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Report of the Joint Review Panel

Benga Mining Limited **Grassy Mountain Coal Project**

Crowsnest Pass

June 17, 2021

**Joint Review Panel Established by the Federal Minister of
Environment and Climate Change and the Alberta Energy Regulator**

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Decision 2021 ABAER 010: Benga Mining Limited, Grassy Mountain Coal Project, Crowsnest Pass

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Alberta Energy Regulator

Suite 1000, 250 – 5 Street SW

Calgary, Alberta T2P 0R4

Telephone: 403-297-8311 Inquiries (toll free): 1-855-297-8311

Email: inquiries@aer.ca Website: www.aer.ca

and

Impact Assessment Agency of Canada

160 Elgin Street, 22nd Floor

Place Bell Canada, Ottawa, Ontario K1A 0H3

Telephone: 613-957-0700

Inquires (toll free) 1-866-582-1884

Website: <https://www.canada.ca/en/impact-assessment-agency.html>

Contents

Abbreviationsv

Executive Summaryvii

1. Introduction 1

2. Panel Approach to Determining the Significance of Effects..... 21

3. Purpose of and Need for the Project..... 45

4. Alternative Means of Carrying Out the Project..... 49

5. Coal Mining, Handling, and Processing 55

6. Conservation, Reclamation, and Closure 77

7. Effects of the Environment, including Climate Change, on the Project..... 101

8. Air Quality 107

9. Greenhouse Gas Emissions 131

10. Noise, Light, and Visual Aesthetics..... 137

11. Groundwater Quantity, Flow, and Quality 147

12. Surface Water Quantity and Flow 179

13. Surface Water Quality 193

14. Fish and Aquatic Habitat 259

15. Terrain and Soils 295

16. Vegetation and Wetlands 311

17. Wildlife 347

18. Wildlife Health 399

19. Human Health..... 415

20. Land and Resource Use 439

21. Historical Resources 443

22. Indigenous Traditional Use of Lands and Resources, Culture, and Rights 447

23. Social and Economic Effects 573

24. Reclamation and Closure Liability..... 589

25. Other Environmental Management Issues..... 599

26. Accidents and Malfunctions	603
27. AER Public Interest Determination and Decisions.....	615
28. Federal Findings and Recommendations	625
References.....	631
Appendix 1. Joint Review Panel Process Timeline.....	633
Appendix 2: Hearing Participants.....	637
Appendix 3: Agreement	641

List of Figures

Figure 1-1. Regional project location.....	18
Figure 1-2. Proposed project footprint.....	19
Figure 2-1. A six-step adaptive management process	30
Figure 5-1. Phases of mining.....	57
Figure 5-2. Mine permit boundary	60
Figure 13-1. Benga’s site water management plan	196
Figure 13-2. Water management system elements.....	197
Figure 13-3. Selenium species remaining in effluent after application of an advanced oxidation process (AOP), in a presentation slide supplied by Teck Resources	219
Figure 15-1. Pre- and post-mining topography.....	307

List of Tables

Table 2-1. Significance criteria	22
Table 4-1. Technical and economic criteria for alternative means options	49
Table 5-1. Primary equipment fleet summary	58
Table 5-2. Waste rock dump design features.....	66
Table 5-3. Properties of proposed dams	69
Table 5-4. Published FSI values and the numbers of additional (unpublished) sample data Benga used in support of its coal quality evaluation.....	74
Table 6-1. Annual reclamation material balance of mining areas	80
Table 6-2. Reclamation activities upon completion of mining activities.....	82
Table 6-3. Correlation of pre-mining ecosite phases to reclaimed ecological units	84

Table 6-4.	Target species of reclaimed ecological communities	85
Table 6-5.	Comparison of cover of pre-disturbance and post-reclamation ecological units in project footprint.....	86
Table 6-6.	Pre-mining and reclaimed terrain at closure	88
Table 8-1.	Ambient background concentrations for modelled criteria air contaminants.....	108
Table 8-2.	Summary of project daily criteria air contaminant emissions in year 19	111
Table 8-3.	Summary of annual average emissions	112
Table 8-4.	Summary of key predicted air quality concentrations at the RSA maximum point of impingement.....	112
Table 8-5.	Summary of predicted NO ₂ concentrations	113
Table 8-6.	Summary of predicted SO ₂ concentrations	114
Table 8-7.	Summary of predicted PM _{2.5} concentrations	114
Table 8-8.	Summary of predicted NO ₂ concentrations compared with CAAQS	116
Table 8-9.	Maximum hourly and daily emissions from project diesel fuel combustion.....	118
Table 8-10.	Details for ammonium nitrate–fuel oil blasting	119
Table 8-11.	Maximum hourly and daily fugitive dust emissions from project activities	120
Table 8-12.	Maximum wind-driven daily emissions on the windiest day in five years of meteorological data.....	124
Table 9-1.	Total greenhouse gas emissions in year 19 and over the life of the project	132
Table 12-1.	Updated water balance volumes.....	179
Table 13-1.	Generation rates for sulphate and selenium	199
Table 13-2.	Selenium removal calculation performed by Benga.....	210
Table 13-3.	Ammonia guidelines for conditions in Blairmore Creek.....	222
Table 13-4.	Water balance and load modelling predicted concentrations for the end-pit lake	250
Table 15-1:	Water erosion risk ratings for upland surface soil	297
Table 15-2:	Water erosion risk ratings for subsoil	297
Table 15-3:	Wind erosion risk ratings.....	298
Table 15-4:	Elevation changes from original topography (m above sea level).....	305
Table 15-5:	Comparison of pre-mining and reclaimed terrain at closure	306
Table 15-6.	Panel's assessment of summary of residual effects and significance determinations.....	309

Table 16-1.	Assessment of project effects on vegetation and wetlands	337
Table 17-1.	Valued wildlife components selected by Benga	347
Table 17-2.	Special status wildlife species selected by Benga	348
Table 17-3.	Species at risk assessed by Benga and their federal and provincial conservation status	349
Table 17-4.	Baseline habitat availability for little brown bats in the wildlife local study area	377
Table 17-5.	Summary of criteria for determining the significance of project effects on assessed wildlife	396
Table 18-1.	Predicted selenium exposure ratios with successive assessments	403
Table 19-1.	Comparison of hazard quotients greater than 1.0 for the application case	424
Table 19-2.	Comparison of hazard quotients greater than 0.2 for the application case	424
Table 22-1:	Criteria for determining the severity of impacts	454
Table 22-2:	Sites of importance to Indigenous groups from information provided by Benga in the Tenth, Eleventh, and Twelfth Addenda	481
Table 22-3.	Summary of panel analysis of residual effects on the Káínai First Nation	487
Table 22-4.	Summary of panel analysis of residual effects on the Piikani Nation	501
Table 22-5.	Summary of panel analysis of residual effects on the Siksika Nation	515
Table 22-6.	Summary of panel analysis of residual effects on the Stoney Nakoda Nations	527
Table 22-7.	Summary of panel analysis of residual effects on Tsuut'ina Nation	537
Table 22-8.	Summary of panel analysis of residual effects on the Métis Nation of Alberta – Region 3	545
Table 22-9.	Summary of panel analysis of residual effects on the Ktunaxa Nation	556
Table 23-1:	Income and employment generated by the project	574
Table 23-2:	Estimates of provincial and federal income taxes and royalties for metallurgical coal	583
Table 24-1.	Mine reclamation cost summary at end of years 10 and 15	595

Abbreviations

AAAQO	Alberta ambient air quality objectives
ACO	Aboriginal Consultation Office
AEP	Alberta Environment and Parks
AER	Alberta Energy Regulator
AGS	Alberta Geological Survey
BAT/BEP	Best available technology / best environmental practices
CAAQS	Canadian Ambient Air Quality Standards
<i>CEAA 2012</i>	<i>Canadian Environmental Assessment Act, 2012</i>
CIAR	Canadian Impact Assessment Registry
CO	carbon monoxide
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPAWS	Canadian Parks and Wilderness Society
DFO	Fisheries and Oceans Canada
ECCC	Environment and Climate Change Canada
EIA	environmental impact assessment
<i>EPEA</i>	<i>Environmental Protection and Enhancement Act</i>
ESRD	Environment and Sustainable Resource Development
FSI	free swelling index
LSA	Local Study Area
M.D. of Ranchland	Municipal District of Ranchland No. 66
M.D. of Pincher Creek	Municipal District of Pincher Creek No. 9
NH ₃	ammonia
NH ₄	ammonium
NO _x	nitrogen oxides
NO ₂	nitrogen dioxide
NRCan	Natural Resources Canada
PAH	polycyclic aromatic hydrocarbons

<i>PLA</i>	<i>Public Lands Act</i>
PM _{2.5}	fine particulate matter
PM ₁₀	particulate matter
<i>REDA</i>	<i>Responsible Energy Development Act</i>
RSA	Regional Study Area
<i>SARA</i>	<i>Species at Risk Act</i>
SO ₂	sulphur dioxide
SSRB	South Saskatchewan River Basin
<i>SSRP</i>	<i>South Saskatchewan Regional Plan</i>
SSWQO	site-specific water quality objective
the Agency	Canadian Environmental Assessment Agency / Impact Assessment Agency of Canada
the Coalition	The Coalition of the Alberta Wilderness Association and the Grassy Mountain Group
the Wildlife Society	Alberta Chapter of the Wildlife Society
TIER	Technology Innovation and Emissions Reduction
TSP	total suspended particulates
VOCs	volatile organic compounds
WSCT	westslope cutthroat trout

Executive Summary

Benga Mining Limited (Benga) submitted an environmental impact assessment (EIA) for the Grassy Mountain Coal Project to the Alberta Energy Regulator (AER) and the Canadian Environmental Assessment Agency (the Agency) on November 10, 2015, and submitted an updated EIA on August 15, 2016. Benga submitted an integrated application to the AER on October 25, 2017.

The applications are for approval to construct, operate, and reclaim a new open-pit metallurgical coal mine in the Crowsnest Pass area, approximately seven kilometres north of the community of Blairmore in southwest Alberta. The project footprint covers 1521 hectares.

The production capacity of the Grassy Mountain Coal Project (the project) would be a maximum of 4.5 million tonnes of metallurgical coal per year over a mine life of approximately 23 years. The project's mining activities would be completed by blasting and truck-and-shovel mining. The project would include surface mine pits and waste rock disposal areas, a coal-handling and processing plant with associated infrastructure, water management structures, an overland conveyor system, a rail loadout facility, and other facilities.

The project required multiple regulatory filings:

- An environmental assessment under Alberta's *Environmental Protection and Enhancement Act (EPEA)*
- An environmental assessment under the *Canadian Environmental Assessment Act, 2012 (CEAA 2012)*
- Applications to the AER under the *Coal Conservation Act*, the *EPEA*, the *Water Act*, and the *Public Lands Act (PLA)* for provincial approvals

On August 16, 2018, the Minister of Environment and Climate Change and the Chief Executive Officer of the AER announced the *Agreement to Establish a Joint Review Panel for the Grassy Mountain Coal Project*. Pursuant to the agreement, the joint review panel was established, appointing Mr. A. Bolton as the panel chair, and Mr. D. O'Gorman and Mr. H. Matthews as panel members. Under the agreement, the panel was tasked with conducting its review in a manner that discharges the responsibilities of the AER under the *Responsible Energy Development Act (REDA)*, the *Coal Conservation Act*, the *EPEA*, the *Water Act*, and the *PLA*, and discharges the requirements of *CEAA 2012*, as well as the panel's terms of reference.

The final 15 months of this review were conducted during an unprecedented global pandemic brought on by COVID-19. We appreciate that Benga and hearing participants adjusted to the challenges to help us complete our assessment.

A public hearing began on October 27, 2020, using electronic means (Zoom videoconferencing and streamed through YouTube). The oral portion of the hearing continued for 29 sitting days and concluded on December 2, 2020. Alberta's Aboriginal Consultation Office (ACO) provided its hearing reports on December 3, 2020, and final arguments were provided in writing thereafter. We closed the hearing record on January 15, 2021.

In the EIA, Benga concluded that the project was not likely to result in any significant adverse effects following implementation of mitigation measures. Benga's conclusions were premised on the assumed

effectiveness of these measures. However, we find that in some cases the claimed effectiveness of the proposed measures was overly optimistic and not supported by the evidence provided. As a result, we are not confident about the technical and economic feasibility of some proposed mitigation measures. We find that this was particularly true for effects on surface water quality, westslope cutthroat trout (and fish and fish habitat more generally), and vegetation.

While Benga acknowledged the importance of taking a conservative approach to the identification and assessment of project effects, we find that in practice it did not always do so. Overly optimistic assumptions resulted in a likely underestimate of predicted project effects in some areas, such as for surface water quality and human health, and this reduces our confidence in Benga's assessment.

Several participants expressed concern about the conceptual nature of some of Benga's proposed project plans and mitigation measures. They also had concerns about Benga's reliance on the use of adaptive management to address uncertainty. We accept that not all relevant information may be available at this stage of the regulatory review process and that the environmental assessment process is not intended to eliminate all uncertainty. We also recognize that follow-up monitoring and adaptive management programs are common and accepted means of dealing with uncertainty. However, a commitment to adaptive management does not eliminate the need to provide sufficient information on the environmental effects of a project. Nor does it eliminate the need to describe the appropriate mitigation measures required to eliminate, reduce, or control those effects, or to describe the extent of the significance of those effects.

We cannot defer important matters or decisions to a later stage of the regulatory process. Our terms of reference require us to assess the environmental effects of the project, including the significance of effects, and, in our capacity as the AER, determine whether the project is in the public interest. We find that Benga's reliance on future adaptive management meant that in some cases it did not provide important details regarding proposed mitigation measures. We also find that Benga's proposed adaptive management approach and plans were not sufficiently developed or detailed to make us confident that anticipated or unanticipated project effects would be effectively mitigated through adaptive management.

Several participants attributed the prolonged length of the regulatory process to the lack of detail and clarity in Benga's application and EIA materials, which necessitated many rounds of information requests. A number of factors affected the timeline for our review. But we agree that the conceptual nature of some of the information initially provided and the need for multiple information requests on the same topic due to incomplete or less than comprehensive responses prolonged the regulatory process.

Based on our assessment, we conclude that the project is likely to result in significant adverse environmental effects on surface water quality, westslope cutthroat trout and their habitat, whitebark pine, rough fescue grasslands, and vegetation species and community biodiversity. Although we identify other adverse residual effects, we determined that they were not likely to be significant. We also find that the project is likely to contribute to existing significant adverse cumulative environmental effects on westslope cutthroat trout, little brown bats, grizzly bears, and whitebark pine. Due to the limitations of Benga's approach to assessing cumulative effects, we are unable to assess the magnitude of some cumulative effects.

We find that the project would result in low to moderate positive economic impacts on the regional economy, but that Benga did not consider some risks that could reduce the magnitude of these positive impacts.

We find that the project would result in the loss of lands used for traditional activities, and this would affect Indigenous groups and their members who use the project area. We also find that the project is likely to result in significant adverse effects to physical and cultural heritage for three Treaty 7 First Nations. The mitigation measures proposed are not sufficient to fully mitigate these effects. However, all of the Treaty 7 First Nations and the Métis Region 3 signed agreements with Benga and provided letters stating they had no objection to the project.

A summary of our key findings follows.

