltan fishing rights	Use of best management practices to minimize sediment entry to waterbodies. Adhere to DFO's operational statements. Adhere to appropriate construction operating window for instream work and the Soils Management Plan. Riparian re-vegetation. Dust suppression on roads. Site isolation. Water quality maintenance.	none
Fish- Dolly Varden, Bull Trout, Coho Salmon, Sockeye Salmon, Chinook Salmon (Chapter 15)	No adverse impacts on Tahltan fishing rights	Use of best management practices to minimize fish mortality with construction machinery. Use of best management practices to minimize sediment entry to waterbodies. Adhere to DFO's operational statements. Adhere to appropriate construction operating window for instream work. Site isolation. Controlled access. Implement of no fishing policy for employees and contractors. Soils Management Plan (Section 29.13). Riparian re-vegetation. Dust suppression on roads. Water quality maintenance.	none
Rare plants and lichens and rare plant and lichen habitat (Chapter 16)	No adverse impacts to Tahltan gathering rights	Avoidance, minimize clearing areas and implement biodiversity strategy.	none
Economic and Culturally Important Plants (Chapter 16)	No adverse impacts to Tahltan gathering rights	N/A	none
Alpine Ecosystems (Chapter 16)	No adverse impacts to Tahltan gathering rights	Minimize loss; restoration.	none
Parkland Ecosystems (Chapter 16)	No adverse impacts to Tahltan gathering rights	N/A	none
Floodplain Ecosystems (Chapter 16)	No adverse impacts to Tahltan gathering rights	Minimize loss and adaptively manage effects through an ecosystem based approach.	none
Forested Ecosystems (Chapter 16)	No adverse impacts to Tahltan gathering rights	Minimize loss and adaptively manage effects through an ecosystem based approach.	none
Wetland Function (Chapter 17)	No adverse impacts to Tahltan gathering rights	Invasive species management, vegetation management, soil management measures along roadways, transportation and access management for the exploration road, wetland monitoring, and environmental effects management and monitoring.	none
Wetland Extent (Chapter 18)	No adverse impacts to Tahltan gathering rights	N/A	none
Mountain goat (Chapter 18)	No adverse impacts to Tahltan hunting rights	Road access limited to employees with no public access and regional monitoring. Practising the current BC Guidelines for air traffic near mountain goat habitat. Participate in regional monitoring program.	none

(continued)

Table 35.3-2. Summary of Impacts on Tahltan Rights and Interests and Mitigation (completed)

Link to Valued Components	Adverse Impacts on Rights and Interests	Mitigation and Commitments	Outstanding Issues
Moose (Chapter 18)	No adverse impacts to Tahltan hunting rights	Traffic and road management, snow clearing protocol (gaps in snowbanks), regional monitoring and avoid building infrastructure near moose travel networks. Minimize development of new roads, control access on existing project roads and regional monitoring.	none
Grizzly bear (Chapter 18)	No adverse impacts to Tahltan hunting rights	Reduced speed limits, employee education, shuttling staff to the site to limit traffic, and regional monitoring. Yielding to wildlife, signage along roads, and vegetation management at identified wildlife crossings. Participate in regional monitoring program. Restricting road access, gates at bridge crossings to deter trespassers, and regional monitoring. Waste management protocol, and planting less attractive roadside vegetation.	none
Bats (Chapter 18)	No adverse impacts to Tahltan hunting rights	N/A	none
American marten (Chapter 18)	No adverse impacts to Tahltan hunting rights	Waste Management Protocol and prohibiting entry into infrastructure.	none
Hoary marmot (Chapter 18)	No adverse impacts to Tahltan hunting rights	N/A	none
Migratory birds - terrestrial and waterfowl (Chapter 18)	No adverse impacts to Tahltan hunting rights	N/A	none
Raptors (Chapter 18)	No adverse impacts to Tahltan hunting rights	N/A	none
Western toad (Chapter 18)	No adverse impacts to Tahltan hunting rights	Amphibian tunnels and culverts, monitoring, and management plans and adaptive management.	none

35.3.3 Nisga'a Nation

Table 35.3-3 summarizes the assessment of impacts of Project components and activities on the exercise of Nisga'a treaty rights and interests (Chapter 27, Assessment of Nisga'a Nation Treaty Rights, Interests). The assessment concluded an overall negligible to low impact on Nisga'a rights with respect to Chapter 10, paragraph 8(e) of the NFA. The Project is predicted to have a low level of impact on Nisga'a citizens' right to harvest fish as a result of potential residual effects on fish species harvested by Nisga'a.

This assessment is based on the following assumptions: the magnitude of the residual effects on fish are of minor concern or severity; the geographic extent of the effects are predicted to be localized to the Brucejack Access Road footprint; the effects are anticipated to be reversible in the short to medium-term; the duration is short; and the frequency is sporadic. The likelihood of the effects are considered to be low to medium and the confidence in the assessment is high.

Table 35.3-3. Summary of Impacts on Nisga'a 8(e) Interests

Nisga'a 8(e) Interests	Conclusions
Land Interests: • Nisga'a Lands • Nisga'a Fee Simple Lands	Effects not assessed as the Project is located outside of Nisga'a Lands, approximately 125 km from the junction of the Brucejack Access Road and Highway 37 to the nearest Nisga'a village of Git'laxt'aamiks.
Other Land-related interests: • Nisga'a citizens right to traditional use of lands and resources within park and ecological reserve • commercial recreation tenure • traplines • angling guide licences • guide outfitter's signature • water reservations • designated heritage sites	Effects not assessed as the Project is located outside of Nisga'a Lands, approximately 125 km from the junction of the Brucejack Access Road and Highway 37 to the nearest Nisga'a village of Git'laxt'aamiks. Mine site is located outside of Nass Area and drains to the Unuk watershed. Treaty Rock, a provincially designated heritage site is not located near project infrastructure or activities.
Nisga'a access to other lands	Effects not assessed as there is a lack of information on Nisga'a use of Crown land in the Project area
Nisga'a citizens right to harvest fish and aquatic plants and non-species of salmon	Residual effects predicted due loss of fish habitat due to erosion and sedimentation and direct mortality during Construction, Operation, and Closure. Effects rated as not significant. Mitigation measures identified in Section 27.4.2.1)
Nisga'a citizens right to harvest wildlife	The Project is not located in the Nass Wildlife Area; project traffic will travel through this area but traffic effects were not scoped into the assessment by the BC EAO.
Nisga'a rights to harvest migratory birds	No residual effects predicted on migratory birds with the implementation of mitigation measures (Section 27.4.2.2).

No residual effects are predicted on migratory birds with the implementation of mitigation measures. The Project is not expected to affect the ability of present or future generations to exercise their rights or to modify Nisga'a Nation's customs and practices related to fishing, hunting, and gathering.

Potential effects on Nisga'a paragraph 8(f) economic, social and cultural interests were assessed based on the Economic, Social, Cultural Impact Assessment report. Potential effects on Nisga'a economic, social and cultural will be mitigated by environmental management plans and mitigation measures identified for economic, social and cultural VCs.

35.3.4 Métis

Table 35.3-4 summarizes the assessment of impacts of Project components and activities on the exercise of Métis rights (Chapter 26, Assessment of Asserted or Established Aboriginal Rights and Interests). The assessment concluded no impacts on Métis rights are anticipated, based on the information provided in Appendix 25-C, Métis Interests Desktop Study.

35.4 SUMMARY OF RESIDUAL EFFECTS AND MITIGATION MEASURES

Table 35.4-1 summarizes all residual Project and cumulative effects, as well as mitigation measures for the predictive studies, biophysical assessment, and human environment assessment. The summaries and conclusions for each discipline are detailed below.

Table 35.3-4. Summary of Impacts on Métis Rights and Interests and Mitigation

Link to Valued Components	Adverse Impacts on Rights and Interests	Mitigation and Commitments	Outstanding Issues
Climate (Chapter 12)	No adverse impacts on Métis fishing, hunting, trapping or gathering rights	Fuel and energy efficiency. Complete re-vegetation during closure, for any area cleared of vegetation.	none
Surface Water Quality (Chapter 13)	No adverse impacts on Métis fishing rights	Implementation of ML/ARD Management Plan (Section 29.10), Waste Rock Management Plan (Section 29.18), Tailings Management Plan (Section 29.15), Water Management Plan (Section 29.19), Aquatic Effects Monitoring Plan (Section 29.3); collection and treatment of seepage from underground workings. Use of best management practices to minimize sediment entry to waterbodies. Dust suppression on roads. Implementation of Soils Management Plan (Section 29.13).	none
Aquatic Resources - Primary and Secondary Producers (Chapter 14)	No adverse impacts on Métis fishing rights	Implementation of ML/ARD Management Plan (Section 29.10), Waste Rock Management Plan (Section 29.18), Water Management Plan (Section 29.19), Aquatic Effects Monitoring Plan (Section 29.3). Use of best management practices to minimize sediment entry to waterbodies. Dust suppression on roads. Implementation of Soils Management Plan (Section 29.13).	none
Fish Habitat (Chapter 15)	No adverse impacts on Métis fishing rights	Use of best management practices to minimize sediment entry to waterbodies. Adhere to DFO's operational statements. Adhere to appropriate construction operating window for instream work and the Soils Management Plan. Riparian re-vegetation. Dust suppression on roads. Site isolation. Water quality maintenance.	none
Fish- Dolly Varden, Bull Trout, Coho Salmon, Sockeye Salmon, Chinook Salmon (Chapter 15)	No adverse impacts on Métis fishing rights	Use of best management practices to minimize fish mortality with construction machinery. Use of best management practices to minimize sediment entry to waterbodies. Adhere to DFO's operational statements. Adhere to appropriate construction operating window for instream work. Site isolation. controlled access. Implement of no fishing policy for employees and contractors. Soils Management Plan (Section 29.13). Riparian re-vegetation. Dust suppression on roads. Water quality maintenance.	none
Rare plants and lichens and rare plant and lichen habitat (Chapter 16)	No adverse impacts to Métis gathering rights	Avoidance, minimize clearing areas and implement biodiversity strategy.	none
Economic and Culturally Important Plants (Chapter 16)	No adverse impacts to Métis gathering rights	N/A	none
Alpine Ecosystems (Chapter 16)	No adverse impacts to Métis gathering rights	Minimize loss; restoration.	none

(continued)

Table 35.3-4. Summary of Impacts on Métis Rights and Interests and Mitigation (completed)

Link to Valued Components	Adverse Impacts on Rights and Interests	Mitigation and Commitments	Outstanding Issues
Parkland Ecosystems (Chapter 16)	No adverse impacts to Métis gathering rights	N/A	none
Floodplain Ecosystems (Chapter 16)	No adverse impacts to Métis gathering rights	Minimize loss and adaptively manage effects through an ecosystem based approach.	none
Forested Ecosystems (Chapter 16)	No adverse impacts to Métis gathering rights	Minimize loss and adaptively manage effects through an ecosystem-based approach.	none
Wetland Function (Chapter 17)	No adverse impacts to Métis gathering rights	Invasive species management, vegetation management, soil management measures along roadways, transportation and access management for the exploration road, wetland monitoring, and environmental effects management and monitoring.	none
Wetland Extent (Chapter 18)	No adverse impacts to Métis gathering rights	N/A	none
Mountain goat (Chapter 18)	No adverse impacts to Métis hunting rights	Road access limited to employees with no public access and regional monitoring. Practising the current BC Guidelines for air traffic near mountain goat habitat. Participate in regional monitoring program.	none
Moose (Chapter 18)	No adverse impacts to Métis hunting rights	Traffic and road management, snow clearing protocol (gaps in snowbanks), regional monitoring and avoid building infrastructure near moose travel networks. Minimize development of new roads, control access on existing project roads and regional monitoring.	none
Grizzly bear (Chapter 18)	No adverse impacts to Métis hunting rights	Reduced speed limits, employee education, shuttling staff to the site to limit traffic, and regional monitoring. Yielding to wildlife, signage along roads, and vegetation management at identified wildlife crossings. Participate in regional monitoring program. Restricting road access, gates at bridge crossings to deter trespassers, and regional monitoring. Waste management protocol, and planting less attractive roadside vegetation	none
Bats (Chapter 18)	No adverse impacts to Métis hunting rights	N/A	none
American marten (Chapter 18)	No adverse impacts to Métis hunting rights	Waste Management Protocol and prohibiting entry into infrastructure.	none
Hoary marmot (Chapter 18)	No adverse impacts to Métis hunting rights	N/A	none
Migratory birds-terrestrial and waterfowl (Chapter 18)	No adverse impacts to Métis hunting rights	N/A	none
Raptors (Chapter 18)	No adverse impacts to Métis hunting rights	N/A	none
Western toad (Chapter 18)	No adverse impacts to Métis hunting rights	Amphibian tunnels and culverts, monitoring, and management plans and adaptive management.	none

Table 35.4-1. Summary of Residual Project and Cumulative Effects and Mitigation Measures

Residual Effects: Environmental	Project Phase(s)	Mitigation Measures	Significance of Residual Project Effects	Significance of Residual Cumulative Effects
Climate Effects (Chapter 12)				
Rise in atmospheric GHG levels	Construction	Fuel and energy efficiency. Complete re-vegetation during Closure, for any area cleared of vegetation.	Not significant	n/a
Rise in atmospheric GHG levels	Operation	Fuel and energy efficiency. Complete re-vegetation during Closure, for any area cleared of vegetation.	Not significant	n/a
Surface Water Quality (Chapter 13)				
Mine Site Area and Receiving Environment				
Change in water quality of receiving environment due to localized increases in sulphate and metal concentrations (contaminants of potential concern: arsenic)	Construction Operation Closure Post-closure	Implementation of ML/ARD Management Plan (Section 29.10), Waste Rock Management Plan (Section 29.18), Tailings Management Plan (Section 29.15), Water Management Plan (Section 29.19), Aquatic Effects Monitoring Plan (Section 29.3).	Not significant	n/a
Change in water quality due to localized increases in sulphate and metal concentrations (contaminants of potential concern: chromium, zinc)	Operation Closure	Implementation of ML/ARD Management Plan (Section 29.10), Waste Rock Management Plan (Section 29.18), Tailings Management Plan (Section 29.15), Water Management Plan (Section 29.19), Aquatic Effects Monitoring Plan (Section 29.3).	Not significant	n/a
Change in water quality due to localized increases in nitrogen as nitrate, nitrite, ammonia (leaching of blasting residues)	Construction Operation Closure Post-closure	Implementation of Waste Rock Management Plan (Section 29.18), Tailings Management Plan (Section 29.15), Water Management Plan (Section 29.19), Aquatic Effects Monitoring Plan (Section 29.3).	Not significant	n/a
Change in water quality of receiving environment due erosion and sedimentation	Construction Operation Closure Post-closure	Use of best management practices to minimize sediment entry to waterbodies; Dust suppression on roads; Implementation of Soils Management Plan (Section 29.13), Water Management Plan (Section 29.19), Aquatic Effects Monitoring Plan (Section 29.3).	Not significant	n/a
Off-site Areas (Ancillary Project Infrastructure)				
Change in water quality of receiving environment	Construction Operation Closure	Implementation of ML/ARD Management Plan (Section 29.10), Soils Management Plan (Section 29.13), Best Management Practices (BMPs).	Not significant	n/a

(continued)

Table 35.4-1. Summary of Residual Project and Cumulative Effects and Mitigation Measures (continued)

Residual Effects: Environmental	Project Phase(s)	Mitigation Measures	Significance of Residual Project Effects	Significance of Residual Cumulative Effects
Aquatic Resources (Chapter 14)				
Mine Site Area				
Erosion and sedimentation	Construction Operation Closure Post-closure	Use of BMPs to minimize sediment entry to waterbodies. Dust suppression on roads. Tailings deposition to the deepest section of Brucejack Lake (eastern portion of lake), with subaquaeous discharge designed to add tailings to the deepest area into sand filter. Implementation of Soil Management Plan (Section 29.13), Water Management Plan (Section 29.19), Aquatic Effects Monitoring Plan (Section 29.3).	Not significant	n/a
Change in surface water quantity	Closure	Use of BMPs and engineered water management structures to maintain natural drainage networks, as much as feasible. Diversion of non-contact water into existing water courses. Implementation of Water Management Plan (29.19).	Not significant	n/a
Change in surface water quality	Construction Operation Closure Post-closure	Implementation of ML/ARD Management Plan (Section 29.10), Waste Rock Management Plan (Section 29.18), Tailings Management Plan (Section 29.15), Water Management Plan (Section 29.19), Aquatic Effects Monitoring Plan (Section 29.3).	Not significant	n/a
Change in sediment quality	Construction Operation Closure Post-closure	Use of BMPs to minimize sediment entry to waterbodies. Dust suppression on roads. Implementation of ML/ARD Management Plan (Section 29.10), Waste Rock Management Plan (Section 29.18), Soil Management Plan (Section 29.13), Water Management Plan (Section 29.19), Aquatic Effects Monitoring Plan (Section 29.3).	Not significant	n/a
Habitat loss	Construction Operation Closure	Tailings deposition to the deepest section of Brucejack Lake (eastern portion of lake), with subaqueous discharge designed to add tailings to the deepest area into sand filter.	Not significant	n/a
Off-site Project Infrastructure Areas				
Change in surface water quality	Construction Operation Closure	Implementation of ML/ARD Management Plan (Section 29.10), Waste Rock Management Plan (Section 29.18), Tailings Management Plan (Section 29.15), Water Management Plan (Section 29.19), and Aquatic Effects Monitoring Plan (Section 29.3).	Not significant	n/a

(continued)

Table 35.4-1. Summary of Residual Project and Cumulative Effects and Mitigation Measures (continued)

Residual Effects: Environmental	Project Phase(s)	Mitigation Measures	Significance of Residual Project Effects	Significance of Residual Cumulative Effects
Fish and Fish Habitat (Chapter 15)				
Fish				
Blunt tissue trauma	Construction Operation Closure	Use of best management practices to minimize fish mortality with construction machinery; Adhere to DFO's operational statements. Adhere to appropriate construction operating window for instream work. Site isolation. Controlled access. Implement of no fishing policy for employees and contractors.	Not significant	Not significant
Erosion and sedimentation	Construction Operation Closure	Use of best management practices to minimize sediment entry to waterbodies. Adhere to DFO's operational statements. Adhere to appropriate construction operating window for instream work and the Soils Management Plan. Riparian re-vegetation. Dust suppression on roads. Work site isolation. Water quality maintenance.	Not significant	Not significant
Fish Habitat				
Erosion and sedimentation	Construction Operation Closure	Use of best management practices to minimize sediment entry to waterbodies; Adhere to DFO's operational statements; Adhere to appropriate construction operating window for instream work and the Soils Management Plan; Riparian re-vegetation; Dust suppression on roads; work site isolation; water quality maintenance.	Not significant	Not significant
Terrestrial Ecology (Chapter 16)				
Alpine Ecosystems				
Loss and/or alteration of ecosystem function and extent	Construction Operation	Minimize loss; reclamation	Not significant	Not significant
Forested Ecosystems				
Alteration of ecosystem function and extent	Construction Operation	Minimize loss and adaptively manage effects.	Not significant	Not significant
Floodplain Ecosystems				
Alteration of ecosystem function and extent	Construction Operation	Minimize loss and adaptively manage effects.	Not significant	Not significant

(continued)

Table 35.4-1. Summary of Residual Project and Cumulative Effects and Mitigation Measures (continued)

Residual Effects: Environmental	Project Phase(s)	Mitigation Measures	Significance of Residual Project Effects	Significance of Residual Cumulative Effects
Terrestrial Ecology (Chapter 16; continued)				
Rare Plants and Lichen				
Loss of species and/ or loss or alteration of habitat	Construction and/or Operation	Avoidance, minimize clearing areas and implement biodiversity strategy.	Not significant	Not determined
Wetlands (Chapter 17)				
Wetland Function	Construction Operation Closure Post-closure	Invasive species management, vegetation management, soil management measures along roadways, transportation and access management for the exploration road, wetland monitoring, and environmental effects management and monitoring.	Not significant	Not significant
Wetland Extent	Construction Operation	N/A	N/A	Not significant
Wildlife (Chapter 18)				
Moose				
Disruption of Movement	Construction Operation	Traffic and road management, snow clearing protocol (gaps in snowbanks), regional monitoring and avoid building infrastructure near moose travel networks.	Not significant	Not significant
Direct Mortality and Injury	Construction Operation	Traffic, road management and monitoring.	Not significant	Not significant
Indirect Mortality	Construction Operation Closure Post-closure	Minimize development of new roads, control access on existing project roads and regional monitoring.	Not significant	Not significant
Mountain Goat				
Sensory Disturbance	Construction Operation	Practising the current BC Guidelines for air traffic near mountain goat habitat. Participate in monitoring program.	Not significant	Not significant
Indirect Mortality	Construction Operation Closure Post-closure	Road access limited to employees with no public access and regional monitoring.	Not significant	Not significant

(continued)

Table 35.4-1. Summary of Residual Project and Cumulative Effects and Mitigation Measures (continued)