Environmental effects

Surface water quality

The project is likely to cause significant adverse effects on surface water quality.

The project is located in a sensitive mountain environment and has the potential to adversely affect the water quality of Gold Creek and Blairmore Creek, which are within the headwaters of the Crowsnest River, Oldman River, and South Saskatchewan River. These creeks contain populations of threatened westslope cutthroat trout. The Oldman watershed contributes to the water supply for residential, tourism, and business users, including agricultural and livestock operations. The project is in an area governed by the *South Saskatchewan Regional Plan (SSRP)* under Alberta's *Land-Use Framework*, which includes a focus on protection of water quality. These waters have a connection to Indigenous people and their traditional territory. Experience in the nearby Elk Valley in British Columbia illustrates the challenges and potential costs of dealing with the water quality issues that this project may face.

The project will release a number of contaminants, particularly selenium, into receiving surface waters. Benga made several optimistic and non-conservative assumptions in assessing project effects on surface water quality, and these assumptions undermined our confidence in the results Benga presented. Benga assumed that it could capture 95 or 98 per cent of the selenium-rich contact water coming from the waste rock dumps, which modelling showed was necessary to achieve target selenium concentrations in the effluent and receiving streams. The project as proposed is unlikely to achieve this capture efficiency. Applying a lower capture efficiency to Benga's assessment, as part of a conservative approach, would result in significantly higher concentrations of selenium in the effluent and in both Blairmore and Gold Creeks, in the absence of further mitigation.

Benga proposed to use saturated backfill zones as its primary approach to managing selenium, and estimated that these measures would remove 99 per cent of influent selenium from contact water, or produce effluent with selenium concentrations below 15 micrograms per litre. Benga did not provide sufficient evidence to demonstrate that the saturated backfill zones can achieve the high degree of effectiveness necessary at the scale of this project. Even a modest reduction in effectiveness from Benga's goals would result in a relatively large increase in selenium in saturated backfill zone effluent. Benga did not demonstrate or satisfy us that it can design and operate the saturated backfill zones in a manner that

achieves its targeted outcomes, or that its proposed pilot study would resolve the operational challenges with these measures.

Benga did not adequately describe or assess the alternative, additional selenium-mitigation measures it would pursue if the saturated backfill zones were not as effective as needed. Benga provided limited information on alternative treatment measures, and stated that it only intends to implement them “if needed” based on monitoring results. This introduces the possibility of an unacceptable time lag between discovery of a contamination problem and construction of an alternative treatment approach.

In addition to the contact water from waste rock piles, other sources of selenium could affect the surrounding environment. This could include pit-wall runoff captured in sedimentation ponds, unassessed sources such as rock from the Fernie Formation, or contaminated groundwater plumes. We are not confident that Benga had adequately considered, or had plans to manage, this additional selenium.

Benga predicted slight but chronic exceedances for a number of non-selenium contaminants, despite not taking a conservative approach to modelling water quality or capturing all potential sources of metal leaching in its model. In particular, Benga’s water quality modelling predictions assumed a metals treatment plant would be built, but Benga did not commit to building such a plant and instead planned to monitor and manage this issue through adaptive management.

Benga proposed a sulphate-adjusted, site-specific water quality objective for selenium in receiving waters downstream of the project. We are not persuaded that this objective would protect surface water quality. Benga did not adequately consider the potential for non-selenate forms of selenium to be present in water released to Blairmore Creek. Benga proposed to implement an advanced oxidation process, if necessary, to convert selenium in waters exiting the saturated backfill zone to selenate. But it provided no details to evaluate whether this process would be effective. No evidence was presented to demonstrate that any jurisdiction in the world has approved a sulphate-adjusted guideline for selenium.

Benga was not able to determine the length of time that active management of water quality at the site would be required. But the evidence suggests that selenium and sulphate could be released from the site for decades following mine closure. Monitoring and treatment would therefore likely be necessary for decades following mine closure. It is likely that Benga underestimated the costs of the long-term monitoring and treatment necessary to protect future water quality at and downstream of the site. Benga appeared to rely heavily on its participation in the province’s Mine Financial Security Program to respond to concerns about long-term treatment. We are concerned that liability for long-term water quality management could be assumed by the taxpayers of Alberta.

Fish and aquatic habitat

The project is likely to cause significant adverse environmental effects on westslope cutthroat trout and their aquatic habitat. Westslope cutthroat trout are listed as threatened under both the provincial *Wildlife Act* and the federal *Species at Risk Act (SARA)*. The project poses a risk to one of Alberta’s few remaining populations of this fish with a reasonable chance of long-term survival. The project would affect federally protected critical habitat in Gold Creek, as well as habitat in Blairmore Creek, which the federal 2019 Recovery Strategy-Action Plan for this species identifies as important. Recent population estimates for this species in these streams are cause for concern, and highlighted the need to employ a high degree of

precaution and the need for confidence in Benga's analysis and proposed measures to avoid negative impacts on these fish and their habitat.

Despite provisions described in the 2019 Recovery Strategy-Action Plan, Benga did not adequately assess the amount of critical habitat that the project would affect, which was important to fully assess the potential impacts of the project. In addition, Benga's hydrology model did not provide sufficiently detailed estimates of impacts of the project on flows in Blairmore and Gold Creeks, particularly during periods of low flow, and did not predict estimated changes to instantaneous flows. These limitations increased the level of uncertainty in the project's estimated impacts on the habitat of westslope cutthroat trout in these streams.

The release of selenium into neighbouring streams would affect westslope cutthroat trout. Although Benga made a number of optimistic assumptions about its ability to manage selenium, we find that its assessment of the effects of selenium on westslope cutthroat trout was inadequate and its proposed site-specific water quality objective for selenium was not protective.

Calcite is likely to form and cause damage to westslope cutthroat trout habitat in Blairmore Creek. The concretion of substrates is likely to cause a reduction in benthic invertebrate productivity and reduce habitat suitability and availability for spawning. Once calcite precipitates onto substrates in a creek, it would remain in place, as there are no proven treatments to remove instream calcite.

Benga's limited assessment of changes in stream temperatures, food supply, and sediment transport increased uncertainty about project impacts on habitat suitability in Gold and Blairmore Creeks. Benga's draft habitat offsetting plan was its main mitigation measure to address residual effects on westslope cutthroat trout habitat. Benga did not adequately demonstrate that the proposed habitat offsets would mitigate project impacts. We are not convinced that the offsetting plan is technically feasible or likely to be effective.

Benga's assessment on westslope cutthroat trout, including changes in water quality and loss of habitat, has implications for other fish species and aquatic organisms present in the streams and rivers downstream of the project, including bull trout, which are listed as threatened under *SARA*. However, Benga and other participants provided little information on these matters.

Surface water quantity and flow

The effects of the project on surface water quantity and flows will be adverse, but not significant.

The lack of hydraulic connection between the original licensed points of diversion and the proposed mine site, coupled with the historically low or non-use of the water licences, means that these licence transfers would result in new and adverse impacts on Blairmore and Gold Creeks, and on the aquatic environment and adjacent landowners along Gold Creek. These impacts warrant a strong and reliable flow-augmentation plan based at least on meeting the instream flow needs of Blairmore and Gold Creeks.

When considering the simplifying assumptions in the groundwater model, together with a simplistic hydrological model that uses average annual precipitation as the only changing parameter, the model's ability to assess the impact of the project on baseflow, fish, and fish habitat is uncertain. Due to

uncertainty about the effectiveness of the saturated backfill zones, there is also a high level of uncertainty about Benga's analysis of predicted surface flows in Blairmore Creek.

The project is likely to have an adverse impact on the quantity of surface water flows in Gold and Blairmore Creeks. These impacts will likely be low to moderate in magnitude and limited to these creeks. We are unable to confidently conclude that the project will have an acceptable effect on the aquatic environment of Gold and Blairmore Creeks, given the uncertainties with water quality management, the presence of a threatened aquatic species, and the lack of a comprehensive flow augmentation plan.

Groundwater quantity, flow, and quality

The effects of the project on groundwater quantity, flow, and quality will be adverse, but are not likely to be significant.

The project will change groundwater levels and flow, which will likely affect base flow to Blairmore and Gold Creeks. The project will also change groundwater quality, with implications for water quality in these creeks. The effects on groundwater quality of most concern are the potential for seepage from the external waste rock disposal areas, saturated backfill zones, and the end-pit lake. We find it unlikely that project impacts on groundwater quality would adversely affect domestic or municipal groundwater wells due to their distance from the project and current understanding of groundwater flow directions. However, some potential remains for the project to adversely affect the flow or quality of springs used by landowners within or adjacent to the proposed mine permit boundary and west of Gold Creek.

Due to limited site-specific hydrogeological information, the use of simplifying assumptions in the groundwater model, and the complexity of site geology, large uncertainties remain about the magnitude, lateral extent, and duration of predicted project effects.

Air quality

Overall, the project is not likely to result in significant adverse effects on air quality. The project will adversely affect ambient air quality in the area immediately surrounding the mine permit boundary, but the effects will be largely localized to the mine permit boundary and the rail loadout facility.

Uncertainties remain regarding the potential effects of dust. Dust emissions from wheel entrainment would be a major source of particulate matter emissions from the project. We find that Benga did not adequately demonstrate the efficiency of its proposed road dust mitigation measures. We also find that Benga likely underestimated the potential for, and effects of, worst-case wind-driven dust emissions.

Greenhouse gas emissions

The project's greenhouse gas emissions would have an adverse, but not significant, effect by contributing to global greenhouse gas emissions and increasing concentrations of greenhouse gases in the atmosphere.

Total greenhouse gas emissions from the project would be approximately 10 million tonnes over the life of the project. We find that, overall, the project will not be a major contributor to greenhouse gases, as it will produce approximately 0.14 per cent of Alberta's and 0.05 per cent of Canada's greenhouse gas emissions, based on 2013 emissions data and the project's predicted maximum annual (year 19) emissions. Benga did not provide evidence to support its assertion that the project would be among the best greenhouse gas performers for metallurgical coal mines. Environment and Climate Change Canada

noted that the project's emissions intensity would be in the middle range of currently operating metallurgical coal mines.

Benga committed to complying with Alberta's new *Technology Innovation and Emissions Reduction Regulations* but did not provide a plan on how it would do so. The project would pose a challenge to the Government of Canada's objective to achieve net-zero emissions by the year 2050. However, at this point in time, the federal government does not have a detailed management or regulatory system in place to achieve this objective.

Noise, light, and visual aesthetics

The project will result in increased noise levels from mine operations, but they are predicted to be within permissible sound levels. The rail loadout facility will result in a slight increase in overall noise at adjacent receptors. Benga's noise mitigation measures are reasonable and consistent with industry-accepted best practices. The project will result in an increase in nighttime light levels, but the mitigation measures proposed by Benga are appropriate and expected to minimize unnecessary lighting and associated effects. The project will result in visual impacts during mining operations that will persist into the post-closure period.

Human health

We find that Benga's assessment of the potential risk of adverse health effects from exposure to nitrogen dioxide and fine particulate matter is conservative, indicates only marginal exceedances, and is driven by baseline concentrations. However, Benga's assessment of risk from exposure to dust in general and coal dust in particular is not conservative, relies on limited baseline data, does not consider the effects of coal dust as a complex mixture, and does not consider the combined risk of coal dust and dust from other sources. The potential for increased health risks associated with dust and coal dust is therefore subject to some uncertainty.

The project is predicted to result in increased hazard quotients for selenium in Blairmore Creek, Gold Creek, the end-pit lake, and the Oldman Reservoir. Predicted hazard quotients are greater than 0.2 but less than 1.0, but we find the assumptions for the capture and treatment of selenium used in the assessment were not conservative. Therefore, concentrations of selenium reaching water bodies and hazard quotients could be higher than predicted. The fish consumption pathway dominates the risk to human health for selenium exposure. We recognize that the anticipated hazards do not necessarily imply a health risk. We find that the potential for an adverse health effect is low, based on the conservative exposure assumptions used in the human health risk assessment (lifetime exposure). However, the potential for increased risk to human health cannot be eliminated.

The end-pit lake is predicted to contain water with elevated concentrations of a number of contaminants of potential concern, including arsenic, aluminum, cadmium, cobalt, lead, and thallium, and there is a higher potential for adverse health effects from long-term exposure to end-pit lake water. While it is unlikely that humans would be exposed to end-pit lake water on a continuous and long-term basis, arsenic is a concern as it is a non-threshold contaminant with no known safe level of exposure.

Our confidence in the results of the human health risk assessment for the project is low due to the lack of conservatism in the water quality modelling, changing risk estimates during the review process, and other limitations of the health risk assessment. But even with all of the uncertainties in the assessment, adverse project-related effects on human health due are unlikely due to the conservative exposure assumptions used in the assessment.

Conservation, reclamation, and closure

Reclamation is the primary mitigation measure for many project effects. The project is located in steep terrain within the highly diverse and specialized landscape of the Montane and Subalpine Natural Subregions of the Rocky Mountain Natural Region of Alberta. Careful analysis and planning are therefore required to achieve reclamation and closure objectives. Benga's proposed conservation and reclamation plan did not provide enough detail to give us confidence that reclamation will effectively mitigate all project effects on terrestrial resources, or that proposed reclamation outcomes can be achieved.

While Benga's conservation and reclamation plan would at some point likely achieve equivalent land capability from a land use perspective, it is uncertain whether such a state can be achieved in a timely manner. There is considerable uncertainty about how long it may take for the project site to reach a stable and self-sustaining state that satisfies the requirements for reclamation certification. Considering the need for ongoing use of some project features, such as the surge ponds and saturated backfill zones, during the closure period for selenium management, the uncertainty is problematic. These areas may not be available for reclamation until 25 years or more after mining operations cease.

We are not confident that all of Benga's proposed reclamation measures are technically feasible and would result in the restoration of important vegetation species and communities removed during development of the project. The conservation and reclamation plan does not mitigate the loss of rare plants and rare plant communities because there are no viable mitigation measures that can counter the loss of rare plants. Nor are we confident that Benga's plans to restore whitebark pine, limber pine, and rough fescue grasslands would be successful, as restoration of these species can be challenging and has not been demonstrated successfully at similar sites. There is also significant uncertainty about whether treed wetlands would be successfully established in the closure landscape due to the proposed timing of restoration, after water management ponds are no longer required for selenium management. These uncertainties are compounded by the potential effects of climate change on long-term reclamation success, specifically changes in annual temperature, precipitation, and evapotranspiration.

Vegetation and wetlands

The project-related effects on vegetation will be adverse and significant for whitebark pine and rough fescue grasslands, as well as for vegetation species and community biodiversity. The project would also have other adverse effects on vegetation that we find will not be significant.

The project area includes undisturbed lands as well as some previously disturbed and unreclaimed areas. Benga proposed to mitigate the effects on vegetation and wetlands primarily through progressive reclamation of the project footprint during the operational phase of the project. Benga proposed to re-establish the variety of species and plant communities found in the pre-disturbance landscape and attain equivalent land capability. We find that Benga's plan to reclaim the project to four broad vegetation classes is insufficient to mitigate the loss of 27 forested ecosite phases. Moreover, it is unclear when

existing ecosite phases will develop on the reclaimed landscape. Benga's proposed reclamation would initiate a vegetation community in the project footprint. But, given the harsh climates of the Rocky Mountains, where plant development is slow, we are not confident the closure landscape would return to equivalent diversity of species and communities found at baseline, within the next 100 years, and possibly much longer.