Residual Effects: Environmental	Project Phase(s)	Mitigation Measures	Significance of Residual Project Effects	Significance of Residual Cumulative Effects
Wildlife (Chapter 18; continued)				
Grizzly Bear				
Disruption of Movement	Construction Operation	Reduced speed limits and employee education, shuttling staff to the site to limit traffic.	Not significant	Not significant
Direct Mortality and Injury	Construction Operation	Yielding to wildlife, signage along roads, and vegetation management at identified wildlife crossings.	Not significant	Not significant
Indirect Mortality	Construction Operation Closure Post-closure	Restricting road access and gates at the entrance to the access road to deter trespassers.	Not significant	Not significant
Attractants	Construction Operation	Waste management protocol, and planting less attractive roadside vegetation.	Not significant	Not significant
American Marten				
Attractants	Construction Operation	Waste Management Protocol and deter entry into infrastructure.	Not significant	Not significant
Western Toad				
Direct Mortality and Injury	Construction Operation	Amphibian tunnels and culverts, monitoring, and management plans and adaptive management.	Not significant	Not significant
Economic (Chapter 19)				
Labour Market				
Increase in competition for labour and wage inflation	Construction Operation	Communications with Aboriginal and non-Aboriginal communities; communications with educational institutions, human resources policies and programs. Mitigation measures developed by other projects.	Not significant	Not significant
Decrease in employment at Closure	Closure	Communications with Aboriginal and non-Aboriginal communities; workforce transition programs. Mitigation measures developed by other projects.	Not significant	Not significant

(continued)

Table 35.4-1. Summary of Residual Project and Cumulative Effects and Mitigation Measures (continued)

Residual Effects: Environmental	Project Phase(s)	Mitigation Measures	Significance of Residual Project Effects	Significance of Residual Cumulative Effects
Social (Chapter 20)				
Education, Skills Development, and Training				
Increase in demand for educational programs in the LSA	Construction Operation	Communicate Project development and workforce schedule with LSA communities and educational institutions; Proponent to work with government and other proponents when and where appropriate at the regional and local levels.	Not significant	Not significant
Community Infrastructure, Services, and Housing				
Increase in demand for infrastructure and housing as a result of population in-migration	Construction Operation	Communicate Project development and workforce schedule with LSA communities; Proponent to work with government and other proponents when and where appropriate at the regional and local levels.	Not significant	Not significant
Increase in demand on health and social services	Construction Operation	Communicate Project development and workforce schedule with LSA communities; Proponent to work with government and other proponents when and where appropriate at the regional and local levels.	Not significant	Not significant
Family and Worker Well-being				
Increase in transient workers in LSA communities	Construction Operation	Communicate Project development and workforce schedule with LSA communities; Proponent to work with government and other proponents when and where appropriate at the regional and local levels.	Not significant	Not significant
Increase in stress levels and anxiety on families due to work schedule	Construction Operation	Employee assistance program; Proponent to work with government and other proponents when and where appropriate at the regional and local levels.	Not significant	Not significant
Increased in poor lifestyle choices	Construction Operation	Human resource policies and employee assistance program; Proponent to work with government and other proponents when and where appropriate at the regional and local levels.	Not significant	Not significant

(continued)

Table 35.4-1. Summary of Residual Project and Cumulative Effects and Mitigation Measures (continued)

Residual Effects: Environmental	Project Phase(s)	Mitigation Measures	Significance of Residual Project Effects	Significance of Residual Cumulative Effects
Health (Chapter 21)				
Health Effects due to Air Quality				
Health Effects due to SO_2, NO_2, TSP, PM_{10} , and $PM_{2.5}$ emissions (Workers at camps and non-workers)	Construction Operation	Air quality will be monitored and mitigation strategies will be adjusted accordingly to meet BC MOE Air Quality Standards and Air Quality Management Plan. Emission control systems (e.g., scrubbers, bughouses, and filters) will be used on stack and relevant ventilation systems to reduce emissions. Vehicles will be maintained regularly, using diesel with lower sulphur content, using add-ons such as cabin heaters to reduce idling, optimizing driving speed to reduce fuel usage and fugitive road dust, use larger haul trucks to minimize the number of trips required, minimize drop distance of material into surge bin, stockpiles or between conveyor belts. Mitigation Measures included in the project design, such as underground mining process. Maintenance of equipment and vehicles on a regular basis. Watering unpaved access road to maintain a minimum of a 2% moisture ratio and achieving at least 75% of dust control efficiency.	Not significant	Not significant
Heritage (Chapter 22)				
Disturbance of archaeological sites protected by the *Heritage Conservation Act* (1996a).	Construction Operation Closure	Avoidance, education, mitigation, Heritage Management Plan.	Not significant	Not significant
Navigation (Chapter 23)				
Ability to safely navigate Ability to access navigable waters	Construction Operation Closure Post-closure	Appropriate signage while works are being constructed or removed from waterways. Aerial cables and bridge decks will be installed at heights that do not interfere with navigation. Clear-span bridge designs. Any Project personnel operating boats on the lake will be made aware of any hazards, if any exist, and appropriate signage will be displayed.	Not significant	Not significant

(continued)

Table 35.4-1. Summary of Residual Project and Cumulative Effects and Mitigation Measures (completed)

Residual Effects: Environmental	Project Phase(s)	Mitigation Measures	Significance of Residual Project Effects	Significance of Residual Cumulative Effects
Commercial and Non-commercial Land Use (Chapter 24)				
Commercial Land Use				
Change in the experience of the natural environment (relevant to commercial licence 6406985).	Construction Operation	Noise Management Plan (Section 29.11), Transportation and Access Management Plan (Section 29.16).	Not significant	Not significant
Change to the abundance and distribution of wildlife resources (relevant to guide outfitter licence 601036).	Construction Operation Closure	Wildlife Management and Monitoring Plan (Section 29.21).	Not significant	Not significant
Current Use of Lands and Resources for Traditional Purposes (Chapter 25)				
Hunting and Trapping Opportunities and Practices				
Change in location, timing, and amount of wildlife harvested by Skii km Lax Ha, and displacement of hunting and trapping activities due to change in the abundance and distribution of resources.	Construction Operation	Access restrictions and speed limits, no hunting policy for employees, Wildlife Management and Monitoring Plan (Section 29.21), helicopter flight paths (Chapter 18, Section 18.5).	Not significant	Not significant

[1] Increased annual runoff values and increased low flows were not considered as negative impacts, and therefore no further assessment was undertaken.
[2] No interaction with other projects was identified.
[3] The increase is expected to be less than 1%.
n/a = not applicable: CEA is not possible for Project level GHG emissions (CEA Agency 2003)

35.4.1 Predictive Studies: Summaries and Conclusions

35.4.1.1 Air Quality

Project-related emissions within the Regional Study Area (RSA) originating from the Project were estimated and the dispersion of Project-related emissions through the atmosphere was predicted. The predicted incremental concentration and deposition rates were added to baseline levels to determine predicted air quality concentrations with the Project. The results showed increase in concentrations and depositions. Infrequent exceedances, with limited extent, were predicted for PM_{10} during Construction (six days in a year or 1.6% of the time) and Operation (one day in a year or 0.3% of the time). Dust deposition also exceeded the BC objective with limited extent from the sources.

Cumulative effects were assessed assuming the Brucejack Gold Mine Project and KSM Project will be operating at the same time. Increased CAC concentrations and dust deposition was predicted for the cumulative effect; however only PM_{10} exceedances and dust deposition were predicted, which is consistent with the Project-only changes.

35.4.1.2 Noise

The assessment of Project-generated noise was undertaken in line with relevant legislation, policies and current best practices. Noise sources will include equipment, vehicles, fixed wing and helicopter traffic, diesel power generation (Construction phase only), and blasting. Predictions based on noise modelling showed that Project-generated noise during the Construction and Operation phases will exceed criteria for sleep disturbance at the majority of the workers' accommodation receptors and at the Skii km Lax Ha Lodge.

Noise generated by helicopters is predicted to exceed relevant wildlife criteria at 19 receptors and continuous construction noise is predicted to exceed relevant wildlife criteria at one modelled receptor.

As an intermediate component, a description of potential effects of the Project on noise, relevant mitigation measures, and predicted changes to noise are provided in this chapter. The determination of significance of changes to noise on relevant receptor VCs is presented in Chapter 18, Assessment of Potential Wildlife Effects, and Chapter 21, Assessment of Potential Health Effects. A Noise Management Plan (see Section 29.11) provides measures to control the noise sources, i.e., to reduce the overall noise generated by the Project.

35.4.1.3 Hydrogeology

Groundwater quantity and quality were identified as key components of the biophysical environment because of linkages to other ecosystem components, including surface water quantity, surface water quality, human health, aquatic resources, and wetlands. The primary effect through groundwater quantity is manifest prior to the Closure phase, when baseflow is reduced to some surface-water receptors in the Local Study Area (LSA).

The primary effect through groundwater quality will be Post-closure, as water affected by metal leaching/acid rock drainage (ML/ARD) processes migrates through the subsurface towards surface water receptors. These effects have been captured in Chapter 10, Surface Water Hydrology Predictive Study, and Chapter 13, Assessment of Potential Surface Water Quality Effects. Change in groundwater quality related to mine cut and fills and the quarry may be experienced during all phases of the Project, although the non-PAG quarry site and ML/ARD Management Plan (Section 29.10), Tailings Management Plan (Section 29.15), Waste Rock Management Plan (Section 29.18), and Water Management Plan (Section 29.19) will limit the amount of groundwater affected.

The current Project is an expansion of both the Sulphurets Advanced Exploration Project and the Brucejack Exploration Bulk Sample Program. Changes in hydrogeology from the current Project will be superimposed on the small changes that might remain from the previous projects. Any legacy effects from the prior projects have been accounted for in the baseline studies. Thus, there no cumulative effects were identified.

35.4.1.4 Surface Water Hydrology

Potential effects on surface water hydrology indicators include streamflows, channel morphology, and glaciers.

Brucejack Mine Site activities are expected to influence streamflows by decreasing the low flows at BJL-H1 by up to 24% during the Closure phase. These changes are spatially confined to the LSA boundary, and temporally limited to the Closure phase (i.e., two years).

Culverts in the Wildfire Creek watershed are expected to affect the channel morphology of their down-drainage slopes by increasing gully formation and potentially downslope mass movements. Based on a preliminary assessment, channel morphologies at the Wildfire Creek Bridge,[5] and at low gradient unconfined bridges (i.e., bridges #18 to 21), are less stable than other access road bridges. Channel morphology could be sensitive to maintenance and decommissioning activities at these bridges.

As far as glaciers are concerned, dustfall levels are predicted to increase by up to 0.24 $mgdm^2$/day on the lower 3 km of the Knipple Glacier during the Project's Construction and Operation phases. However, the conservative nature of the dustfall modelling results is acknowledged.

35.4.1.5 Terrain and Soils

The Project will result in potential loss of 63.9 ha of ecologically functional soil. However, the loss of soil must be seen in the context of the Brucejack Mine Site being located on a gossan that is void of actual soil and the generally low ecological function of soil in the area. The Project will result in the alteration of 927.6 ha, and the degradation of 187.3 ha of low-value ecologically functional soil.

Key mitigation measures will be to minimize clearing activities, stockpile soils, and non-soil materials for eventual use in reclamation, and follow best management practise for soil handling. Project related effects to terrain stability will be mitigated by appropriate geotechnical and engineering design measures.

Considered cumulatively with other past, present, and future projects in the Unuk and Lower Bell-Irving watersheds, Project activities would account for less than 1% increase in the area of soils lost or degraded. Residual changes to soils are considered in Chapter 16, Assessment of Potential Terrestrial Ecology Effects, and Chapter 21, Assessment of Potential Health Effects (country foods).

35.4.2 Biophysical Assessments: Summaries and Conclusions

35.4.2.1 Climate

The Project will produce greenhouse gas (GHG) emissions throughout its life due to fuel and energy requirements as well as land-use change. GHG emissions will primarily occur during the Construction and Operation phases and will be negligible during the Closure and Post-closure phases. Construction

[5] The structural abutments of the bridge are nevertheless located on bedrock.

and Operation emissions have been compared against the national reporting threshold, as well as against mining sector norms in BC, in order to determine the significance of the effects of a rise in global atmospheric GHG levels on the climate due to Project GHG emissions. This comparative method is consistent with guidance by the Canadian Environmental Assessment Agency (CEA Agency; 2003) and the majority of Canadian environmental assessments as an alternative to assessing the cumulative effects of project GHG emissions.

The Project will emit an estimated annual average of 62 kt CO_2e/year during the Construction phase and 36 kt CO_2e/year during the Operation phase at the facility-level (Scopes 1 to 3). Land-use change is estimated to result in zero net GHG emissions after mitigation is applied. The estimated facility-level residual GHG emissions are considered negligible when compared to international, national, and provincial anthropogenic GHG emission levels, and are considered low when compared to industry norms for metal mining. Therefore, the residual effect on climate of increasing atmospheric GHG levels is rated as **not significant** for the Construction and Operation phases.

Although Project GHG emissions have been assessed as minor compared to the global atmospheric pool, it is expected that the Project will emit enough Scope 1 facility-level GHGs during the Construction phase (62 kt CO_2e/year) to require reporting to Environment Canada and the British Columbia Ministry of Environment (BC MOE), as well as verification by a third party. During the Operation phase, it is expected that the Scope 1 facility-level GHG emissions (31 kt CO_2e/year) will only need to be reported to the BC MOE and verified by a third party. GHG emissions can be reported to both Environment Canada and the BC MOE through the online Single Window reporting system (BC MOE 2011).

The Proponent will monitor the Project GHG footprint over the Project life and mitigate potential effects through the implementation of fuel and energy efficiency improvements and other measures as outlined in Section 29.2, Air Quality Management Plan.

35.4.2.2 Surface Water

Surface water quality a is key indicator of environmental health as it is linked to other important ecosystem components including fish and fish habitat, aquatic resources (primary and secondary producers, sediment quality), soil, vegetation, wildlife, and human health. The effects assessment included several different pathways through which surface water quality can be affected by Project activities, many of which overlap in terms of definition and scope.

Project related activities at Brucejack Lake and Brucejack Creek are not expected to affect surface water quality of mid- and far-field receiving environments (Sulphurets and Unuk watersheds). Therefore no cumulative effects are expected with any past, present, or reasonably foreseeable projects or activities.

In off-site areas, the potential residual effects on surface water quality were associated with ML/ARD, nitrogen leaching from blasting residues, as well as erosion and sedimentation. Considering these potential effects on surface water quality in combination with Project infrastructure in the LSA and RSA, and mitigation to minimize effects, the overall potential Project-related residual effect on surface water is assessed as **not significant** for all residual effects. No cumulative effects are expected.

Based on the environmental effects assessment, the residual effect for the Brucejack Mine Site is assessed as **not significant**, and the residual effect for off-site areas (ancillary Project infrastructure) is assessed as **not significant**.

35.4.2.3 Aquatic Resources

The proposed Project could affect aquatic resources thorough the physical and chemical alteration of their habitat. Generally, the Project area is characterized by aquatic communities with low productivity and low abundances of aquatic organisms, which is typical for high-altitude ecosystems in the region.

The residual effects from changes in surface water quantity, predicted from the quantitative site water balance model, will result in a short-term decrease in the available aquatic habitat in Brucejack Creek during the Closure phase. This decrease will be restricted to less than two years, and aquatic resources are predicted to fully recover. The residual effect on aquatic resources from these predicted changes in surface water quantity is assessed to be not significant.

The possible residual effects from changes in surface water quality, predicted from one of the sensitivity analyses of the quantitative water quality model results, are associated with increases in the concentrations of arsenic, chromium, and zinc due to ML/ARD and increases in nutrient concentrations from blasting residues and operation of the sewage treatment plant. Although the increases in metal concentrations may be greater than relevant BC water quality guidelines, the subsequent effects on aquatic organisms are predicted to be modest and short-lived, and aquatic resources are predicted to fully recover once metal concentrations in Brucejack Creek decrease. The residual effects on aquatic resources from ML/ARD and nutrient loading are predicted to be not significant.

The residual effects from changes in sediment quality are predicted to be minor because of the elevated natural sediment metal concentrations and the relatively small predicted changes in water quality, suspended sediment concentrations and stream flows. The potential for additional changes from the Project are minor and predicted to be within the range of natural variation when the natural background of sediment metal concentrations are considered. Therefore, the residual effects on aquatic resources from changes in sediment quality are predicted to be not significant.

The residual effects from habitat loss are predicted to result from the deposition of waste rock and tailings in Brucejack Lake. This habitat loss will occur across the majority of the bottom of the lake, and will only be reversible by natural re-colonization over longer time scales. However, the ecological context of Brucejack Lake is low—it is a typical high-alpine, fishless lake with no known unique ecological features. As a result, the residual effect is considered to be not significant.

In the off-site Project infrastructure areas, the residual effect from erosion and sedimentation is predicted to be not significant. Although Project activities may result in short-term increases in the concentration of suspended material and the deposition of sediments in the freshwater receiving environment, the mitigation and management measures are predicted to be largely effective, and the increases will be short-term and spatially restricted to the freshwater environment local to the Project infrastructure. Aquatic resources are predicted to be resilient to these modest changes in sediment loading.

Based on the environmental effects assessment, the residual effects of Project activities on aquatic resources for the mine site area is assessed as not significant, and the residual effect for off-site Project infrastructure areas is assessed as not significant.

35.4.2.4 Fish and Fish Habitat

Residual non-significant effects for fish are direct mortality, erosion and sedimentation, and change in water quality. There is negligible potential that Brucejack Lake discharge will lead to an increase in fish tissue metal concentrations downstream in Lower Sulphurets Creek (below the cascades) or in the Unuk River.

There is no anticipated Project-specific fish habitat loss caused through the construction, operation, and closure of Project infrastructure. Overall, potential Project-related residual effects on fish habitat were assessed as **not significant**.

35.4.2.5 Terrestrial Ecology

The Project-related residual effects of loss and/or alteration of ecosystem function or extent will not result in significant effects on alpine, parkland, forested, and floodplain ecosystems and culturally/ economically important plant habitat. The Project-related residual effects of loss and/or alteration of rare plant and lichen species or associated habitat will not result in a significant effect.

The cumulative loss of terrestrial ecosystems within the cumulative effects assessment (CEA) boundary—excluding the Project—is 5,358 ha (1.7%). The Project may result in the potential disturbance of 217 ha (0.1%) of alpine ecosystems, 178 ha (0.12%) of forested ecosystems, and 15 ha (0.19%) of floodplain ecosystems. The cumulative loss of terrestrial ecosystems within the CEA boundary—including the Project—is 5,769 ha (1.9%), including 1,706 ha (1.1%) of alpine ecosystems; 4,051 ha (2.8%) of forested ecosystems, and 225 ha (2.8%) of floodplain ecosystems. The Project will contribute approximately 7.1% of the total cumulative loss of ecosystems expected within the CEA boundary.

The cumulative alteration of terrestrial ecosystems within the CEA boundary—excluding the Project—is 20,582 ha (6.6 %). The Project may result in the alteration of 196 ha (0.1%) of alpine ecosystems, 983 ha (0.7%) of forested ecosystems, and 102 ha (1.3%) of floodplain ecosystems. The cumulative alteration of terrestrial ecosystems within the CEA boundary—including the Project—is 21,806 ha (7.0%), including 3,442 ha (2.1%) of alpine ecosystems; 17,654 ha (12.16%) of forested ecosystems, and 710 ha (8.69%) of floodplain ecosystems. The Project will contribute approximately 5.9% of the total cumulative alteration of ecosystems expected within the CEA boundary.

The Project's residual effects, in combination with the residual effects of past, present, and future projects, will not result in significant effects on alpine, forested, and floodplain ecosystems. Parkland ecosystems and culturally/economically important plant habitat were not included in the CEA because effects to these receptor VCs are expected to be undetectable. The Project's residual effect on rare plants and lichens is expected to be **not significant**. The significance of cumulative residual effects of loss and/or alteration of rare plant and lichen species or associated habitat cannot be determined based on currently available information.

35.4.2.6 Wetlands

Alteration of wetland function is rated as low in magnitude. As shown by the probability and consequence model, 6 and 12% of wetlands are in high and moderate risk, respectively. The probability of effects on hydrological, biochemical, functional diversity, or habitat function will be minimized through adherence to the mitigation and management strategies described within Chapter 29, Environmental Management and Monitoring Plans.

Alteration of wetland function is local in extent, as it occurs directly adjacent to the exploration access road and Brucejack Mine Site. The use of weighted buffers to model effects of hydrological connectivity, fragmentation, edge effects, dust, sedimentation/water quality, and exotic invasive species were chosen to model Project effects on function, as effects generally decrease with increasing distance from the causal agent. The weighted buffers also facilitated the contribution of each effect to the final assessment of probability, ensuring that minor effects (such as invasive species in this case) were not over emphasized and potentially important effects (such as changes to hydrologic connectivity) were allotted appropriate weighting.

The effects of alteration of wetland functions are generally reversible in the long term (e.g., after Construction, Closure, and Post-closure activities are complete), except where infrastructure such as roads and transmission lines are not reclaimed, as continued use may degrade adjacent ecosystems. Wetlands are sensitive to disturbance, have low resiliency compared to most upland ecosystems, and recover more slowly in many cases. Implementing management plans to help ameliorate impacts during the life of the mine will help in the restoration of wetland functions during the Post-closure phase.