The project would result in the removal of productive forests, old-growth forests, vegetation species identified as important to Indigenous peoples, and most of the organic wetlands in the local study area. We find, however, that these effects would not be significant due to the localized nature of project effects and because equivalent vegetation communities will continue to exist in the project area.

The project would also result in the removal of rare plants and rare plant communities, including approximately 21 000 whitebark pine and 1000 limber pine trees. The whitebark pine is listed as endangered under *SARA* and Alberta's *Wildlife Act*, while the limber pine is designated as endangered under Alberta's *Wildlife Act* and currently under consideration for listing under *SARA*. The project would also result in the permanent removal of rough fescue–dominated grasslands, including areas subject to a protective notation under the *PLA*.

We find that the overall effects on rare plants and rare plant communities would not be significant due to the localized nature of project effects and because most rare plant species and communities would remain in the local study area. However, we find that the project would likely result in significant adverse effects on whitebark pine and rough fescue grasslands, given their status as at risk or protected, their limited distribution, and the likelihood that restoration in the closure landscape will not be possible.

The collective loss of species and plant communities (ecosite types), rare plants, old-growth forest, rough fescue grasslands, whitebark pine, and organic wetlands in the reclaimed landscape would result in the loss of vegetation species and community biodiversity in the local study area for 100 years or longer. We consider this effect to be significant and likely.

Wildlife and wildlife health

The project would adversely affect a number of wildlife species, including some listed under *SARA* and identified as sensitive under the *General Status of Alberta Wild Species*. The project would cause changes in wildlife habitat availability, habitat connectivity, movement, mortality risk, and abundance. Although individuals would be affected by the project, we find that overall the project would not likely affect the sustainability of the populations of listed species in the regional study area. We find that the project would not likely result in significant adverse effects on wildlife, including species at risk and migratory birds.

For little brown bats, in the event that the destruction of previously unidentified hibernacula occurred, a significant adverse residual effect from the project would be expected. However, as no hibernation sites have been identified within the project footprint to date and with the mitigation measures proposed, we find that this is unlikely.

Benga's baseline surveys may have underestimated project effects on amphibians and little brown bats, causing uncertainty over the magnitude of these effects. There is also uncertainty associated with the technical feasibility of some of the measures proposed by Benga to mitigate effects on wildlife, including

progressive reclamation, wildlife deterrents, amphibian pitfall traps, wildlife crossings, and bat boxes. We find that uncertainty associated with the effectiveness of Benga's proposed mitigation measures, particularly progressive reclamation, means that certain wildlife species—such as those dependent on old-growth forests—may not return to the project area for decades after project operations end, if they come back at all.

We find that selenium was the only contaminant of concern that would pose potential risks of adverse effects on wildlife health. We find that the surge ponds, raw water pond, and end-pit lake would contain elevated levels of selenium for an extended period and may pose a risk to wildlife. This risk is also concerning for migratory birds that may frequent or interact with contaminated pond waters and may be attracted to suitable habitat in and around ponds. We are not confident that the limited mitigation measures proposed by Benga, in both the short and long term, would discourage birds from landing on the surge ponds or raw water pond.

We find that Benga did not demonstrate that the constructed wetlands would be a safe and suitable habitat for amphibians. We are concerned that the loss of effective amphibian habitat may not be mitigated through the constructed wetlands, as Benga was unable to confirm when the wetlands will no longer contain contaminants of potential concern at levels that pose a risk to individual amphibians.

We find that the residual effects of the project, in combination with other projects and activities that have been and will be carried out, are likely to contribute to existing significant adverse cumulative effects on little brown bats and grizzly bears.

Social and economic effects

The project will have a moderate positive economic impact on the Crowsnest Pass area, and a low economic impact on the rest of Alberta and Canada. Benga's socioeconomic impact assessment presented three benchmark coal prices (in real, 2019 dollars) for calculating royalties: US\$100, US\$140, and US\$200 per tonne. It used the US\$140/tonne long-term average price to estimate royalty revenues.

Benga submitted that, during the operations phase, it would employ approximately 400 workers directly, and pay about \$77 million annually in royalties and income taxes to the provincial and federal governments over the 23-year life of the project. Benga estimated it would pay approximately \$990 000 and \$490 000 annually in municipal taxes to the Municipal District of Ranchland No. 66 and the Municipality of Crowsnest Pass, respectively, over the life of the project.

The project would provide well-paying jobs and have a positive effect on the regional economy through employment, spending, and revenue to municipal governments. However, as Benga did not submit key methodological details and models to support its estimates, we are not able to verify the magnitude of the estimated benefits. Additionally, we are not confident that Benga's estimate of future royalty payments of \$30 million per year is accurate. Benga did not submit a detailed financial feasibility model or provide a clear explanation to support its estimates. Nor did it provide an adequate explanation of why its royalty payments would be significantly higher than those of other bituminous coal mines in the province. We find that Benga's estimated royalty payments are likely overstated. By extension, we do not have confidence in the tax estimates that Benga produced, as they came from the same model.

Benga argued that demand for steel will remain high, but it did not address the issue of what technologies will be used to make steel over the lifetime of the mine. It also did not discuss whether steel-making technologies might evolve to become less dependent on metallurgical coal as part of efforts to reduce greenhouse gas emissions responsible for climate change.

The project has the potential to impose negative impacts on other economic sectors, while other risks in Benga's estimates that were not assessed could reduce the positive economic impacts of the project, including

- the likelihood that Benga overestimated the royalties that the project would generate;
- the potential for negative impacts on the tourism and recreation sectors;
- the potential for the quality of coal from the project to decline in later years of mine life, reducing the prices received and resulting in lower government revenues; and
- the potential for negative impacts on the demand for or price of metallurgical coal later in the life of the project due to global measures to reduce greenhouse gas emissions, general economic conditions in the metallurgical coal and steel markets, and competition from new technologies for steel-making.

If these risks materialize and the benchmark price of metallurgical coal in the future is closer to Benga's low-price scenario of US\$100/tonne, then government revenues from the project would be very low. We find that Benga presented an overly optimistic economic analysis that did not adequately consider these economic risks, which could undermine project economic viability, employment, and payments to governments later in the mine life.

Effects on Indigenous traditional use of lands and resources, culture, and rights

The project lies within Treaty 7 territory, in the headwaters of the Oldman watershed. The Crowsnest Pass is an important harvesting area and cultural landscape, and a traditional travel route for many Indigenous groups. Indigenous groups emphasized the importance of the Oldman watershed as a cultural landscape and source of traditional resources, and the need to protect it.

In our review, we evaluated two distinct but interrelated issues with respect to the effects of the project on Indigenous peoples. Under *CEAA 2012*, we assessed whether the project would cause changes to the environment that would affect: current use of lands and resources for traditional purposes; physical and cultural heritage; any structure, site or thing that is of historical, archaeological, paleontological, or architectural significance; or health and socioeconomic conditions. As part of our terms of reference, we also considered the adverse impacts of the project on asserted or established Aboriginal and treaty rights of 14 Indigenous groups:

- Káínai First Nation (Treaty 7)
- Piikani Nation (Treaty 7)
- Siksika Nation (Treaty 7)
- Stoney Nakoda Nations (Treaty 7)
- Tsuut'ina Nation (Treaty 7)

- Métis Nation of Alberta – Region 3
- Ktunaxa Nation
- Shuswap Indian Band
- Samson Cree Nation (Treaty 6)
- Louis Bull Tribe (Treaty 6)
- Ermineskin Cree Nation (Treaty 6)
- Montana First Nation (Treaty 6)
- Métis Nation British Columbia
- Foothills Ojibway First Nation

All of the Treaty 7 First Nations and the Métis Region 3 signed agreements with Benga and provided letters stating they had no objection to the project. They all indicated that they came to agreement on the basis that Benga had addressed their concerns. The Ktunaxa stated at the hearing that they were in discussions with Benga with the aim of negotiating an agreement as well.

Although details of the private agreements are not available, Benga provided information on “basic Indigenous commitments” it said were central to the agreements. Benga committed to consulting with Indigenous communities on the development of final monitoring and mitigation plans, reclamation plans that reflect traditional knowledge, a community-based monitoring program, communications protocols, and an access management plan. Benga stated that these commitments would apply to the Ktunaxa Nation and Shuswap Indian Band until such time that an agreement is made that supersedes the commitments.

Regardless of whether an Indigenous community signed an agreement or stated its support for the project, the potential adverse effects the project may have on Indigenous peoples are included in our assessment. We also consider the project’s effects on asserted or established Aboriginal or treaty rights and information regarding any measures proposed to avoid or mitigate the potential adverse effects of the project on asserted or established Aboriginal or treaty rights.

Overall, we find the project will result in the loss of lands used for traditional activities, and this would affect Indigenous groups and their members who use the project area. The mitigation measures proposed are not sufficient to fully mitigate these effects. We find that the project would have an adverse, but not significant, effect on the current use of lands and resources for traditional purposes for the Indigenous groups who demonstrated use of the project area: the Káínai, Piikani, Siksika, and Métis Region 3.

We also find that as a result of sensory disturbances from mining and blasting, the project would have an adverse but not significant effect on the current use of lands and resources for Indigenous groups harvesting occasionally in the project area, as well as those harvesting in the regional study area, including the Stoney Nakoda Nations, Tsuut’ina Nation, Ktunaxa Nation, and the Shuswap Indian Band.

We also find that the project would have a significant adverse effect on physical and cultural heritage for the Káínai, Piikani, and Siksika. These project effects, in combination with other projects and activities that have been or would be carried out, are likely to contribute to existing significant adverse cumulative

effects on the current use of lands and resources by the Káíñai, Piikani, and Siksika for traditional purposes and physical and cultural heritage.

We find the project is not expected to have an effect on Indigenous health conditions.

We agree with Benga's characterization that the economic opportunities resulting from the project are likely to have both positive and negative social and cultural implications. We also agree that the socioeconomic effects of the project would be experienced differently by each Indigenous group, and by individuals within each group. Neither Benga nor individual Indigenous groups provided information about the potential socioeconomic effects of the project on specific communities. As such, we were unable to complete an assessment of the effects of the project on the socioeconomic conditions of individual Indigenous groups.

The project is likely to have an impact on the Aboriginal and/or treaty rights of the Treaty 7 groups, the Ktunaxa Nation, and the Métis Region 3. The potential severity of impacts on rights is low to moderate for these groups. For all other groups, we summarize the information we received, but did not have sufficient information to make any determination of impact on rights.

Decision of the AER

To make decisions on the provincial applications as a panel of AER hearing commissioners, we must consider certain factors described in the AER's governing legislation. The mandate of the AER is set out in section 2 of *REDA*. In considering the applications, we are also aware of our responsibilities under section 15 of *REDA* and section 3 of the *REDA General Regulation*. The *Coal Conservation Act* requires us to consider whether the proposed project is in the public interest. We must also have regard for the purpose and requirements of the energy and specified enactments under which the applications are made, including the purposes of the *EPEA* and the *Water Act*. We are satisfied that, throughout this proceeding and in this decision report, we have considered the identified factors.

As part of our consideration of the public interest, we evaluated the potential impacts of the project on the rights and interests of Indigenous peoples. We also took into account the requirements of the *SSRP*. Furthermore, we considered the views expressed by different participants, and the economic, environmental, and social impacts that we expect the project to cause.

In our capacity as a panel of AER hearing commissioners, we find that the project's significant adverse environmental effects on surface water quality and westslope cutthroat trout and habitat outweigh the low to moderate positive economic impacts of the project. Therefore, we find that the project is not in the public interest. In making this determination, we understand that this means that the expected employment, related spending and economic benefits for the region will not be realized. However, even if the positive economic impacts are as great as predicted by Benga, the character and severity of the environmental effects are such that we must reach the conclusion that approval of the *Coal Conservation Act* applications is not in the public interest.

The project is likely to result in additional significant adverse effects beyond effects on surface water quality and westslope cutthroat trout and their habitat. We find that these effects, in and of themselves, would not have been sufficient to determine that the project is not in the public interest. It is the effects on surface water quality and westslope cutthroat trout and habitat that drive our public interest determination.

Exercising our authority as the AER, we deny Benga's applications 1844520 and 1902073 under the *Coal Conservation Act*. Correspondingly, there is no need for the approvals sought by Benga under the *EPEA*, the *Water Act* and the *PLA* and we deny these applications as well.

In May 2020, prior to the hearing, Alberta rescinded the 1976 *Coal Development Policy for Alberta (Coal Policy)*. Several participants at the hearing expressed concern about rescission of the policy and its implications for coal development in the region. In February 2021, subsequent to the close of the record for the hearing, Alberta reinstated the *Coal Policy*. The reinstatement of the *Coal Policy* did not persuade our decision because of our conclusion that the project was not in the public interest as a result of its environmental effects.

Federal responsibilities

In our capacity as a review panel under *CEAA 2012*, we are submitting this report to the Minister of Environment and Climate Change. Within this report, we provide our rationale, conclusions, and recommendations related to the environmental effects of the project.

We considered all records relating to the review, including submissions, correspondence, hearing transcripts, exhibits, and other information received and posted to the public registry.

In accordance with *CEAA 2012*, we take into account potential environmental effects on the components of the environment that are within the legislative authority of Parliament: fish and fish habitat as defined in the *Fisheries Act*, aquatic species as defined in *SARA*, and migratory birds as defined in the *Migratory Birds Convention Act*.

Our assessment includes whether any resulting changes to the environment would occur on federal lands, in a province other than Alberta, or outside Canada. We find that there are no such effects. However, the project's greenhouse gas emissions would contribute to global greenhouse gas emissions and increase atmospheric concentrations of greenhouse gases.

With respect to Indigenous peoples, our assessment considers the effects on the environment in Canada; health and socioeconomic conditions; physical and cultural heritage; the current use of lands and resources for traditional purposes; and any structure, site, or thing of historical, archaeological, paleontological, or architectural significance.

The project is subject to permitting and authorization by Fisheries and Oceans Canada under the *Fisheries Act* and *SARA*, and by Natural Resources Canada under the *Explosives Act*. In accordance with *CEAA 2012*, we take into account additional environmental effects in the context of the federal authorizations required for the project.

As required by our terms of reference, we provide an assessment of all incremental air pollutants and greenhouse gas emissions directly attributable to the project, including those associated with rail transport to the west coast of British Columbia and marine emissions within Canadian territorial waters.

We also provide our rationale, conclusions, and recommendations that relate to the manner in which the project may adversely affect asserted or established Aboriginal or treaty rights, as well as measures that may reduce or avoid potential impacts. In addition, we provide a summary of comments received from the

public, including Indigenous persons and groups. As required by our terms of reference, we also consider the effects of the project on *SARA*-listed species and their critical habitat.

In accordance with the precautionary principle, our review considers the project in a careful and precautionary manner, so to avoid significant adverse environmental effects on components of the environment that are within the legislative authority of Parliament.

We do not provide mitigation measures for consideration by the federal minister should the project proceed. In our capacity as a panel of AER hearing commissioners, we deny Benga's applications under the *Coal Conservation Act* and related applications under the *EPEA*, *Water Act*, and *PLA*. Without approval of the provincial applications, the project cannot proceed. However, we make a number of recommendations to the federal government relating to the environmental effects of the project. These recommendations address limitations that we observed during the review process. Implementation of the recommendations may improve the effectiveness of future reviews of proposed projects, and provide helpful information and direction to decision makers, proponents, and members of the public.

1. Introduction

Project description

[1] Benga Mining Limited (Benga) has applied to construct, operate, and reclaim a new, open-pit metallurgical coal mine approximately 7 kilometres (km) north of the community of Blairmore in the Crowsnest Pass area of southwestern Alberta (Figure 1-1). The development area is located in Townships 8 and 9, Ranges 3 and 4, west of the 5th meridian on private and public lands. The mine would occupy montane and subalpine natural subregions in an area that has previously experienced surface and subsurface coal mining.

[2] The maximum production capacity of the Grassy Mountain Coal Project (the project) would be 4.5 million tonnes of metallurgical coal per year, over a mine life of approximately 23 years. The project would include surface pits and waste rock disposal areas, a coal-handling and processing plant with associated infrastructure, water management structures, an overland conveyor system, a rail loadout facility, and other facilities. The project's footprint is approximately 1521 hectares (ha) (Figure 1-2).

[3] The project's mining activities would be completed by blasting and truck-and-shovel mining. Rock above the coal would be drilled, blasted, and hauled to waste rock disposal areas or used to backfill a portion of the mine pit. The pit would be approximately 1.8 km wide, 6 km long, and up to 430 metres (m) deep. Once the mined coal has been removed, it would be transported by truck to the coal-handling and processing plant, where it would be cleaned to make a saleable product. Waste rock and process fines from the coal-handling and processing plant would be disposed of in the waste rock disposal areas. After processing, the coal would be transported via overland conveyor to a rail loadout facility along an existing Canadian Pacific Railway track in the Town of Blairmore. The coal would then be loaded into rail cars and transported to marine facilities on British Columbia's west coast. Benga has proposed to progressively reclaim the land as mining operations are completed. The closure landscape would include an 18.4 ha end-pit lake.

Legislative and regulatory framework

[4] The project requires an environmental assessment under Alberta's *Environmental Protection and Enhancement Act (EPEA)*. The project is also subject to an assessment under the *Canadian Environmental Assessment Act, 2012 (CEAA 2012)*. A joint provincial-federal review process was established to create a cooperative proceeding pursuant to section 18 of the *Responsible Energy Development Act (REDA)* and a joint review panel pursuant to sections 38, 39, 40, and 42 of *CEAA 2012*.

[5] On August 16, 2018, Canada's Minister of Environment and Climate Change (the Minister) and the Chief Executive Officer of the AER announced the *Agreement to Establish a Joint Review Panel for the Grassy Mountain Coal Project*. Pursuant to the agreement, a joint review panel was established, with Mr. A. Bolton appointed as panel chair, and Mr. D. O'Gorman and Mr. H. Matthews as panel members. Under the provincial-federal agreement, the panel must conduct its review in a manner that discharges the responsibilities of the Alberta Energy Regulator (AER) under *REDA*, the *Coal Conservation Act*, *EPEA*, the *Water Act*, and the *Public Lands Act (PLA)*, and discharge the requirements of *CEAA 2012* and the panel's terms of reference, which are attached as an appendix to the agreement.

Provincial responsibilities

[6] In our capacity as a panel of AER hearing commissioners, we are responsible for deciding the applications related to the project under the *Coal Conservation Act*, the *EPEA*, the *Water Act*, and the *PLA*.

[7] Provincial approvals are required for the following applications:

- Application 1844520 under section 10 of the *Coal Conservation Act* for a mine permit and under section 11 for mine licences to construct, operate, and reclaim the open-pit mine, north rock disposal area, central rock disposal area, and south rock disposal area associated with the project
- Application 1902073 that updates and amends Application 1844522, under section 23 of the *Coal Conservation Act* for an approval to construct and operate a new coal-processing plant
- Application 001-00403427 under section 66 of the *EPEA* to construct, operate, and reclaim a new open-pit metallurgical coal mine
- Application 001-00403428 under the *Water Act* to transfer a licence held by Canadian Natural Resources Limited for surface water from the Crowsnest River
- Application 001-00403429 under the *Water Act* to transfer a licence held by the Municipality of Crowsnest Pass for surface water from the York River
- Application 001-00403430 under the *Water Act* for a licence to divert surface water for use in the project
- Application 001-00403431 under the *Water Act* for approval to capture, collect, treat, and manage surface runoff and groundwater as part of a water management program, including development of an end-pit lake
- Application MSL 160757 under the *PLA* for the Grassy Mountain Coal Mine
- Application MSL 160758 under the *PLA* for a corridor (access, conveyor, and powerline)
- Application LOC 160841 and LOC 160842 under the *PLA* for the railway loop and access

[8] If we were to decide the project was in the public interest and should be approved, the AER would require authorization from the Lieutenant Governor in Council of Alberta prior to issuing approvals for the mine permit and coal processing plant under the *Coal Conservation Act*. In making our decisions on the applications, we must consider certain factors set out in the AER's governing legislation. The mandate of the AER, which is set out in section 2 of *REDA*, is "to provide for the efficient, safe, orderly, and environmentally responsible development of energy resources in Alberta." In considering the *Coal Conservation Act* applications, section 15 of the *REDA*, and section 3 of the *REDA General Regulation*, require that we consider the project's social and economic and environmental effects and the impacts on landowners as a result of the use of the land on which the energy resource activity would be located. We must also have regard for the purpose and requirements of the energy and specified enactments under which the applications are made, including:

- the public interest within 8.1(2) of the *Coal Conservation Act*,
- the purposes in section 4 of the *Coal Conservation Act*, and in particular:

- 4(c) to ensure orderly, efficient and economic development of Alberta’s coal resources in the public interest
 - 4(e) to assist the Government to control pollution and ensure environment conservation in the development of the coal resources of Alberta
 - 4(f) to ensure the observance of safe and efficient practices in
 - (i) the exploration for, and the mining, storing, processing and transporting of, coal
 - the purposes of section 2 of the *EPEA*, and in particular:
 - 2(a) the protection of the environment is essential to the integrity of ecosystems and human health and to the well-being of society
 - 2(b) the need for Alberta’s economic growth and prosperity in an environmentally responsible manner and the need to integrate environmental protection and economic decisions in the earliest stages of planning
 - 2(c) the principle of sustainable development, which ensures that the use of resources and the environment today does not impair prospects for their use by future generations
 - 2(d) the importance of preventing and mitigating the environmental impact of development and of government policies, programs and decisions.
 - the purpose of section 2 of the *Water Act*, and in particular:
2. ... to support and promote the conservation and management of water, including the wise allocation and use of water, while recognizing
- (a) the need to manage and conserve water resources to sustain our environment and to ensure a healthy environment and high quality of life in the present and the future
 - (b) the need for Alberta’s economic growth and prosperity
 - (c) the need for an integrated approach and comprehensive, flexible administration, and management systems based on sound planning, regulatory actions, and market forces.

[9] As part of our consideration of the applications made to the AER, we must consider the potential impacts of the project on the rights and interests of Indigenous peoples.

[10] The Aboriginal Consultation Office (ACO) within the Government of Alberta’s Ministry of Indigenous Affairs provides consultation management services. Under provincial ministerial orders,¹ the AER is required to request advice from the ACO prior to deciding certain applications under the *Water Act*, *EPEA* and the *PLA*. That advice relates to whether Crown consultation has been adequate in relation

¹ Energy Ministerial Order 105/2014, Environment and Sustainable Resource Development Ministerial Order 53/2014; Energy Ministerial Order 39/2016, and Environment and Parks Ministerial Order 16/2016.

² This should be nitrite, not nitrate. Benga referenced the transcript (CIAR 884, PDF p. 210) for this statement.

to the applications, a topic over which the AER has no authority, according to Section 21 of *REDA*, and whether mitigation measures may be required to address potential impacts on Aboriginal rights.

[11] Alberta's *Land-Use Framework*, released in 2008 and supported by the *Alberta Land Stewardship Act*, sets out how land will be managed in Alberta to effectively balance competing economic, environmental and social demands. The regional plan under the *Alberta Land Stewardship Act* relevant to the project is the *South Saskatchewan Regional Plan (SSRP)*. According to section 13 of the *Alberta Land Stewardship Act*, a regional plan is an expression of the public policy of the government of Alberta and section 15(1) says it binds the AER as a decision maker unless expressly stated otherwise. Section 20(1) of *REDA* provides that the AER is required to act in accordance with any applicable regional plan.

Federal responsibilities

[12] In August 2019, the *Impact Assessment Act* came into force and repealed *CEAA 2012*. Pursuant to section 181(1) of the *Impact Assessment Act*, the review of this project continued under *CEAA 2012* as if that Act had not been repealed.

[13] As required by section 5(1)(a) of *CEAA 2012*, we assessed the potential environmental effects of the project that may be caused to the components of the environment that are within the legislative authority of federal Parliament. Our assessment considered potential effects on fish and fish habitat as defined in the *Fisheries Act*, aquatic species as defined in the *Species at Risk Act*, and migratory birds as defined in the *Migratory Birds Convention Act, 1994*. As required by our terms of reference, we have also considered the effects of the project on *SARA*-listed wildlife species and their critical habitat.

[14] We have assessed whether changes that may be caused to the environment would occur on federal lands, in a province other than Alberta, or outside Canada, in accordance with section 5(1)(b) of *CEAA 2012*.

[15] With respect to Indigenous peoples, under section 5(1)(c), we considered effects occurring in Canada of any change that may be caused to the environment on health and socioeconomic conditions, physical and cultural heritage, the current use of lands and resources for traditional purposes, and any structure, site, or thing that is of historical, archaeological, paleontological or architectural significance.

[16] The project is subject to permitting and authorization by Fisheries and Oceans Canada (DFO) under sections 35 of the *Fisheries Act* and section 73 of *SARA*, and by Natural Resources Canada (NRCan) under section 7(1) of the *Explosives Act*. Section 5(2) of *CEAA 2012* requires additional environmental effects to be considered in the context of the federal authorizations required for the project.

[17] In our capacity as a review panel under *CEAA 2012*, we must prepare and submit a report to the Minister summarizing our rationale, conclusions, and recommendations regarding the environmental effects of the project, including any mitigation measures and follow-up programs. The report must include a summary of comments received from the public, including Indigenous persons and groups. The report must also include our rationale, conclusions, and recommendations that relate to the manner in which the project may adversely impact asserted or established Aboriginal or treaty rights as described by Indigenous persons or groups and other parties, including any measures that may reduce or avoid potential impacts to those rights.

[18] Our terms of reference under the joint review panel agreement provide that the joint review panel shall not make any determinations as to

- the validity of asserted or established Aboriginal or treaty rights asserted by an Indigenous group or peoples or the strength of such claims
- the scope of the Crown’s duty to consult an Indigenous group
- whether the Crown has met its respective duties to consult or accommodate in respect of rights recognized and affirmed by section 35 of the *Constitution Act* of 1982, or
- any matter of treaty interpretation.

[19] *CEAA 2012* requires us to consider the project in a careful and precautionary manner to avoid significant adverse environmental effects on components of the environment within the legislative authority of Parliament.

Joint review process

[20] The AER issued the *Final Terms of Reference for the Environmental Impact Assessment Report for the Grassy Mountain Coal Project* on March 19, 2015.

[21] The Canadian Environmental Assessment Agency, now the Impact Assessment Agency of Canada (the Agency), issued the *Final Environmental Impact Statement Guidelines* for the project on July 6, 2015.

[22] Benga submitted an Environmental Impact Assessment (EIA) to the AER and the Agency on November 10, 2015.

[23] Benga submitted an updated EIA to the AER and the Agency on August 15, 2016.

[24] Benga submitted an integrated application to the AER on October 25, 2017. The integrated application provided information required under the *Coal Conservation Act*, the *EPEA*, the *Water Act*, and the *PLA*. The Government of Alberta’s ministries of Transportation; Culture, Multiculturalism and Status of Women; and Health; as well as the ACO were given an opportunity to review the applications and provide comments, as part of a provincial review team led by the AER.

[25] Between January 31, 2017, and October 24, 2018, Benga responded to nine packages of pre-panel requests for information from the AER and the Agency. The Agency held a public comment period after Benga submitted its responses to each package of requests for information, allowing the public to review and provide additional comments on the information supplied by Benga.

[26] The joint review panel was established on August 16, 2018.

[27] We announced a public comment period on the EIA and eight addenda submitted by Benga, beginning on November 5, 2018, and running through January 21, 2019.

[28] On December 21, 2018, we requested additional information from Benga regarding Indigenous traditional land use.

[29] Between August 2019 and March 2020, Benga responded to our information requests. The information requests were split across six packages and involved various topics. Benga submitted the Tenth Addendum, which included responses to our information requests, on August 30, 2019. We announced a public comment period (for the Ninth and Tenth Addenda) beginning on September 9, 2019, and running through October 24, 2019. Benga submitted the Eleventh Addendum, which included responses to our information requests, on March 13, 2020, and we announced a public comment period from March 19 through May 4, 2020. Because of the COVID-19 pandemic, we extended the public comment period from 30 to 45 days.

[30] We conducted a site visit of the Grassy Mountain area by helicopter and vehicle on September 25, 2019. Prior to conducting our site visit, we advised participants in the review process and members of the public via the registry and the distribution list of our plans to conduct the site visit and solicited input on what we should see during our visit.

[31] On April 3, 2020, the Minister extended the time limit for the assessment of the proposed Grassy Mountain Coal Project by 90 days in recognition of the extenuating circumstances arising from the COVID-19 pandemic and its impacts on communities, businesses, and stakeholders. The Minister allocated the additional 90 days to the time limit for us to submit our report.

[32] On May 22, 2020, we advised Benga that, while additional information was required, the information deficiency was minor in nature and we were prepared to move to the next stage of the review process, subject to receiving a commitment from Benga that it would provide the additional information in a timely manner. Following receipt of the additional information, our next steps included: deeming the EIA complete under the *EPEA*, confirming the information provided by Benga was sufficient to proceed to a public hearing, and issuing the notice of hearing.

[33] On June 1, 2020, Benga provided a commitment to deliver the required additional information by June 19, 2020. On June 19, 2020, Benga filed the Twelfth Addendum.

[34] On June 25, 2020, we advised Benga that we had deemed the EIA for the Grassy Mountain Coal Project complete pursuant to section 53 of the *EPEA*. In addition, we informed Benga that the information on the public registry was sufficient to proceed to the public hearing stage of the process.

[35] We issued a notice of hearing on June 29, 2020. In the notice, we noted the groups listed below had demonstrated they may be directly and adversely affected by the project or have relevant information or expertise about the project and could participate fully in the hearing.

- Káínai Nation (Blood Tribe)
- Ktunaxa Nation
- Métis Nation of Alberta – Region 3
- Piikani Nation
- Samson Cree Nation
- Siksika Nation

- Stoney Nakoda Nation
- Tsuut'ina Nation
- Canadian Parks and Wilderness Society – Southern Alberta Chapter
- Coalition of Alberta Wilderness Association and Grassy Mountain Group
- Livingstone Landowners Group
- Municipality of Crowsnest Pass

[36] Groups or individuals not listed in the notice were asked to file a request to participate in the hearing by July 20, 2020.