It is expected that effects will not occur uniformly throughout the buffers used to model probability of function alteration. Uncertainty exists with respect to where and to what degree alteration of functions may occur. As a result, alteration of function may exceed or fall short of the chosen buffers or have a lesser or greater effect. However, the approach to selecting the buffer sizes and the weights assigned to each effect was precautionary to avoid underestimating the potential Project effects. In summary, the potential residual effects of the proposed Project on wetlands are considered to be **not significant.**

Cumulative effects for the Project and projects within or directly adjacent to the RSA were assessed. The KSM, NTL, Long Lake Hydroelectric, Treaty Creek Hydroelectric, Brucejack Exploration, and Sulphurets projects were reviewed in the CEA. Data were not available for wetland extent and effects on function for the Sulphurets, Long Lake, and Treaty Creek projects; however, the KSM, Brucejack Exploration, and NTL projects had information on wetland extent and function effects.

A residual cumulative effect on the loss of wetland extent and alteration of function is expected due to additive losses in the region. However, this effect is not expected to be significant, because of the limited loss of wetlands associated with the Brucejack Exploration Project and limited alteration of function associated with the proposed Brucejack Gold Mine Project. Compensation and reclamation activities planned for the KSM Project will also mitigate cumulative effects on regional wetland extent and function. The NTL environmental assessment identified that less than 7% of wetlands along the right-of-way would be affected, which is similar to the Brucejack Gold Mine Project (Table 17.11-1; Rescan 2010). The potential cumulative effects of the proposed Brucejack Gold Mine Project and other projects in the area on wetland extent and function are considered to be **not significant**.

35.4.2.7 Wildlife

The scoping process identified 10 wildlife receptor VCs: moose, mountain goat, grizzly bear, American marten, hoary marmots, bats, raptors, migratory waterbirds, migratory land birds, and western toads. Potential effects on wildlife include: 1) habitat loss and alteration; 2) sensory disturbance; 3) disruption of movement; 4) direct mortality; 5) indirect mortality; 6) attractants; and 7) chemical hazards. Despite application of mitigation measures, residual effects are predicted for five receptor VCs: moose, mountain goat, grizzly bear, American marten, and western toad. Low-magnitude effects are predicted for all of the individual effects on each sub-component. Medium-magnitude effects are predicted for the overall additive effect (i.e., all residual effects acting synergistically on the VC) for moose and grizzly bears. However, through implementation of mitigation and monitoring, no residual effects associated with the Project are assessed as significant.

An assessment of cumulative effects was also conducted, which evaluated the effects of the Project in addition to other mining projects, hydroelectric projects, forestry, and other land use activities in the area. A scoping process identified which wildlife VCs, additional projects, and potential effects were to be evaluated (Section 18.9, Cumulative Effects Assessment for Wildlife). The five wildlife VCs with residual effects were evaluated (moose, mountain goat, grizzly bear, American marten, and western toad). No significant residual effects due to cumulative effects were predicted for any of the VCs.

Several species or groups were evaluated in the scoping section and excluded from the assessment as potential VCs because other species with similar habitat requirements were selected as a VC and could act as a proxy for other species. Fisher and wolverine were considered to have similar responses as American marten and grizzly bear assessments. Hence, potential residual effects on fisher and wolverine due to the Project are also considered not significant. Lynx, fox, coyote, and weasel were considered to have the same responses as the American marten assessment; therefore, potential residual effects on these four species are also considered not significant. Wolf was considered under the moose assessment, as moose are a primary prey source for wolf. The potential residual effects on wolf from the Project are therefore also considered not significant.

Northern goshawk, short-eared owl, trumpeter swan, grouse, ptarmigan, olive-sided flycatcher, rusty black bird, and common nighthawk were not considered separate VCs for this assessment because any potential effects on these species would be addressed in the raptor, waterbird, and landbird assessments. After implementation of mitigation, no residual effects were predicted for all avian species. Hence, no residual effects were predicted for the five *Species at Risk Act* (2002)-listed bird species (short-eared owl, northern goshawk, olive-sided flycatcher, rusty blackbird, and common nighthawk), or on trumpeter swan, grouse, and ptarmigan.

Frog species, such as wood frogs and Columbia spotted frogs, were excluded from the assessment because any potential effects on the species are addressed in the assessment of alteration to wetland extent in the wetlands section (Chapter 17, Assessment of Potential Wetlands Effects). The magnitude of the effects of the Project on wetlands is expected to be low, thus the interactions were not considered important. Therefore, potential residual effects on wood frogs and Columbia spotted frogs are also considered not significant.

35.4.3 Human Environment Assessments: Summaries and Conclusions

35.4.3.1 Economic

Potential economic effects of the Project include effects related to employment and labour, and procurement of goods and services. These effects are expected to interact with one economic VC: labour market. Labour market in the LSA communities is expected to experience two adverse residual economic effects including: 1) increased competition for labour and wage inflation; and 2) decrease in employment at Closure. These adverse residual effects on the labour market are expected to occur during Construction, Operation, and Closure. The effects on the “increased competition for labour and wage inflation” will be mitigated through engagement with Aboriginal and non-Aboriginal communities in the LSA, as well as educational institutions and other interested stakeholders, to communicate the Project development schedule and workforce requirements. The effect on the “decrease in employment at Closure” will be mitigated through the communication of the Project Closure in advance and the provision of support services assisting workers with job transition.

After mitigation measures have been implemented, the magnitude of residual effects is expected to be moderate, with moderate magnitude expected for the decrease in employment at Closure. This is due to the share of residents in LSA communities that are expected to experience Project-related employment and be affected by the Closure of the mine at the end of Operation. In sum, all adverse residual effects of the Project on the economic environment are rated **not significant**.

Two adverse residual Project effects were carried forward for the CEA. In addition to the Project-specific mitigation, there may be additional mitigation required to address cumulative effects. Specifically, it is assumed that the proponents of other projects and activities, in particular other mine developments in the RSA, will implement mitigation and benefit enhancement measures that are

similar to those identified for the Brucejack Gold Mine Project. In sum, the two adverse residual cumulative effects on the economic environment (i.e., increased competition for skilled labour and wage inflation; decreased employment at Closure) are rated **not significant** as they are expected to be moderate in magnitude. There may be competition for skilled labour with the planned construction of new developments in the region; however, the specialized skillsets and qualifications of workers required for the Brucejack Gold Mine Project may not necessarily overlap with the requirements for workers at other projects in the region. Further, it is unknown how many of the proposed projects will proceed and interact with the Project. For the second effect, the coinciding closure of future projects and resulting termination of employment may cause the unemployment rate to deviate from historical baseline variations, should most of the proposed projects be constructed. If only a few of the proposed projects proceed, or the closure of future projects do not coincide, then changes are predicted to be similar to what has been previously experienced in the region

35.4.3.2 Social

The proposed Project is expected to result in a number of social effects. Specifically, activities related to employment and labour, and procurement of goods and services, are expected to interact with three social VCs:

- education, skills development, and training;
- community infrastructure, services and housing; and
- worker and family well-being.

The education, skills development, and training of local communities are expected to change due to Project-related employment and related population in-migration. The two key effects are expected to be an increased demand for educational programs in the LSA (adverse), and changes in the educational profile of the LSA (positive). Only the increased demand for educational programs is predicted to be adverse, as existing institutions with currently limited capacity have difficulty meeting the expected increase in demand. This effect also has a positive aspect, however, as it leads in the longer term to greater capacity for training and education in the region and the delivery of more training to residents of the LSA communities. The effects will be mitigated through communications with local educational institutions, as well as partnerships with Aboriginal communities. Effects are expected to occur mainly during the early period of Operation.

Community infrastructure, services, and housing may also be affected by the Project due to employment and associated population in-migration. The two key effects are expected to be an increased demand for infrastructure and housing (including in Aboriginal communities) as a result of population in-migration, and an increased demand on health and social services. These effects will be mitigated through an Engagement Strategy, engagement with municipal leaders, capacity building for community planning, engagement with Aboriginal leadership, and a Project Health and workforce schedule. These two effects are expected to occur during both Construction and Operation. During the Closure and Post-closure phases, it is expected that there could be a decreased demand for infrastructure and housing as a result of population out-migration. This will be mitigated through a Stakeholder Engagement Strategy and a Closure Plan.

Worker and family well-being may also be affected by the Project due to employment and associated population in-migration. There are three key effects that are predicted during the Construction and Operation phases of the Project: increase in transient workers coming into the LSA communities, increased levels of stress and anxiety on families due to rotational work, and increase in poor lifestyle choices. These effects will be mitigated through a Stakeholder Engagement Strategy, Employee Codes

of Conduct and Human Resources Policies, and an Employee Assistance Program. One potential effect during Closure and Post-closure as it relates to worker and family well-being is an increase in levels of stress and anxiety on workers and families due to uncertainty around future employment and maintaining income. This will be mitigated through a Workforce Transition and Assistance Program and a Closure Plan.

After mitigation measures have been implemented, a number of residual adverse social effects are predicted to occur. However, the magnitude of each residual effect is expected to be relatively low. This is largely due to the relatively modest share of residents in LSA communities that are expected to be employed, as well as the size of the Project itself. In sum, all adverse residual effects of the Project on the social environment are rated **not significant**.

All six adverse residual Project effects were carried forward for the CEA. In addition to the Project-specific mitigation, there will be additional mitigation to address cumulative effects. Specifically, it is assumed that the proponents of other projects and activities, in particular other mine developments in the RSA, will implement mitigation and benefit enhancement measures that are similar to those identified for the Brucejack Gold Mine Project. In sum, all adverse residual cumulative effects on the social environment are rated **not significant**.

35.4.3.3 Health

Human health is a highly valued component for individuals and for society. The assessment included several different pathways through which health can be affected: the effects of noise, the ingestion of the inhalation of air, ingestion of water, and the ingestion of country foods. It is recognized that health is more than just physical well-being. For instance, social, cultural, nutritional, and economic factors also play in a person's overall health status. These health indicators have been assessed in other sections of the Application/EIS. Chapter 21, Assessment of Potential Health Effects, follows a science-based approach recommended by Health Canada to protect people from adverse health effects by exposure to noise and exposure to contaminants of potential concern in air, water, and country foods.

The Project location is remote; therefore, the assessment focused on temporary and seasonal land users: Nisga'a Nation; First Nations; resident hunters, trappers, and berry pickers; recreationalists; guide-outfitters; and trapline holders. While worker health is covered under Occupational Health and Safety Plans, as required by law, the health of off-duty workers was included in the assessment, as required by Health Canada.

The human health assessment relied on data measured during baseline studies, and future modelled noise predictions, air quality, water quality, and country foods quality. These predicted data were used to model and assess potential effects of the proposed Project on human health. There are high uncertainties associated with the models; therefore, highly conservative assumptions were made. This resulted in an overestimation of human health risks.