[37] Benga, Environment and Climate Change Canada (ECCC), DFO, Health Canada, Indigenous Services Canada, the Agency, and NRCan were required to participate in the hearing.

[38] In response to requests to participate in the hearing, we issued further participation decisions on August 10, 2020. On September 9, 2020, we issued a notice of scheduling of hearing and advised that the hearing would begin on October 27, 2020.

[39] On October 16, 2020, we sent a letter to the Minister and the Chief Executive Officer of the AER, requesting an extension to June 18, 2021 to deliver the joint review panel report. We cited the complexity of the project and volume of materials on the record, including 12 addenda and hundreds of submissions from participants, additional work and process required to deem the EIA complete, the impact of the COVID-19 pandemic on the time needed to hold a public hearing, and the need to receive advice from the ACO prior to closing arguments. We were notified on December 17, 2020, that the Minister had granted the extension.

Hearing

[40] The public hearing began on October 27, 2020, using electronic means (Zoom and broadcast through YouTube). The oral portion of the hearing continued for 29 sitting days and concluded on December 2, 2020.

[41] The ACO provided its hearing reports on December 3, 2020, and final arguments were provided in writing thereafter. We closed the hearing record on January 15, 2021.

[42] Those who appeared at the hearing are listed in Appendix 1.

[43] In reaching the determinations contained in this report, we considered all relevant materials constituting the record of the joint review on the public registry maintained by the Agency. This includes all records relating to the review, including submissions, correspondence, hearing transcripts, exhibits and all other information we received up to the close of the record on January 15, 2021. References in this report to specific parts or portions of the record are intended to help the reader understand our reasons and should not be taken as an indication that we did not consider all relevant evidence on the record. As a general principle, if written material was filed in the proceeding and the submitter did not participate in the oral portion of the hearing to allow that material to be tested, we gave that written material less evidentiary weight compared with written material that had the opportunity to be tested during oral

portions of the hearing. In making a decision on the applications made to the AER, we gave no weight to any material filed after the close of the record for the oral hearing on January 15, 2021.

Participant Funding Program

[44] The Agency administers the federal Participant Funding Program, which supports individuals, non-profit organizations, and Indigenous groups interested in participating in federal environmental assessments. Funding was made available to help eligible individuals and groups review and provide comments on the draft Review Panel Terms of Reference and the environmental impact assessment. Funding was also provided to help participants prepare for and participate in the public hearing.

[45] The Agency established a funding review committee, independent of the review panel process, to review funding applications and recommend funding allocations. Neither the panel nor the panel secretariat was involved in the administration of the federal Participant Funding Program or decisions on funding allocations. Over the course of the review, the Agency allocated \$745 983.07 to 13 applicants:

- Blood Tribe
- Canadian Parks and Wilderness Society – Southern Alberta Chapter
- Coalition of Grassy Mountain Group and Alberta Wilderness Association
- Ktunaxa Nation Council
- Métis Nation of Alberta – Region 3
- Métis Provincial Council of British Columbia
- Piikani Nation
- Samson Cree Nation
- Shirley Kirby
- Shuswap Indian Band
- Siksika Nation
- Stoney Nakoda Nation
- Tsuut'ina Nation

Hearing participants

Indigenous groups

[46] The Káínai First Nation submitted a statement of concern, comments on the draft joint review panel agreement and terms of reference, as well as comments on the EIA and associated addenda. On July 10 and August 23, 2019, the Káínai indicated that they supported the project on the basis that Benga had adequately addressed their project-specific concerns. The Káínai were granted full participation, but did not participate in the hearing.

[47] The Piikani Nation submitted a statement of concern and comments on the project description, as well as comments on the EIA and associated addenda. On January 18, 2019, and March 7, 2019, the

Piikani indicated their support for the project. They stated that their partnership with Benga would allow them to provide employment, training, and education to their members, and would help build their economy. The Piikani were granted full participation, but did not participate in the hearing.

[48] The Siksika Nation submitted a statement of concern and comments on the draft joint review panel agreement and terms of reference, as well as comments on the EIA and associated addenda. On March 23, 2020, the Siksika stated that they do not object to the project and its related applications on the basis that Benga had adequately addressed their project-specific concerns. The Siksika were granted full participation, but did not participate in the hearing.

[49] The Stoney Nakoda Nations submitted a statement of concern and comments on the project description. On March 11, 2019, the Stoney Nakoda advised us that they did not object to the project on the basis that Benga had adequately addressed their project-specific concerns. The Stoney Nakoda participated in the hearing by providing a written submission and making a presentation. In Mr. B. Snow's statement at the hearing, the Stoney Nakoda indicated that as a result of their work with Benga, they conditionally supported the development of the project and would "accept the decision of the Joint Review Panel should they agree that the Grassy Mountain Project can proceed in a manner that will protect the environment while providing economic and social benefits to the Stoney Nakoda Nations, the province of Alberta, and to Canada, as a whole" (CIAR 622, PDF p.1; and CIAR 740, PDF p. 60). The Stoney Nakoda later submitted a letter clarifying that they did not object to the project and were not asking us to implement the conditions described in their hearing submission and at the hearing.

[50] Tsuut'ina Nation submitted a statement of concern and comments on the draft joint review panel agreement and terms of reference, as well as comments on the EIA and associated addenda. On December 4, 2019, Tsuut'ina indicated their support for the project. Tsuut'ina Nation were granted full participation, but did not participate in the hearing.

[51] The Métis Nation of Alberta – Region 3 submitted a statement of concern and comments on the environmental impact assessment and associated addenda. They participated in the hearing by providing a written submission and making a presentation. On June 9, 2020, the Métis Region 3 expressed their support for their project.

[52] The Ktunaxa Nation provided comments on the EIA and associated addenda and participated in the hearing by providing written submissions, a presentation, and a final argument. The Ktunaxa provided a report that outlined their rights and interests related to the project, and provided information on water quality, wildlife, fish and fish habitat, reclamation, and cumulative effects. The Ktunaxa did not take a position on whether the project is in the public interest, but emphasized the need to ensure that any mitigation measures and management plans are clear, timely, precautionary, and adaptive.

[53] The Shuswap Indian Band participated in the hearing by providing a written submission and making a presentation. They indicated that they have frequently used and moved through the project area in Crowsnest Pass, both ancestrally since time immemorial and presently, and intend to continue to revive stewardship through this area for future generations.

[54] The Samson Cree Nation submitted a statement of concern and comments on the draft Environmental Impact Statement Guidelines. They stated that the project would have an adverse effect on

the environment and their traditional territory, uses, interests, freedom of religion, and basic human rights. The Samson Cree were granted full participation, but did not participate in the hearing.

Government of Canada

[55] The Government of Canada provided expert information and comments throughout the review process on the draft Joint Review Panel Agreement and the conformity and sufficiency of the EIA and 12 addenda. The Government of Canada participated in the hearing by making a written submission and providing oral testimony and a final argument. The Government of Canada did not cross-examine other witnesses but made experts available for cross-examination during the hearing.

[56] The federal departments involved in the review included DFO, ECCC, Health Canada, and NRCan, as well as the Agency. These departments participated in the hearing as federal authorities in accordance with section 20 of *CEAA 2012* by providing us with expert information and knowledge on areas within their respective mandates.

[57] ECCC's submissions focused on selenium and the site-specific risk assessment and site-specific water quality objective developed by Benga, as well as accidents and malfunctions, air quality and greenhouse gases, climate change, and the wildlife risk assessment. ECCC's submissions also focused on the project's potential effects on migratory birds and species at risk, including the little brown bat (*Myotis lucifugus*), whitebark pine (*Pinus albicaulis*), and limber pine (*Pinus flexilis*). ECCC was supportive of the proposed progressive reclamation activities, including restoration of the legacy mine footprint.

[58] DFO's submissions focused on the potential effects of the project on the westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) and its designated critical habitat in Gold Creek. DFO concluded that the offsetting proposed by Benga contains a high degree of uncertainty due to the specialized adaptations of westslope cutthroat trout and the complexity of the habitat. DFO concluded the project could result in significant adverse effects on westslope cutthroat trout.

[59] Health Canada's submissions focused on the potential effects of the project on human health, specifically changes in air quality, water quality, and the acoustic environment. Health Canada also indicated that the overall human health risk assessment did not fully address potential health risks from multi-media exposures (simultaneous exposure to substances released into the environment from coal mining activities and deposited into air, food, and water).

[60] NRCan's submissions focused on surficial geology and terrain hazards, seismicity, and hydrogeology.

[61] The Agency's submission focused on an assessment of the potential impacts of the project on asserted or established Aboriginal or treaty rights as described by Indigenous groups. The Agency stated that the project is likely to have adverse biophysical environmental effects that may have implications for the current use of lands and resources for traditional purposes as defined under *CEAA 2012*, in addition to potential impacts on the exercise of Aboriginal or treaty rights.

Municipal governments

[62] The Municipal District of Ranchland No. 66 submitted statements of concern and comments during the review process, and participated in the hearing through a written submission, the presentation

of expert evidence, cross-examination of Benga, and written final argument. The M.D. of Ranchland submissions focused on the spread of noxious weeds and the impacts on municipal infrastructure and services. They indicated that the project is not in the public interest, and argued that we have the necessary evidence to recommend that the application be rejected.

[63] The Town of Pincher Creek provided letters of support and comments throughout the review process and participated in the hearing by making a written submission and oral presentation. The Town of Pincher Creek indicated that the project would be an economic driver for the region.

[64] The Municipality of Crowsnest Pass submitted statements of concern and letters of support for the project throughout the review process and participated in the hearing by making a written submission and having an expert make a presentation. On November 6, 2020, the municipality indicated that they would not present any further evidence at the hearing. The municipality's position was that the project would provide essential tax relief for the residents of Crowsnest Pass.

Industrial organizations

[65] The Coal Association of Canada participated in the hearing and expressed their support for the project. The association emphasized that our decision is of the utmost importance not only to the Crowsnest Pass region but to the entire industry and supply chain, and will play a significant role in future investments in Canadian coal operations.

Individuals

[66] K. Allred provided letters of support for the project and participated in the hearing by making a written submission and presentation. Mr. Allred stated that the project would provide a much-needed economic boost for Crowsnest Pass.

[67] F. Bradley participated in the hearing by providing a written submission and a presentation. Mr. Bradley expressed his support for the project and indicated that the jobs and economic activity generated by the project would provide long-term stability to the economy of the Crowsnest Pass.

[68] A. Des Moulins provided comments during the review process and participated in the hearing by making a written submission and presentation. Mr. Des Moulins' submissions focused on the impact of the project on tourism and recreation in Crowsnest Pass, and indicated that Benga had underestimated wind speeds and their potential to spread coal dust.

[69] G. Des Moulins provided comments during the review process and participated in the hearing by making a written submission and presentation. Ms. Des Moulins stated that demand for metallurgical coal would decline in the future, and was concerned that reclamation of the mine site would not continue if the project became unprofitable.

[70] M. Field provided comments during the review process and participated in the hearing by making a written submission and presentation. Ms. Field's submissions focused on the potential effects of blasting on the stability of Turtle Mountain, the lack of reclamation of coal mines, and the contribution of the project to dust and noise.

[71] B. Janusz provided comments during the review process and participated in the hearing by making a written submission, a presentation, a cross-examination of Benga and other participants adverse in interest, and a final argument. Ms. Janusz's submissions focused on the incompatibility of the project with tourism and amenity migration in the Crowsnest Pass, and indicated that the estimated tax benefits from the project do not outweigh its potential adverse environmental effects. Ms. Janusz indicated that Benga's statement that the project is in the public interest was not supported by evidence, and urged us to dismiss Benga's applications.

[72] M. Judd participated in the hearing by providing a written submission and a presentation. Mr. Judd said that the project would have a significant negative impact on the eastern slopes of the Rockies, which he considers an iconic landscape.

[73] D. McIntyre submitted statements of concern and comments during the review process and participated in the hearing by providing a written submission and a presentation. In his submissions, Mr. McIntyre provided information on the local environment, and indicated that the project would degrade the aesthetic and ecological integrity of the landscape and the headwaters of the Oldman watershed. Mr. McIntyre expressed concern regarding high wind speeds in the area and the potential of the project to circulate dust, the potential for a landslide at Turtle Mountain, and effects of the project on recreation.

[74] J. Rennie submitted a statement of concern and comments during the review process, and participated in the hearing by making a written submission, a presentation, and by providing a final argument. In his submissions, Mr. Rennie provided information regarding fish catch numbers for the westslope cutthroat trout in Gold Creek and discussed a 2015 fish-kill event in Gold Creek.

Nongovernmental organizations

[75] The Alberta Chapter of the Wildlife Society (the Wildlife Society) participated in the hearing by providing a written submission and a presentation. They stated that they were concerned about the cumulative effects of the project on wildlife and their habitats in the region, and the impact on carnivore populations and landscape connectivity.

[76] Canadian Parks and Wilderness Society (CPAWS) Southern Alberta Chapter submitted a statement of concern and comments during the review process and participated in the hearing by providing a written submission, presentation of expert evidence, cross-examination of Benga, and written final argument. During the hearing, CPAWS provided evidence and cross-examined Benga on matters related to coal quality, effects on amphibians, adaptive management, and selenium mitigation. CPAWS's position was that the project was unlikely to have any social or economic benefits, and likely to cause significant adverse environmental effects. CPAWS stated that the project is not in the public interest, and should not be approved.

[77] The Coalition of the Alberta Wilderness Association and the Grassy Mountain Group (the Coalition) submitted a statement of concern and comments during the review process and participated in the hearing by providing a written submission, a presentation of expert evidence, a cross-examination of Benga, and a final argument. The Coalition consists of the public-interest Alberta Wilderness Association and a landowner group comprised of individuals, families, and corporations who own and occupy lands within, adjacent to, or in close proximity to the project. During the hearing, the Coalition provided evidence and cross-examined Benga on matters related to noise; climate change; property access; socioeconomics; species at risk, including whitebark pine, little brown bat, and westslope cutthroat trout; hydrogeology; and the inclusion of other potential projects in the cumulative effects assessment. The Coalition's position was that the project will have significant adverse social, economic, and environmental effects that will exceed any economic benefit. The Coalition stated that approval of the project is not in the public interest and should be denied.

[78] The Crowsnest Conservation Society submitted a statement of concern, provided comments during the review process, and participated in the hearing by providing a written submission, a presentation, and a final argument. Their submissions highlighted the potential adverse effects of the project on recreation and tourism in the Crowsnest Pass, and the uncertainties surrounding the project's economic benefits and viability. The society stated that Benga has neither demonstrated that the project is in the public interest, nor that it would not cause significant environmental effects.

[79] Eco-Elders for Climate Action participated in the hearing by providing a written submission and making a presentation. They said that their grandchildren's health, livelihoods, and ability to thrive on the affected land would be diminished because of the project's negative impacts on valuable ecosystems.

[80] The Livingstone Landowners Group submitted a statement of concern and comments during the review process and participated in the hearing by providing a written submission, a presentation of expert evidence, a cross-examination of Benga, and a final argument. The group represents landowners and supporters of the Livingstone-Porcupine Hills area. During the hearing, the group provided evidence and cross-examined Benga on the economic impacts of the project, air quality, human health, selenium management, landform design, and closure and reclamation. The group's position was that the project would have significant adverse environmental effects that cannot be justified due to the marginal economic and socioeconomic benefits promised. The group concluded that the project is not in the provincial public interest.

[81] The Oldman Watershed Council submitted a statement of concern and comments during the review process, and participated in the hearing through a written submission and presentation. The council emphasized the importance of the headwaters as a source of water for the Oldman River and was concerned about selenium contamination from the project and its potential impact on downstream water uses, including irrigation and drinking.

[82] The Timberwolf Wilderness Society provided comments during the review process and participated in the hearing through a written submission, a presentation of expert evidence, a cross-examination of Benga, and a final argument. The society's submissions focused on the potential effects of the project on westslope cutthroat trout and its critical habitat, greenhouse gas emissions from the project, and the influence of climate change on the frequency and intensity of extreme precipitation events that

could lead to dam failure. Their position was that the project is not in the public interest and that it should not be approved.

[83] Trout Unlimited Canada submitted a statement of concern and comments during the review process, and participated in the hearing by making a written submission and presentation. The group stated their opposition to the project, and outlined concerns that the project would result in negative effects on downstream water quality and undermine efforts to recover westslope cutthroat trout populations.

Groups, organizations, and individuals that engaged in the review process but did not participate in the hearing

Nongovernmental organizations

[84] The Crowsnest Pass Chamber of Commerce provided a letter of support for the project on January 14, 2016, stating that the project would be beneficial to many businesses while bringing in additional tax revenue and creating employment.

[85] The Crowsnest Pass Quad Squad provided a letter of support for the project on December 3, 2017, highlighting that Benga had looked at ways to connect trails from east of Highway 40 to the Lille Valley historical trail system across lands owned by Benga.

[86] The Hillcrest Fish and Game Protective Association provided a letter of support for the project on December 7, 2017, stating that its members were in favour of the project but had concerns about water quality and the management of wildlife habitat.

[87] The Speak Up for Wildlife Foundation provided a letter to us on January 21, 2019. Their submission stated that the Grassy Mountain area is a high-risk mortality sink, and the environmental and social costs of the project cannot be justified.

[88] The Ironworkers Union Local 725 provided a letter to us on October 17, 2019, expressing support for the project. The union stated that the project would supply a much-needed boost for workers across southern Alberta.

[89] The Yellowstone to Yukon Conservation Initiative provided a letter to us on September 4, 2020. The comments stated that Benga should address the need for wildlife movement through and around the Grassy Mountain mine site, and should also address the need for secure habitat and movement corridors for grizzly bears (*Ursus arctos*) and elk (*Cervus canadensis*) into the future.

[90] The Canadian Association of Physicians for the Environment provided a letter to us on October 6, 2020. The association recognized the intrinsic value of mountain wilderness and its importance as a wildlife habitat and clean water source, and its benefits for recreation, physical activity, and mental health. They stated that, from a human health-risk perspective, large-scale open-pit mining would expose atmospheric, surface water, vegetation, and wildlife pathways to contamination by chemicals of potential concern in unanticipated ways.

[91] The Angling Outfitter and Guide Association of Alberta provided comments to us on January 10, 2021, after the oral portion of the hearing concluded. The association expressed concern about the impacts of coal mining on water quality, fish, and critical habitat for westslope cutthroat trout.

[92] The Bow Valley Naturalists provided comments to us on January 11, 2021, after the oral portion of the hearing concluded. They expressed concern regarding the potential effects of the project on downstream water quality. They stated that the economy would benefit in the short term, but the environment, and Albertans living downstream in particular, would bear the long-term damages and costs.

Indigenous groups, organizations, and individuals

[93] The Louis Bull Tribe provided comments on the environmental impact assessment and associated addenda, but did not participate in the hearing. The Louis Bull Tribe was concerned that the project would eliminate their ability to hunt and collect important vegetation within the project's footprint, and emphasized the importance of maintaining wildlife populations in the region to support these practices.

[94] The Métis Nation British Columbia provided comments on the project description, draft Environmental Impact Statement guidelines, and EIA and associated addenda but did not participate in the hearing. They stated that Métis harvesters who rely on the direct and surrounding area for sustenance and social and ceremonial purposes could see negative impacts from the project.

[95] The National Coalition of Chiefs provided a letter on May 14, 2020, indicating there is an urgent need to support Indigenous communities, businesses, and workers involved in Canada's energy and natural resources industry and its members are looking forward to the economic activity that the project would provide to Treaty 7 citizens.

[96] The Elk Valley Métis provided a letter to us on January 11, 2021, after the close of the oral portion of the hearing. They stated that they have unextinguished Aboriginal rights to hunt, fish, trap, and gather on lands overlapping the project area.

[97] Following the close of the oral portion of the hearing, a number of organizations and individuals self-identifying as Indigenous submitted comments to us. Some comments stressed that, although the proponent may have engaged with elected leadership, the community-level consultation was not adequate and community members were not directly consulted. Their comments expressed concern that the project would affect their treaty rights and cultural and spiritual use of the lands. Additional concerns raised included project-related air emissions and water contamination and how those changes would affect wildlife health and habitat and human health. They also expressed concern for cumulative impacts from other future coal projects in the region, the threat of climate change, and the unsustainable nature of the coal industry. Many comments discussed the effects the project would have on tourism, agriculture, recreation, and angling, and indicated that the economic benefits of the project would not outweigh the costs.

Government of Alberta/Alberta Energy Regulator

[98] The Government of Alberta through the ministries of Transportation; Culture, Multiculturalism and Status of Women; and Health, and the ACO engaged in the review of completeness of the EIA, but did not participate in or provide a written submission to the hearing.

[99] The Alberta Geological Survey (part of the AER) provided information on the potential effects of the project on Turtle Mountain and the Turtle Mountain Monitoring Plan in response to an information request from us. The Alberta Geological Survey did not take part in the hearing.

[100] The ACO informed us of their intent to monitor and observe the hearing on May 8, 2020. The ACO provided an assessment of consultation adequacy to the AER on October 23, 2020, prior to the start of the hearing on October 27, 2020. The ACO observed the hearing and provided a hearing report and a final consultation adequacy decision to the AER on December 3, 2020.

Municipalities

[101] The City of Lethbridge provided comments to us on January 15, 2021, after close of the oral portion of the hearing. The City of Lethbridge expressed concern regarding the potential effects of the project on selenium contamination of the Oldman River, and highlighted the importance of the Oldman River as a source of irrigation and drinking water.

Comments from the public

[102] Between 2015 and the start of the hearing on October 27, 2020, members of the public submitted statements of concern and comments on the potential adverse effects of the project. These included concerns related to a number of species at risk, including westslope cutthroat trout, little brown bats, grizzly bears, and whitebark pine. Members of the public living near the project were concerned about changes to air quality, noise, health, recreational opportunities, property access, and effects on tourism. They also expressed concerns about the boom-and-bust cycle of mining and the potential liabilities associated with the project.

[103] Members of the public who saw the project as an opportunity to improve the region's economy provided letters of support.

[104] Members of the public drew similarities between the project and mining operations in the Elk Valley, particularly with respect to the potential for downstream selenium contamination and uncertainty regarding the effectiveness of Benga's proposed mitigation measures. Members of the public were concerned about negative effects on the headwaters of the Oldman River, and noted that the Oldman River is a major source of irrigation and drinking water for downstream municipal and agricultural users.

[105] Several members of the public commented on the legacy disturbance on Grassy Mountain and indicated that the project provided an opportunity for the land to be reclaimed.

[106] Several local organizations, including the CNP40 Initiative and the Crowsnest Pass Golf and Country Club expressed support for the project and highlighted Benga's involvement in community affairs, local events, and initiatives.

[107] After the oral portion of the hearing concluded but before the record of the review was closed between December 3, 2020, and January 15, 2021, we received more than 4000 comments from members of the public, a majority of which were not "form letters" but contained unique language about aspects of the project with which the writer was particularly concerned. These comments primarily expressed concerns regarding coal mining in the eastern slopes of the Rockies, the rescinding of the 1976 Coal Policy, and opposition to the project due to potential adverse environmental effects. Members of the public were also concerned about other potential coal mining projects, and the cumulative effects of those projects in combination with other land uses in the area.

[108] Comments from members of the public after the oral portion of the hearing concluded indicated that several petitions were being circulated related to the project and coal mining in the eastern slopes. The first petition, submitted to the House of Commons, called for the Minister of Environment and Climate Change to cancel the Grassy Mountain Coal Project application. Two other petitions posted to change.org called on the Government of Alberta to put a stop to open-pit mining in the Rocky Mountains of Alberta.

[109] Several members of the public indicated their support for the project on the basis that the project would boost the economy of the Crowsnest Pass by creating jobs, supporting local businesses, and creating tax revenue. Participants highlighted the importance of metallurgical coal in steel making, and the importance of steel making during economic recovery and growth. Participants emphasized that mining can be done safely and sustainably, and would help the Alberta and Canadian economies grow.

[110] Other members of the public indicated that, while they supported the diversification of the Alberta economy, the project was located in a sensitive area, and the economic benefits did not outweigh the environmental effects.

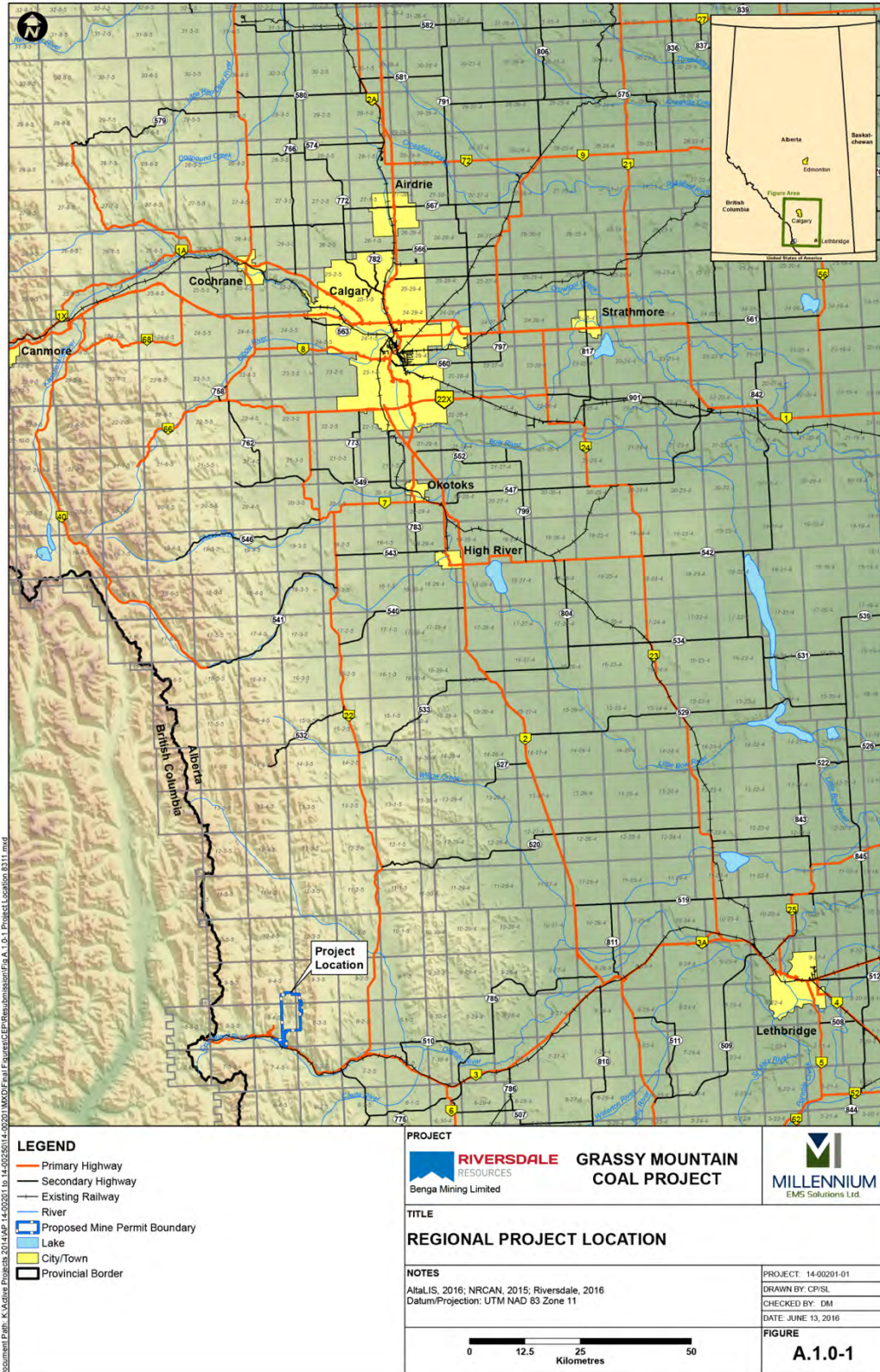


Figure 1-1. Regional project location. Source: CIAR 42, Section A, Figure A.1.0-1, p. 158.

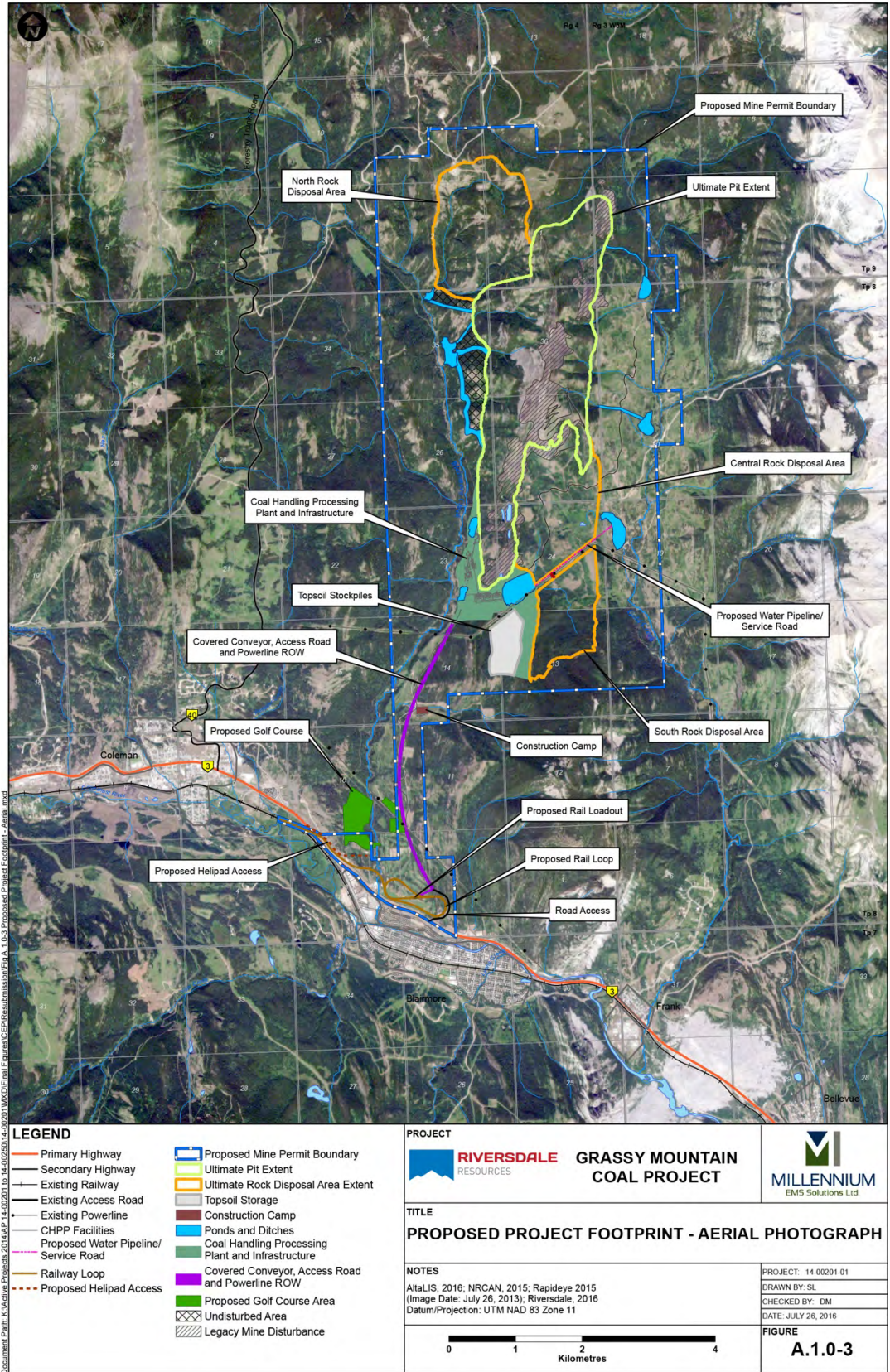


Figure 1-2. Proposed project footprint. Source: CIAR 42, Section A, Figure A.1.0-3, PDF p. 160.