The following paragraphs summarize the results for the assessment of the four sub-components.

<u>Human Health Effects due to Noise</u>

Noise effects are expected to occur for the Construction and Operation phases at worker camps during off-duty hours and at the Skii km Lax Ha Lodge. Noise effects at worker camps are limited to sleep disturbance. Residence of the Skii km Lax Ha Lodge may experience sleep disturbance, interference with speech communications, and complaints due to noise (% highly annoyed) during the Construction and Operation phases of the Project.

Based on the availability of mitigations in place if monitoring results indicate possible health effects due to elevated noise levels, the residual effect is considered **not significant** at worker camps and non-worker human health receptor locations. Noise levels at the worker camps and non-workers human health receptor location (Skii km Lax Ha Lodge) should be monitored as proposed in the Noise Management Plan (Section 29.11), so if the noise levels at these human health receptor locations exceed guidelines additional mitigation measures are taken to protect human health.

No cumulative residual effects on human health due to noise were identified due to the location of the Project and the logarithmic nature of noise.

Human Health Effects due to Air Quality

The Project is likely to have residual effects on human health from changes in air quality during the Construction and Operation phases. However, these effects have been assessed as **not significant**. Results of the human health residual effects due to air quality for the Construction and Operation phases were based on $PM_{2.5}$ and PM_{10} levels, respectively. This is because $PM_{2.5}$ levels resulted in the highest hazard quotients (HQs) among criteria air contaminants (CACs) during Construction while PM_{10} had the highest HQs among CACs for the Operation phase.

Limited to no risk is expected from predicted SO_2, NO_2, CO, and TSP concentrations since the HQ for these CACs is below 1.0, indicating negligible or low human health effects due to exposure to these parameters. Therefore, the human health residual effects from these CACs are considered not significant. Although predicted PM_{10} and $PM_{2.5}$ levels at some of the worker camps and the Skii km Lax Ha Lodge during the Construction and Operation phases are elevated, the air quality at the camps and Skii km Lax Ha Lodge will be monitored. If a particular area or process results in exceedance of air quality guidelines, further mitigation measures will be instituted. Therefore, residual effects from all CACs are considered **not significant**.

Human Health Effects due to Drinking Water Quality

Since residual drinking water quality effects due to Project infrastructure or activities along the Brucejack Transmission Line or Brucejack Access Road corridors are considered to be negligible (i.e., within the range of natural variability), the magnitude of any potential cumulative residual effect would have to be driven by the interacting project and the overall cumulative residual effect is unlikely to be due to the Brucejack Gold Mine Project. In addition, there are no permanent residents in the area in which Project-related residual effects may occur; therefore, it is unlikely that transient land users would experience high enough exposure levels to have their health adversely affected. Although there are several other current or reasonably foreseeable projects that may have temporal overlap with the Project, no measurable cumulative effects on human health due to water quality are likely due to either lack of spatial overlap in residual effects or lack of technical information to use in the CEA. Therefore, no cumulative effects to human health due to drinking water quality were identified.

Human Health Effects due to Country Foods Quality

Human health effects from the ingestion of country foods have been assessed for the Construction and Operation phases of the Project. However, effects were found to be negligible and have been rated as **not significant**. No cumulative effects due to dustfall are expected. Therefore, no cumulative human health residual effects due to ingestion of country foods are expected either.

35.4.3.4 Heritage

Heritage resources are non-renewable, can be very susceptible to disturbance, and are finite in number. They are protected for their historical, cultural, scientific, and educational value to the

general public, local communities, and Aboriginal groups. In BC, both recorded and as-yet unrecorded archaeological sites are protected by the *Heritage Conservation Act* (1996a), and such sites may be affected by the Project.

Potential effects of the Project on protected archaeological resources will be mitigated and managed through site avoidance, Project personnel education, and implementation of the Heritage Management Plan and Chance Find Procedure. With the application of site avoidance and/or other mitigation and management measures prior to Project impacts, residual effects on known protected archaeological resources are not anticipated and as a result will be negligible and **not significant**. Similarly, implementation of the Project's Chance Find Procedure and Heritage Management Plan will facilitate the protection of any as-yet undiscovered protected heritage resources within the Project footprint, which may be identified during Construction and/or Operation. Therefore, as-yet undiscovered protected heritage resources will be avoided and/or properly mitigated and managed, and residual effects are not anticipated. As residual effects to protected archaeological sites are not anticipated, cumulative effects to protected archaeological sites are also not anticipated.

35.4.3.5 Navigation

Fifty-one transmission line crossings, seven bridge crossings, and subaqueous tailings and waste rock disposal were assessed to determine if they would have an effect on the ability to safely navigate or access navigable waters within the Project region. It was determined that there may be some localized effects of very short duration during construction and decommissioning of the various Project works, but with proper mitigation and management the overall effects will be negligible to minor. In addition, navigation by water is uncommon within the Project region based on a desk-based study, which included a review of historical documents and consultations with various stakeholder groups, including recreational business owners and Aboriginal groups. Pretivm determined that, based on public utility, the only navigable waterway potentially affected by Project activities is Bowser River and none of the other waterways are navigable.

In conclusion, waterways potentially affected by Project works are not expected to be publicly utilized during the duration of the Project. Nevertheless, if waterways are used for public navigation, effects on navigation are expected to be negligible to minor, localized, and temporary in duration. Because the effects on the ability to safely navigate as well as the effects on the ability to access navigable waters were both determined to be negligible to minor, temporary, and local, they are not discussed further in this assessment.

35.4.3.6 Commercial and Non-commercial Land Use

The two valued components considered in the effects assessment included commercial and non-commercial interests. The assessment identified potential residual effects on two commercial tenures. One residual effect is anticipated on guide outfitter licence 60136 due to changes in the abundance and distribution of mountain goat and grizzly bear based on the conclusions reached in wildlife effects assessment for these two wildlife VCs. The second residual effect is on commercial recreation licence 6406985 due to potential noise and visual quality effects. Both residual effects were determined to be **not significant.** The two residual effects were carried forward into the cumulative effects assessment. Residual effects due to cumulative effects on were the two commercial tenures are rated as **not significant**.

35.4.3.7 Current Use of Lands and Resources for Traditional Purposes

Effects included in the assessment of potential effects on current use of lands and resources for traditional purposes included: (1) change in access or ability to access and use land and resource areas;

(2) change in quality of experience of the natural environment; (3) change in the abundance and distribution of resources; and (4) change to the (real or perceived) quality of resources.

Potential effects on Tahltan and Métis fishing, hunting and gathering opportunities and practices, as well as habitations, trails, burial sites and cultural landscapes, are not assessed as there is a lack of information on Tahltan and MNBC use in the Project area to enable an effects assessment. Should the Tahltan and MNBC provide information to the Proponent, it will be considered during the Application/EIS review stage. Potential effects on Nisga'a hunting and gathering opportunities and practices are not assessed as there is a lack of information on Nisga'a use of the Project are to gather plants. Should Nisga'a provide information to the Proponent, it will be considered during the Application/EIS review stage.

After considering mitigation measures, no residual effects due to the Project are predicted on Skii km Lax Ha fishing opportunities and practices, Skii km Lax Ha gathering opportunities and practices, or Skii km Lax Ha habitations, trails, burial sites, and cultural landscapes. One residual effect was predicted on Skki km Lax Ha hunting and trapping opportunities and practices due to a change in the abundance and distribution of wildlife harvested by the Skii km Lax Ha. This effect was predicted to be **not significant**.

In the event that all reasonably foreseeable future projects commence on time and as designed, the cumulative residual effect on Skii km Lax Ha hunting and trapping opportunities and practices, even with the Brucejack Gold Mine Project, is anticipated to be **not significant**. This conclusion was informed by the wildlife cumulative effects assessment (Section 18.9), which determined that no significant adverse cumulative residual effects to moose, mountain goat, grizzly bear, marten, or migratory birds are anticipated.

35.5 FOLLOW-UP PROGRAM

The *Operational Policy Statement for Follow-Up Programs under the Canadian Environmental Assessment Act* (CEA Agency 2011) provides the following definition for follow-up programs from the *Canadian Environmental Assessment Act* (1992):

- to verify the accuracy of the conclusions of the EA process for a designated project; and
- to determine the effectiveness of any measures taken to mitigate the adverse effects of the project.

35.5.1 Verification of Environmental Assessment Conclusions

As far as verifying the accuracy of EA conclusions is concerned, this is contingent on the level of confidence determined as an outcome of the assessment of a particular effect. In the assessment methodology applied in the EA process for the Project, specific reference is made to such levels of confidence for each VC subjected to assessment, both at the project scale as well as at the cumulative scale. The permutations of significance rating, confidence level, and occurrence probability that allowed these conclusions to be reached are presented in each of the biophysical and human environment effects assessments[6] in Parts C and D of the Application/EIS respectively. None of the VCs assessed during the EA process for the Project warrant a verification follow-up program per se.

[6] Note that the predictive studies presented in Part B of the Application/EIS do not reflect significance ratings, since they serve as intermediate components to the effects experienced by receptor VCs.

The Wildlife Management and Monitoring Plan (Section 29.21) makes reference to a follow-up program specifically to determine the suitability and effectiveness of measures implemented to mitigate or compensate for impacts on moose and mountain goats. The envisaged follow-up program will evaluate the implementation and effectiveness of mitigation measures and in this way verify the predictions of the EA and identify opportunities for adaptive management. Given that the program will rely on the monitoring of suitable indicators, its execution can occur within the scope of the determination of mitigation effectiveness dealt with in Section 35.5.2 below.

Similarly, in Chapter 13, Assessment of Potential Surface Water Quality Effects, the assumption is made that the determination of discharge-related potential effects on downstream receiving environments will have to rely on the accuracy of water quality modelling data results. Since this would also be a case of monitoring the relevant indicators and interrogating these insofar downstream effects may need to be subjected to adaptive management, such verification can also occur as part of the determination of mitigation effectiveness dealt with in Section 35.5.2 below.

There were no environmental impacts predicted with respect to Aboriginal peoples and Nisga'a Nation as indicated in Chapter 26, Sections 26.7.1.4 and 26.7.2.4 and Chapter 27, Sections 27.5 and 27.6. Pretivm has developed an approach to responding to outstanding issues (Section 3.7.2.1 in Chapter 3, Information Distribution and Consultation) and will continue to respond to comments from the public in a timely manner. In the event that the public were to express significant and/or widespread concerns about the Project, Pretivm will consider holding additional open houses, and/or targeted meetings with stakeholders (including local governments and tenure holders) as practicable to provide additional information and respond to questions and comments.

35.5.2 Determination of Mitigation Effectiveness (Monitoring)

As far as the determination of mitigation effectiveness is concerned, the follow-up program for the Project will focus largely on the monitoring of such mitigation measures. The importance of monitoring mitigation measures is reflected in the reality of environmental factors changing over time, necessitating adaptive management actions to maintain an acceptable level of environmental performance. Focussing the follow-up program for the Project on the monitoring as prescribed by the array of EMPs also accords with the AIR (BC EAO 2014), and is consistent with the notion that follow-up monitoring can lend support to Pretivm's overarching Environmental Management System (EMS).

Table 35.5-1 presents details of the follow-up monitoring envisaged for the Project according to the particular parameters relevant to each VC or mitigation measure. The phase of the Project when the monitoring would be needed as well as the responsible agency and particular regulatory instrument needing to be adhered to are also provided. Note that follow-up monitoring does not serve the purpose of determining compliance. Compliance monitoring is aimed at the verification of whether stipulated mitigation measures have been carried out, whereas follow-up monitoring is aimed at determining whether mitigation measures have been effective. In the context of the follow-up program described here, the latter is clearly the case.

A fundamental underpinning to follow-up monitoring is that it allows for adaptive management to be applied, typically in response to stipulated thresholds not being achieved, unacceptable changes occurring in the condition of an environmental receptor, or new factors becoming apparent. Adaptive management will thus provide an effective means of minimizing the effects of the Project where such effects are shown, through follow-up monitoring, to warrant it. The actions applied in bringing about adaptive management will also receive ongoing monitoring, in a system of continual improvement based on the cycle of planning, implementing, checking, and acting inherent in Pretivm's EMS.

Table 35.5-1. Follow-up Monitoring Requirements

Monitoring Parameter	Project Phase	Agency/Instrument
Air Quality and Climate Monitoring of the following air quality parameters will be undertaken: • meteorological conditions; • nitrogen dioxide, sulphur dioxide and ozone by means of passive air sampling; • dustfall; and • GHG emissions (for reporting on CO_2e when required).	Construction Operation Closure	BC EAO/EA Certificate BC MOE/*Environmental Management Act* (2003) Air Permit
Aquatic Effects Given that aquatic pathways are embedded within numerous components of the biophysical environment, aquatic effects monitoring will rely on commitments contained in the following subject-specific plans: • Air Quality Management Plan (Section 29.2); • Hazardous Materials Management Plan (Section 29.7); • ML/ARD Management Plan Section (29.10); • Soils Management Plan (Section 29.13); • Spill Prevention and Response Plan (Section 29.14); • Waste Rock Management Plan (Section 29.18); and • Water Management Plan (Section 29.19).	Construction Operation Closure Post-closure	BC EAO/EA Certificate BC MOE/ *Environmental Management Act* (2003) Effluent Permit CEA Agency/Metal Mining Effluent Regulations (SOR/2002-222) Environment Canada/EA Decision Statement
Avalanche The management of avalanches is stipulated in Pretivm's existing Brucejack Project Avalanche Safety Plan (BJ-042; Pretivm 2013). This will entail monitoring on the part of dedicated Mountain Safety Technicians, registered as Professional members of the Canadian Avalanche Association, that will encompass: • forecasting; • disseminating snow and avalanche information; • monitoring avalanche hazard; • monitoring snow stability; and • applying avalanche hazard reduction as required.	Construction Operation Closure	Avalanche Divisional Manager (Professional member of the Canadian Avalanche Association)
Ecosystems The management of ecosystems will rely on adherence to and coordination with the monitoring requirements of the following related management plans: • Wetlands Monitoring Plan (Section 29.20); • Air Quality Management Plan (Section 29.2); • Soils Management Plan (Section 29.13) • Aquatic Effects Monitoring Plan (Section 29.3); • Wildlife Management and Monitoring Plan (Section 29.21); • Water Management Plan (Section 29.19); • Invasive Plan Management Plan (Section 29.9); and • Rare Plant and Lichen Management Plan (Section 29.12).	Construction Operation Closure Post-closure	DFO/EA Decision Statement BC EAO/EA Certificate

(continued)

Table 35.5-1. Follow-up Monitoring Requirements (continued)

Monitoring Parameter	Project Phase	Agency/Instrument
Emergency Response		
The Mine Emergency Response Plan includes the following monitoring components: • periodic review of pre-planning exercises; • notification planning; and • annual rescue equipment inventory reports.	Construction Operation Closure Post-closure	Health, Safety and Reclamation Code for Mines in BC (BC MEMPR 2008) British Columbia Ministry of Energy and Mines (BC MEM)/*Mines Act* Permit
Hazardous Materials		
The Hazardous Materials Management Plan provides for the maintenance of an effective inspection procedure. The plan includes the monitoring of storage facilities, equipment, and inventory records for dangerous goods and hazardous materials	Construction Operation Closure	BC MOE/Petroleum Storage and Distribution Facilities and Storm Water Regulation (BC Reg. 168/94) BC MEM/Health, Safety and Reclamation Code for Mines in British Columbia (BC MEMPR 2008) BC MOE/*Environmental Management Act* (2003) – BC Hazardous Waste Regulation (BC Reg. 63/88) Health Canada/Controlled Products Regulations (SOR/88-66) Natural Resources Canada/*Explosives Act* (1985) BC MEM/Magazine Licence Transport Canada/Transportation of Dangerous Goods Regulations (SOR/2001-286) BC MEM/Explosives Storage and Usage Permit
Heritage		
Monitoring of identified heritage sites will be undertaken annually according to the Heritage Management Plan	Construction Operation Closure	BC Archaeology Branch
Invasive Plants		
Monitoring to evaluate and document the success of invasive plant management will include a program to detect, inventory and eradicate invasive plants.	Construction Operation Closure Post-closure	British Columbia Ministry of Forests, Lands and Natural Resources Operations (BC MFLNRO)/*Weed Control Act* (1996e)
ML/ARD		
Monitoring of the effects of waste rock deposition will follow the Aquatic Environmental Effects Assessment (Section 29.3)	Construction Operation Closure Post-closure	BC EAO/EA Certificate BC MOE/*Environmental Management Act* (2003) Effluent Permit CEA Agency/ Metal Mining Effluent Regulations (SOR/2002-222) Environment Canada/EA Decision Statement
Monitoring requirements of tailings, paste, and ore under the ML/ARD Management Plan will be determined when the full-scale process plant is in use.	Construction Operation Closure Post-closure	BC EAO/EA Certificate BC MEM/*Mines Act* Permit BC MOE/*Environmental Management Act* (2003) Effluent Permit CEA Agency/Metal Mining Effluent Regulations (SOR/2002-222) Environment Canada/EA Decision Statement

(continued)

Table 35.5-1. Follow-up Monitoring Requirements (continued)

Monitoring Parameter	Project Phase	Agency/Instrument
ML/ARD (cont'd)		
The ML/ARD Management Plan will monitor surface materials at on-site and off-site facilities for evidence of ML/ARD using visual and water chemistry surveys.	Construction Operation Closure Post-closure	BC EAO/EA Certificate BC MEM/*Mines Act* Permit BC MOE/*Environmental Management Act* (2003) Effluent Permit CEA Agency/Metal Mining Effluent Regulations (SOR/2002-222) Environment Canada/EA Decision Statement
Noise		
Noise monitoring for human health will be conducted in compliance with the Code.	Construction Operation Closure	BC EAO/EA Certificate BC MEM/Code compliance
Rare Plants and Lichens		
If Project infrastructure expands into areas with identified rare plant and lichen populations monitoring will be undertaken and adaptive management applied.	Construction Operation Closure Post-closure	BC EAO/EA Certificate
Soils and Terrain		
Monitoring of salvaged soils will form part of the Project's environmental program. Results of the monitoring program will be used to measure the success of the management strategies and to identify where adaptive management may be necessary.	Construction Operation Closure	BC EAO/EA Certificate BC MEM/*Mines Act* Permit
A soil erosion and sediment control monitoring program will be maintained throughout the Project's duration, particularly after high rainfall and/or melt events and at locations identified as susceptible to erosion and sedimentation.	Construction Operation Closure Post-closure	BC MOE/*Environmental Management Act* (2003) Effluent Permit BC MEM/*Mines Act* Permit
If the monitoring of dustfall consistently shows exceedances of the 30 day objective levels, further dust prevention measures will be undertaken.	Construction Operation Closure	BC MOE/*Environmental Management Act* (2003) Air Permit
Spills		
The Spill Prevention and Response Plan provides for the monitoring of: • the results of regular audits of facilities; and • the results of post-spill investigations and reporting.	Construction Operation Closure	Environment Canada/Spill Reporting Regulation (BC Reg. 263/90) Transport Canada/ Environmental Emergency Regulations (SOR/2003-307) BC MOE/*Environmental Management Act* (2003) Spill Reporting Regulation (BC Reg. 263/90)
Tailings		
The Tailings Management Plan is based on the best management practices described in the existing *Brucejack Gold Mine Project: Brucejack Lake Tailings System Design* (Rescan 2013) and will include routine bathymetric surveys to monitor the extent of the tailings mound.	Construction Operation Closure Post-closure	BC MOE/*Environmental Management Act* (2003) Effluent Permit BC MEM/*Mines Act* Permit CEA Agency/Metal Mining Effluent Regulations (SOR/2002-222)
Additional monitoring of water quality effects related to tailings management will be carried out as part of the Aquatic Effects Monitoring Plan.	Construction Operation Closure Post-closure	BC MOE/*Environmental Management Act* (2003) Effluent Permit CEA Agency/Metal Mining Effluent Regulations (SOR/2002-222)

(continued)

Table 35.5-1. Follow-up Monitoring Requirements (continued)

Monitoring Parameter	Project Phase	Agency/Instrument
Transportation and Access		
Control over transportation on and access to the Project site will ensure the maximization of safety to road users and minimization of adverse effects on the environment by: • controlling traffic noise; • conducting daily surveys of ice conditions on the Knipple Glacier Road by avalanche and glacier technicians; • tracking road safety incidents • inspecting bridges, culverts, and toad tunnels; • recording ungulate use of roads during periods of deep snow; • observing wildlife use of road verges; • inspecting road ditches; • preventing unauthorized use of access roads; • preventing unauthorized fish, wildlife, and plant harvesting by Project employees and contractors; • tracking results of vehicle inspections; • requiring mobile equipment brought onto the site from other areas be clean; and • monitoring vertical ablation from the glacier road and access ramp.	Construction Operation Closure Post-closure	BC MEM/*Mines Act* Permit BC EAO/EA Certificate
Waste Rock		
The waste rock dumping platform will be monitored visually and through instrumentation throughout the period of deposition of waste rock.	Construction Operation Closure Post-closure	BC MEM/*Mines Act* Permit CEA Agency/Metal Mining Effluent Regulations (SOR/2002-222) Environment Canada/EA Decision Statement
Water		
A Water Management Plan will be implemented at the initiation of construction activities that will monitor: • the performance of water management structures and systems; and • identify and promptly address areas where upgrades, modifications, or additional mitigation measures are necessary.	Construction Operation Closure Post-closure	BC MEM/*Mines Act* Permit BC MFLNRO Water Licence
A follow-up program based on the principles of adaptive management will be implemented if the results of the monitoring programs or water balance model indicate that the water management structures and systems are not functioning as required and additional management and mitigation measures are needed.	Construction Operation Closure Post-closure	BC MEM/*Mines Act* Permit BC MFLNRO/Water Licence
Wetlands		
Wetlands will be monitored in conjunction with other environmental monitoring. Records of wetland extent, wildlife observations and hydrological function will be maintained.	Construction Operation Closure Post-closure	BC EAO/EA Certificate Environment Canada/Federal Policy on Wetland Conservation