2. Panel Approach to Determining the Significance of Effects

[111] We completed our review of the project and its cumulative effects in accordance with the requirements of provincial legislation and *CEAA 2012* as required by our terms of reference. During our review, we were cognizant that there are similarities and differences between provincial and federal requirements pertaining to our review. When making findings or decisions, we were careful to consider any differences that exist between provincial and federal requirements, and ensure that we only applied factors that were relevant to that jurisdiction.

Determination of significance

[112] In assessing whether the project is likely to cause significant adverse effects, we followed an approach consistent with the Agency's policy and technical guidance document *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under CEAA 2012* (the Agency's significance guidance). While the *EPEA* requires proponents to determine the significance of effects as part of an environmental assessment, Alberta does not prescribe the approach that must be used. Benga applied the Agency's significance guidance, which is widely accepted and used in EIAs and satisfies the provincial requirement.

[113] This approach includes determining whether

- the residual environmental effects are adverse,
- the residual adverse environmental effects are significant, and
- the significant adverse environmental effects are likely.

[114] We assessed only the significance of effects that we considered adverse and residual. This is because the *Environmental Assessment Framework* within the *Operational Policy Statement*, as defined by the Agency's significance guidance, requires us to determine whether a project is likely to result in significant adverse effects, considering the implementation of any mitigation measures. Moreover, *CEAA 2012* protects components of the environment within federal legislative authority from significant adverse environmental effects caused by a project, including cumulative environmental effects.

[115] Benga adopted federal criteria for determining significance for a broader range of effects, including positive effects and matters within exclusive provincial jurisdiction. In conducting our review, we also applied the criteria in the Agency's significance guidance to a broader range of effects, including those under exclusive provincial jurisdiction, as Benga had done. We concluded that, in this case, such an approach advances the purposes of

- section 2 of the *EPEA*, particularly to support and promote the protection, enhancement, and wise use of the environment while recognizing that protection of the environment is essential to the integrity of ecosystems and human health and to the wellbeing of society, the need for Alberta's economic growth and prosperity in an environmentally responsible manner, and the need to integrate environmental protection and economic decisions in the earliest stages of planning; and

- section 2 of the *Water Act*, and in particular the need to manage and conserve water resources to sustain our environment and ensure a healthy environment and high quality of life in the present and the future, the need for an integrated approach and comprehensive, flexible administration and management systems based on sound planning, regulatory actions and market forces, and the important role of comprehensive and responsive action in administering the Act.

[116] We also believe that applying the criteria in the Agency’s significance guidance to a broader range of effects advances the purpose of our terms of reference. It ensures the project is evaluated in a cooperative manner according to the spirit and requirements of provincial and federal authorities, while avoiding unnecessary duplication, delays, and confusion that could arise from individual reviews by the Government of Canada or the AER.

[117] Throughout this report, references to the “review process” undertaken as a joint review panel describe both our environmental assessment under *CEAA 2012*, and our consideration of applications made to the AER under the *Coal Conservation Act* and other provincial legislation.

Criteria used for determining significance

[118] We examined the information and conclusions the proponent used to determine significance, as well as other perspectives on significance received during the review process. Table 2-1 summarizes the criteria we used to determine significance. In some cases, a particular valued component required us to modify or add more specificity to one or more criteria (particularly magnitude). Where this was necessary, we discuss it in the chapter dealing with that valued component.

Table 2-1. Significance criteria

Criteria	Assessment	Definition
Magnitude	Nil	No change from background conditions anticipated after mitigation
	Low	Somewhat above background conditions, but change is well below levels of protectiveness for the identified parameter or valued component, and well within relevant regulatory thresholds or site-specific thresholds where applicable
	Moderate	Considerably above background conditions, and change approaches level of protectiveness for the identified parameter or valued component, as defined by relevant regulatory thresholds or site-specific thresholds where applicable
	High	Considerably above background levels, and change exceeds levels of protectiveness for the identified parameter or valued component, as defined by relevant regulatory thresholds or site-specific thresholds where applicable
Geographic extent	Local	Effects occur mainly within or immediately adjacent to the project footprint or within the relevant local study area
	Regional	Effects extend outside of the immediate project footprint or local study area but within the relevant regional study area
	Provincial	Effects extend outside the regional study area or regional area, but within Alberta
	National	Effects extend outside of Alberta, but within Canada
	International	Effects extend outside of Canada
Duration	Short	Effects occur within the development/construction phase and/or last less than two years

Criteria	Assessment	Definition
	Medium	Effects occur during the development/construction phase and continue during the operations phase, lasting between 2 and 25 years
	Long	Effects continue past the operations phase but diminish with time, lasting between 26 and 50 years
	Persistent	Effects persist for more than 50 years
Frequency	Isolated	Effects are confined to a specified period or activity (e.g., construction)
	Occasional	Effects occur intermittently and sporadically over the assessment period
	Periodic	Effects occur intermittently but repeatedly over the assessment period (e.g., routine maintenance activities)
	Continuous	Effects occur continuously over the assessment period
Reversibility	Reversible	Effects are reversible and diminish upon cessation of activities, or remain after cessation of activities but diminish after a number of years
	Irreversible	Effects are not reversible, do not diminish after cessation of activities, and do not diminish with time
Ecological or social context	Positive	Ecological or social setting is subject to few historical or current pressures and is relatively unimpaired with stable or improving trends and well within any defined regulatory or policy thresholds
	Neutral	Ecological or social setting is subject to some historical or current pressures that have impaired quality or function but trends are stable and/or well within any defined regulatory or policy thresholds
	Negative	Ecological or social setting is subject to historical or current pressures that are contributing to declining or deteriorating trends and approaching or exceeding defined regulatory or policy thresholds

[119] When determining significance, we considered the ecological and social context within which the potential residual adverse environmental effect may occur.

[120] The proposed mine pit and coal-handling and processing plant would be located on Grassy Mountain within the montane and subalpine natural subregions of Alberta. These areas include native fescue grassland, limber pine, whitebark pine, and westslope cutthroat trout. Alberta's *PLA* provides protection for these native fescue grasslands. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has designated limber pine and whitebark pine as endangered species, and the federal *SARA* lists whitebark pine as endangered. Gold Creek and its tributaries, including areas immediately adjacent to and downwind of the project, provide critical habitat for westslope cutthroat trout, which is listed as threatened under *SARA*. Critical habitat for westslope cutthroat trout is defined and protected under *SARA*; and a permit under that legislation is required for the project to proceed.

[121] Residents value the project area for ranching and the recreational opportunities it provides, including hiking, mountain biking, fishing, and off-road vehicle use. The project is located within the headwaters of the Oldman watershed, which is an important source of water for a large number of Albertans living downstream in the South Saskatchewan River watershed. The project area is also covered by the *SSRP*, which establishes a long-term vision for the South Saskatchewan Region and aligns provincial policies at the regional level to balance economic, environmental, and social goals.

[122] Several parcels of private land exist within and immediately adjacent to the proposed mine permit boundary. Development of the project has been described as affecting access to these properties.

[123] While Crowsnest Pass and Grassy Mountain have a history of coal mining, no active coal mining has occurred in the area for several decades. More recently, Crowsnest Pass has attracted people for its natural beauty, outdoor and recreational opportunities, and mountain lifestyle. The Municipality of Crowsnest Pass and some community members welcome the potential jobs and economic opportunities that the project may provide in an area that has seen limited economic development or growth in recent years. Others believe the proposed project is incompatible with the recent and future direction of Crowsnest Pass as a recreational and mountain-lifestyle amenity destination.

[124] Benga provided confidence ratings for its assessment conclusions using the following definitions:

- **Low confidence** – based on an incomplete understanding of cause-effect relationships and incomplete data pertinent to study area (less than 50 per cent confidence)
- **Moderate confidence** – based on a good understanding of cause-and-effect relationships using data from elsewhere or incompletely understood cause-and-effect relationship using data pertinent to study area (50 per cent to 80 per cent confidence)
- **High confidence** – based on a good understanding of cause-effect relationships and data pertinent to study area (greater than 80 per cent confidence)

[125] We found the definitions provided by Benga for its confidence ratings to be reasonable and adopted these definitions for our assessment of project and cumulative effects.

Determining likelihood

[126] The Agency’s significance guidance defines likelihood as the probability that an event or incident, such as a significant adverse environmental effect, will occur as a result of a project. We considered probability as part of our determination of whether significant adverse effects were likely. Consistent with Agency guidance, we made this determination after establishing that predicted residual adverse effects were significant.

[127] Benga used the following definitions for likelihood:

- Unlikely (less than 1 per cent probability of occurring)
- Possible or probable (between 1 per cent and 95 per cent probability of occurring)
- Certain (greater than 95 per cent probability of occurring)

[128] We determined that Benga’s proposed definitions of likelihood assumed the ability to quantitatively assess probabilities of certain project impacts. However, its analysis contained too many uncertainties and assumptions to be able to make these quantitative statements concerning likelihood. Furthermore, Benga’s proposed definition of “possible or probable” covered such a broad range (1 to 95 per cent probability) that it was not particularly useful.

[129] We adopted the following definitions:

- **Unlikely:** A potential effect has a very low or low probability of occurring and is not expected to occur.
- **Possible:** A potential effect has a moderate probability of occurring, but may or may not occur.
- **Likely:** A potential effect has a high or very high probability of occurring and is expected to occur.

[130] As we did not have the information available to calculate numerical probabilities of various outcomes, we assessed likelihood in a qualitative manner based on the evidence available and professional judgement. Where we determined the predicted residual adverse effects were significant and applied likelihood, we supported our analysis with an explanation.

Uncertainty and the use of adaptive management

[131] Several participants expressed concern about the conceptual nature of some of Benga's proposed project plans and mitigation measures. They also had concerns about Benga's reliance on the use of adaptive management to address uncertainty. For example, in their final argument, the Livingstone Landowners Group submitted that Benga's application is too high-level and conceptual, and too lacking in detail and substance, to demonstrate that the project is in the public interest. The group said Benga's mine design, reclamation plan, and mitigation plans are so conceptual and high level that it's impossible to have any confidence in them. The group prepared a list of examples illustrating the lack of detail and substance in Benga's public hearing testimony.

[132] The Livingstone Landowners Group argued that Benga's failure to provide detailed, substantive responses to many of the questions that were asked of it, both during the information-request process and at the hearing, undermined its credibility. The group submitted that a witness can only say "we will address that during final design" so many times before losing all credibility (CIAR 1351, PDF p. 31).

[133] CPAWS submitted that both the information-request process and the hearing were unusually long. They argued the length of the request process was the result of Benga's strategy of attempting to obtain an approval on a conceptual, bare-bones plan with minimal detail or clarity. Even after many rounds of information requests, Benga's application contained omissions and errors, and CPAWS contended that Benga had given little attention to important parts of the project plan. CPAWS also stated that Benga would not have benefitted from advancing to the hearing sooner, as the proponent's application would have been missing even more information necessary for the panel's assessment. In CPAWS' view, the lengthy process was caused entirely by Benga's refusal to provide sufficient detail or clarity in its application.

[134] CPAWS submitted that Benga's approach assumed that final detailed plans are not required in the application phase, and that it can develop plans to mitigate environmental impacts after project approval is granted. CPAWS argued that while the project assessment process cannot eliminate uncertainty, it is meant to provide a workable plan that shows, at a high level, how environmental impacts will be mitigated. They also argued that Benga has submitted a plan that produces a number of water quality guideline exceedances and long-term loss of habitat, and no evidence the project will be profitable enough

to pay for the monitoring, mitigation, and reclamation work the project will require. CPAWS submitted that “even on a very high level, Benga’s plan [for the project] does not work” (CIAR 1347, PDF p.3).

[135] CPAWS expressed concern that Benga’s strategy is to obtain approval and start mining as quickly as possible, at which point the mine becomes a fait accompli and regulators would be unlikely to stop the project regardless of environmental problems. CPAWS said that Benga’s plan fails to properly mitigate environmental impacts at even a conceptual level. Moreover, Benga provided the panel with no reason to expect the detailed plan to mitigate environmental impacts any better than the conceptual version.

[136] The Municipal District of Ranchland No. 66 argued that “Benga repeatedly demonstrated, with its deficient policies and lack of long-term planning on numerous issues, that Benga is simply making things up as they go” (CIAR 1349, PDF p.7). As evidence, the M.D. of Ranchland noted Benga’s admission that the project would be the first mine operated by the company in Canada and that many of its procedures will be developed as it operates the project over its 24-year life. The M.D. of Ranchland submitted that Benga’s lack of concrete policies and procedures was problematic for a billion-dollar project and that the panel and the Minister of Environment and Climate Change should be in possession of all the relevant information to make an informed decision about the application, not just the information Benga feels is important. The M.D. of Ranchland argued that, based on the additional coal mines proposed for the municipal district, the panel should insist that Benga, as the first recent coal-mine applicant within the municipal district, provide a more thorough application, with complete policies and procedures. This would establish a high standard for subsequent applicants. The M.D. of Ranchland suggested that approval of the application would set a dangerous precedent for future applicants, and would signal that deficient applications will be open for approval.

[137] Benga argued that the review process does not require the proponent to have iron-clad, final detailed plans in place at this stage. Benga said that would be unfair to the proponent because of the level of investment that would be required, with no guarantee of a return. Requiring final detailed plans before a public hearing would usurp the role of the panel in making its recommendations, and the role of regulatory bodies involved in finalizing plans necessary to secure permits under other legislation, such as *SARA* and the *Fisheries Act*. Benga acknowledged that elements of uncertainty remain, but suggested this uncertainty is to be expected in the course of responsible natural resource development. It proposed to deal with this uncertainty through adaptive management.

[138] Benga said that it developed and described its monitoring and adaptive management plans in accordance with the terms of reference and the guidelines issued for the project. It said that its proposed approach to adaptive management is consistent with the Agency’s operational policy statement for *Adaptive Management Measures under the Canadian Environmental Assessment Act*.