(continued)

Table 35.5-1. Follow-up Monitoring Requirements (completed)

Monitoring Parameter	Project Phase	Agency/Instrument
Wildlife		
The management measures that will be implemented to minimize and avoid adverse effects on wildlife and wildlife habitat include: • Wildlife Protection Measures (Section 29.21.3); • Wildlife Access and Traffic Management Plan (Section 29.21.5); • Wildlife Helicopter Management Plan (Section 29.21.6); • Wildlife Light Management Plan (Section 29.21.7); • Employee Wildlife Education and Training Program (Section 29.21.8); • Wildlife Effects Monitoring Program (Section 29.21.9); • Air Quality Management Plan (Section 29.2); • Aquatic Effects Monitoring Plan (Section 29.3); • Avalanche Management Plan (Section 29.4); • Noise Management Plan(Section 29.11); • Waste Management Plan (Section 29.17); • Water Management Plan (Section 29.19); and • Wetlands Monitoring Plan (Section 29.20).	Construction Operation Closure Post-closure	BC EAO/EA Certificate
The Wildlife Access and Traffic Management Plan will include recording of wildlife collisions and mortalities along all mine site roads and Brucejack Access Road.	Construction Operation Closure Post-closure	BC EAO/EA Certificate
A Wildlife Effects Monitoring Program will be implemented and conducted and include: • Moose Monitoring Program; and • Mountain Goat Monitoring Program.	Construction Operation Closure Post-closure	BC MFLNRO BC EAO/EA Certificate
A follow-up monitoring program will be used to evaluate previous mitigation measures, verify the predictions of the EA, and identify opportunities for adaptive management.	Construction Operation Closure Post-closure	BC MFLNRO BC EAO/EA Certificate

There were no environmental impacts predicted with respect to Aboriginal peoples and Nisga'a Nation as indicated in Chapter 26, Sections 26.7.1.4 and 26.7.2.4 and Chapter 27, Sections 27.5 and 27.6. Therefore, no additional mitigation is necessary beyond that identified in other sections of the Application/EIS. Similarly, since there were no adverse effects to Aboriginal rights and interests identified in Chapter 26, or treaty rights or interests as identified in Chapter 27, no additional mitigation is necessary beyond that identified in other sections of the Application/EIS.

If previously unanticipated adverse environmental effects with respect to Aboriginal peoples or Aboriginal rights are identified, the adaptive management process outlined above will be implemented. Should information that could be used to improve and/or support future EAs and Aboriginal consultation processes become available, it will be provided to the British Columbia Environmental Assessment Office (BC EAO) and CEA Agency.

35.6 TABLE OF COMMITMENTS

Table 35.6-1 identifies commitments that have been derived from the Application/EIS to mitigate potential effects on environmental, economic, social, health, and heritage VCs.

Table 35.6-1. Table of Commitments

No.	Commitment
Air Quality Management	
1.	Pretivm will monitor ground-level dust deposition values and compare these to BC dustfall objectives per *The Pollution Control Objectives for the Mining, Smelting, and Related Industries of British Columbia* (BC MOE 1979). Increasing trends or deviations from target criteria will be analyzed on a case-by-case basis and will be responded to by modifying dust control procedures accordingly.
Aquatic Effects	
2.	Pretivm will monitor the physical and chemical quality of the water flowing out of Brucejack Lake and in Brucejack Creek as part of an Aquatic Effects Monitoring Plan that will be developed in compliance with *Environmental Management Act* (2003) and Metal Mining Effluent Regulations (SOR 2002-222) requirements. Water quality monitoring results are analyzed as indicators of failure or non-compliance of upstream control measures and such indicators will be responded to by modifying the water quality management system accordingly.
3.	Sediment curtains at the outlet of Brucejack Lake and around the active waste rock deposition areas will be maintained year-round. Replacement curtains will be stored on site for immediate replacement if installed curtains are damaged.
4.	The system of subaqueous tailings deposition in Brucejack Lake requires a constant flow to maintain sufficient pressure to keep the deposit surrounding the end of the outfall fluidized. Pretivm will demonstrate particular vigilance in monitoring the performance of the tailings deposition system, to ensure rapid response in activating contingency plans in case of an upset condition.
Hazardous Materials Management	
5.	Transportation over the Knipple Glacier between the Brucejack Mine Site and the Knipple Transfer Area will primarily be by means of tracked or otherwise specially equipped vehicles. Given the heightened possibility of mishaps inherent in vehicular travel over glaciers, Pretivm will have a response plan in place that specifically addresses the potential spillage of hazardous materials on this section of the Brucejack Access Road.
Heritage Resources	
6.	A single heritage site that is protected by the *Heritage Conservation Act* (1996a) falls within 50 m of the Project footprint. The site is at risk of direct impacts from use and maintenance of the Brucejack Access Road. Pretivm will ensure the continued avoidance and exclusion demarcation of the site. If this proves to not be possible, mitigation of the site will be conducted in consultation with the British Columbia Archaeological Branch.
Rare Plants and Lichens	
7.	Appropriate mitigation measures are in place to minimize the likelihood of rare plants and lichens being affected by the Project activities.
Transportation and Access	
8.	Pretivm will control access to the Brucejack Access Road. This will include a gate that will be staffed as appropriate. Only authorized vehicles will be permitted to pass through the gate.
9.	The inherent risk of vehicular travel over glaciers requires that purpose-designed procedures and contingency plans are in place. Pretivm will ensure that such plans are effectively applied in a demonstrable manner for safe travel over the Knipple Glacier section of the Brucejack Access Road.
10.	Roads may potentially affect wildlife through presenting physical barriers to movement and providing attractants such as pooled water and road salts. Pretivm will undertake the amelioration of road-related barriers and attractants as stipulated in the Wildlife Management and Monitoring Plan (Section 29.21) for the Project, which will include the creation of gaps in snowbanks and prohibiting the use of road salts in winter.

(continued)

Table 35.6-1. Table of Commitments (completed)

No.	Commitment
Transportation and Access (cont'd)	
11.	Pretivm will continue to manage Project roads and maintain access control in the event of temporary shut-down periods, to ensure minimized indirect mortality (i.e., hunting) of wildlife.
12.	Pretivm will continue to participate in the Highway 37/37A Northwest Wildlife and Environmental Management Advisory Group.
Waste Rock	
13.	The subaqueous deposition of waste rock in Brucejack Lake will minimize the effects of ML/ARD, but may contribute to physical and chemical changes in water quality if foundation failures and slumping of the rock pile occurs. Pretivm will apply purpose-designed stability monitoring throughout the period of deposition of waste rock in Brucejack Lake. A 1-m depth of water will be maintained above the deposited waste rock and the deposition will occur in a demonstrably safe manner.
Closure and Reclamation	
14.	Pretivm will implement its Closure and Reclamation plan (Chapter 30).
Consultation	
15.	Pretivm will maintain continued engagement and consultation with Skii km Lax Ha, Nisga'a and Tahltan groups throughout all phases of the Project.

35.7 CONCLUSION

Throughout the EA process, Pretivm has maintained a considered approach that is mindful of the precautionary principle in environmental decision-making. Continual consultation through accountable engagement with all participants in the EA process has underpinned the approach. This is evidenced by the manner in which potentially adverse environmental effects identified early in the EA process have been responded to. This response has resulted in changes to the engineering design of the Project, as described in Chapter 4, Project Design and Alternatives Assessment.

This Application/EIS is intended to provide sufficiently comprehensive information on the extent to which the Project as planned avoids, minimizes, or compensates for the effects that may be undesirable for the biophysical and human environments. By the same token, the Application/EIS also demonstrates how the biophysical and human environments may benefit from the proposed Project. Pretivm will maintain this precautionary, responsive, and collaborative approach as the EA process progresses through the review, permitting, and execution stages of the Project. In particular, Pretivm will continue to remain engaged with Aboriginal groups and strive to incorporate community and traditional knowledge into deliberations about the Project, such that asserted or established Aboriginal right and interests, are factored into decision making.

It is thus the intention of this Application/EIS to demonstrate that the authorization of the Project will result in economic benefits at local, regional, provincial, and national levels, while being undertaken in an environmentally responsible and acceptable manner. It is certain that all regions of BC and northwestern BC in particular will benefit economically. Benefits will be derived from the generation of employment and commercial opportunities, with the resultant increment in the generation of local, provincial, and federal tax revenues.

Pretivm is intending to apply for approvals pursuant to the Concurrent Approval Regulation (BC Reg. 371/2002) as follows: *Water Act* (1996h) authorizations related to mine site water management; a mining lease under the *Mineral Tenure Act* (1996d); Licence of Occupation under the *Land Act* (1996c); Occupant Licence to Cut under the *Forest Act* (1996a); and potable water authorizations under the

Drinking Water Protection Act (2001) for Knipple Transfer Area and Tide Staging Area camps. Pretivm will also engage in the provincial coordinated authorizations process to apply for authorizations under the *Mines Act* (1996c), the *Environmental Management Act* (2003), the *Water Act* (1996d), and the *Land Act* (1996b).

As the proponent of the Brucejack Gold Mine Project, Pretivm is of the belief that the development can be undertaken in a manner that maintains social well-being at the family and community level, while not undermining the rights and interests of Aboriginal groups potentially affected by the Project, or inhibiting the level of public health in the area any way. It is similarly believed that the biophysical environment affected by the proposed Project will not see unacceptable constraints placed on its ecological functionality, given the comprehensive mitigation measures prescribed in the Application/EIS and committed to by Pretivm. With sustainable development at the forefront of responsible mining practices, the Project will be implemented in accordance with the relevant and applicable environmental statutory regulations and industry performance standards, as described in the appropriate sections of the Application/EIS. Pretivm is thus of the opinion that the approval of the Application/EIS for the Project should receive due consideration on the part of the regulatory agencies.

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