[139] We accept that final engineering plans are not generally required at the environmental assessment and application stage. We also realize that some uncertainty in project effects and the effectiveness of proposed mitigation measures is not unusual. However, proponents must provide sufficient detail to demonstrate that project plans and proposed mitigation measures are technically and economically feasible, and that these measures will effectively manage risks to valued components. This is consistent with the precautionary principle and an inherent aspect of careful and precautionary consideration of evidence with a view to avoidance of significant adverse environmental effects on matters within

provincial or federal jurisdiction. It is also necessary to ensure that decision makers have the information necessary to understand and evaluate the significance of effects from the project.

The precautionary approach

[140] The “precautionary approach” is a purpose of *CEAA 2012*:

4(1) The purposes of this Act are:

(a) to ensure that projects are considered in a careful and precautionary manner before federal authorities take action in connection with them, in order to ensure that such projects do not cause significant adverse environmental effects.

[141] We have adopted a careful and precautionary approach in our review for matters within federal jurisdiction. While there is no explicit provision under provincial legislation that requires a precautionary approach, we have adopted a similar approach for matters under provincial jurisdiction. We believe considering project effects in a careful and precautionary manner advances the purposes of the *EPEA* and the *Water Act*, which identify the importance of environmental protection, and is consistent with our public interest mandate in this matter. In our view, a careful and precautionary approach ensures the project is evaluated according to the spirit and requirements of our federal and provincial authorities. This approach allows us to have confidence that proposed mitigation measures will prevent significant adverse environmental effects.

The precautionary principle

[142] In *CEAA 2012*, the precautionary principle is distinct from, but related to, the careful and precautionary consideration obligation.

[143] This is also a federal mandate obligation under *CEAA 2012*:

4(2) The Government of Canada, the Minister, the Agency, federal authorities and responsible authorities, in the administration of this Act, must exercise their powers in a manner that protects the environment and human health and applies the precautionary principle.

[144] The Livingstone Landowners Group submitted that, in assessing the significance of the environmental and social effects of the project and determining whether the project is in the public interest, the panel must respect the precautionary principle. The group noted that in *114957 (Spraytech, Societe d'arrosage) v Hudson (Town)*, 2001 SCC 40, the Supreme Court of Canada accepted that the precautionary principle, as developed in the context of international law, is a part of Canadian domestic law. The Court adopted the definition of the principle found in the Bergen Ministerial Declaration on Sustainable Development (1990): in order to achieve sustainable development, policies must be based on the precautionary principle. Environmental measures must anticipate, prevent and attack the causes of environmental degradation. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation (CIAR 1351, PDF p. 15).

[145] The Livingstone Landowners Group argued that the area in which the Grassy Mountain project is located, the southern Eastern Slopes of the Rocky Mountains, is ecologically sensitive and therefore demands extremely robust plans for mine design, closure and reclamation, and mitigation. Benga failed to present the panel with plans that satisfied this need. The group submitted that Benga's proposed open-pit coal mine would most certainly cause serious environmental damage. It was demonstrated in the public hearing that Benga's proposed mitigation measures were inadequate to mitigate this damage. The group argued that, in light of these limitations, application of the precautionary principle requires that the panel reject Benga's application. Other participants also submitted their views on the appropriate definition and application of the precautionary principle.

[146] Benga argued that the project is unlikely to cause significant adverse effects, considering Benga's proposed mitigation measures. It submitted that it has proposed credible measures based on the best information available. Benga acknowledged that several participants' final arguments noted the importance of applying the precautionary principle where uncertainties remain, but argued that the precautionary principle does not preclude a project from proceeding in the face of uncertainty and should not paralyze development. Benga cited *Homalco Indian Band v British Columbia (Minister of Agriculture, Food and Fisheries)*, 2005 BCSC 283, in which the British Columbia Supreme Court stated that the precautionary principle "does not require governments to halt all activity which may pose some risk to the environment until that can be proven otherwise" (CIAR 4917, PDF p. 28). Benga said that requiring proof that an activity will pose no risk would be contrary to regulatory schemes that are expressly designed to enable responsible development to proceed.

[147] Benga said that it has made adaptive management a key feature of its response to uncertainties that are bound to remain at this stage of review for any resource development project. Benga noted that the Federal Court of Appeal has recognized that adaptive management counters the potential paralysis induced by the precautionary principle. It said that the Federal Court has held that adaptive management is an important tool for addressing uncertainty and permits projects with uncertain effects to proceed:

[A]daptive management permits projects with uncertain, yet potentially adverse environmental impacts to proceed based on flexible management strategies capable of adjusting to new information regarding adverse environmental impacts where sufficient information regarding those impacts and potential mitigation measures already exists (*Pembina Institute for Appropriate Development v Canada [AG]*, 2008, FC 302, para 32).

[148] According to Benga, this approach allows projects to proceed in the face of uncertainty in a manner that is consistent with the precautionary principle. Otherwise, no projects would ever proceed.

[149] We accept that some uncertainty is normal at this stage of the regulatory process and does not mean that development cannot proceed. It also does not mean that a project needs to provide proof that an activity will pose no risk. We interpret the precautionary principle to mean that where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation. In other words, the lack of certainty with respect to whether additional mitigation measures would be needed is not a reason for postponing these measures. We note that the Federal Court of Appeal decision cited by Benga says that adaptive management permits projects with uncertain, yet potentially adverse impacts, to proceed, *where sufficient*

information regarding those impacts and potential mitigation measures already exists. However, in some cases we find that the level of information provided by Benga is not sufficient to provide confidence that project effects are understood and that the mitigation measures being proposed are both technically and economically feasible and capable of preventing significant adverse environmental effects. We have applied the precautionary principle as a component of the careful and precautionary approach.

Adaptive management

[150] *The Practitioners Glossary for the Environmental Assessment of Designated Projects Under the Canadian Environmental Assessment Act, 2012* defines adaptive management as a planned and systematic process for continuously improving environmental management practices by learning about their outcomes. It involves, among other things, the implementation of new or modified mitigation measures over the life of a project to address unanticipated environmental effects. It also states that the need to implement adaptive management measures may be determined through an effective follow-up program. The final *Environmental Impact Statement Guidelines* state that “[a]daptive management is not considered as a mitigation measure, but, if the follow-up program indicates that corrective action is required the proposed approach for managing the action should be identified.” No specific Agency technical guidance is available for adaptive management under *CEAA 2012*.

[151] Benga outlined its approach to adaptive management in its EIA report. Benga recognized three stages of adaptive management: before mine development, during mine operations, and following completion of mine development. Benga indicated it would document baseline environmental conditions in the first stage, monitor to ensure that control and mitigation measures are effective or whether adaptive measures are required in the second stage, and carry out a post-reclamation assessment in the third stage. Benga stated that potentially adverse environmental effects can be halted or mitigated prior to becoming a concern by applying adaptive management practices as follows:

- continually updating relevant environmental baseline information throughout the life of the operation
- determining whether the impacts and risks identified prior to development were correct, or whether all impacts and risks had been identified
- assessing whether existing mine plans and operations can be modified to further reduce environmental risk and impact

[152] In response to our request for additional information, Benga indicated that its adaptive management program is organized into four main components, which are re-evaluated and reassessed in a feedback loop. It provided further details on each component:

- assess the problem
- adaptive management process design
- implement, monitor, and evaluate
- adjust the mitigation as required

[153] Benga stated it understands that outcomes that are different from modelled predictions may result from areas of uncertainty. With respect to uncertainty about the representativeness of input data, Benga

stated that its EIA analysis was based on information about the project from sampling that may not be representative of project conditions. As an example, Benga noted that the amount of selenium present in the waste rock was based on a limited number of rock samples. If these samples turn out to be unrepresentative, the total amount of selenium loading could be greater or smaller. Benga also identified assumptions used for modelling, errors and omissions, and unforeseen external factors as other sources of uncertainty.

[154] Benga indicated that as site conditions and monitoring dictate, or as new technology emerges, it will adaptively manage site practices and its monitoring programs. Benga indicated that for some programs this would involve regular evaluation of predictive models, which would be clearly defined in each applicable management plan.

[155] CPAWS argued that many of Benga’s plans for the project are conceptual in nature, that Benga is relying on adaptive management to fill in missing details, and that Benga did not employ a precise or technical definition of the term “adaptive management”; instead, its witnesses used the term as a synonym for “planning,” “continuous improvement,” or “contingency planning.” CPAWS submitted that Benga does not plan to carry out the rigorous and systematic process known in the scientific and environmental management literature and described in regulatory guidance documents as adaptive management.

[156] CPAWS retained Professor M. Olszynski of the University of Calgary’s Faculty of Law to review Benga’s approach to adaptive management. Mr. Olszynski provided background information on adaptive management and practice. He noted that adaptive management is not “fail-safe” or suitable for all environmental problems. He outlined the following six-step adaptive management cycle to define the problem, design actions to test hypotheses, implement the actions as designed, monitor implementation, evaluate the results, and revise uncertainties and hypotheses.

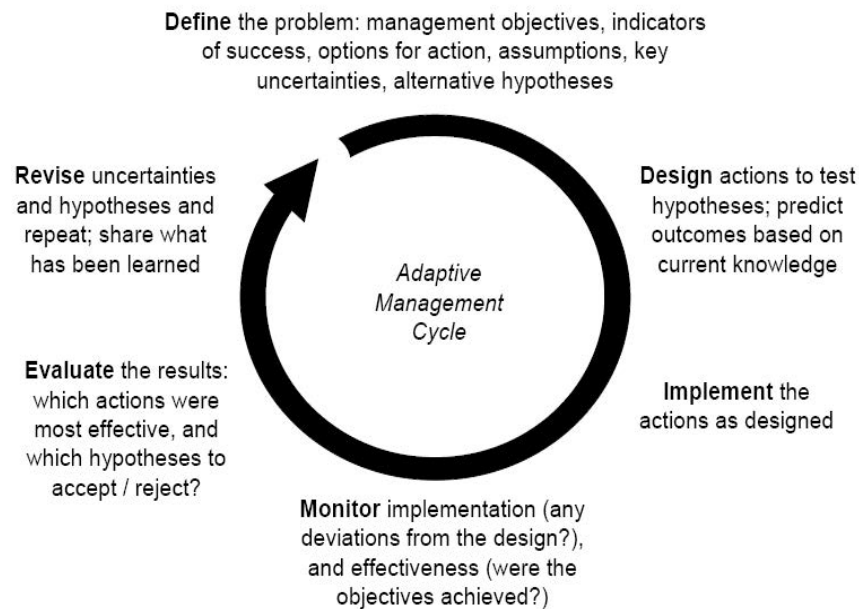


Figure 2-1. A six-step adaptive management process as defined by M. Olszynski, University of Calgary.
Source: CIAR 555, PDF p. 600, after C. Murray and D.R. Marmorek. 2004.

[157] Mr. Olszynski used a word-search algorithm to conduct a content analysis of Benga’s EIA and associated supplemental information requests and responses to those request. He found that “adaptive management” is referred to at least 560 times in the Grassy Mountain EIA and associated addenda. He reported that the Grassy Mountain EIA contains the most references to adaptive management—by a factor of almost 10—compared with other EIAs for energy projects that he had previously reviewed. He indicated that this high number is consistent with Benga’s references to adaptive management as a “routine component” of its environmental management activities.

[158] Mr. Olszynski said Benga appears to consider adaptive management a fail-safe approach that ensures successful environmental outcomes. He provided several excerpts from the project’s EIA to support this conclusion:

“... to allow for effective adaptive management of mitigation measures over time to ensure that the Project-related effects on wildlife are avoided or minimized”

“... will utilize the adaptive management program to ensure that healthy rangeland communities are established”

“Benga will utilize best management practices currently used in the industry as well as adaptive management to ensure that reclamation practices are effective”

“An adaptive management approach, including non-native invasive species control and monitoring ... will be used to ensure that sites have been re-vegetated to meet target vegetation communities”

“Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful” (CIAR 555, PDF pp. 606 and 607).

[159] Based on his analysis, Mr. Olszynski found that Benga proposes to rely on adaptive management in the context of at least 18 different environmental issues or challenges. These issues include but are not limited to erosion control, infill planting, wildlife, reclamation, water quality (sulphate), revegetation, salvage practices, invasive species, species at risk (olive-sided fly catcher and whitebark pine), aquatics/species at risk (westslope cutthroat trout), water quality (selenium), water quality (end-pit lakes), sand mobilization, nitrous oxide (NO_x) emissions, eagle nesting sites, dust mitigation, and light pollution.

[160] Mr. Olszynski said that in the vast majority of instances, Benga did not attempt to complete an adaptive management plan. Clear identification of uncertainties, objectives, suitable indicators, relevant thresholds, and alternative management actions were often not identified. He noted that in many cases Benga deferred completion of adaptive management plans to the post-environmental assessment phase, notwithstanding numerous requests for additional details through the supplemental information request process.

[161] For those areas where adaptive management plans were proposed, Mr. Olszynski found that the discussions with respect to reclamation, air quality, and the aquatic environment were the most detailed. He reported that while these plans contain some of the components of adaptive management, none are complete plans. He noted that while Benga admitted that these plans will need to be finalized post-approval, it provided no reason they could not be submitted at this phase. He added that, even where some

components are present, the plans have other deficiencies, such as the use of ambiguous or subjective language. He suggested this is why complete draft adaptive management plans should be included in the assessment phase: so that they can be scrutinized and improved by participants.

[162] Mr. Olszynski concluded that Benga “badly misconstrued adaptive management, its potential, and its limitations” (CIAR 555, PDF p. 599). He indicated that the Grassy Mountain EIA exhibits all of the hallmarks of deficient adaptive management practices, including the erroneous view that it can ensure successful outcomes (i.e., that it is fail-safe); that it can be applied to virtually any and all environmental problems without regard to spatial, temporal, and other limitations; and that it can be implemented as a routine matter rather than as a result of careful and deliberate planning and implementation. He acknowledged that rigorously implemented adaptive management can help recognize management mistakes, but does not prevent such mistakes. Nor does it guarantee that such mistakes will be reversible. Mr. Olszynski submitted this was particularly important given Benga’s reliance on adaptive management in the context of several species at risk, including the westslope cutthroat trout, as well as water quality issues, especially selenium.

[163] In its final argument, Benga stated that it was inappropriate for some hearing participants, such as CPAWS and the Livingstone Landowners Group, to be asking that the project provide more detailed outlines for monitoring and follow-up at this stage. Benga said that the public hearing was not the time for parties to suggest the terms the project should have to meet for its EIA and the information Benga should have to provide. Rather, that should have occurred during the public consultation periods that preceded the development of the AER terms of reference, the Agency’s guidelines, and the joint review panel terms of reference, and during the information-request process.

[164] Benga argued that *CEAA 2012*’s statutory scheme, which, like its predecessor, provides for follow-up programs, recognizes that not all relevant information will be available at this stage of project development. Benga suggested it was incorrect to suggest that its intention to continue to gather information, monitor, and apply adaptive management is contrary to the precautionary principle.

[165] Benga did agree with Mr. Olszynski’s statements that adaptive management is not fail-safe and should be systematic and the result of careful and deliberate planning and rigorous implementation. However, while conceding Mr. Olszynski’s evidence was philosophically interesting and his ideas for how adaptive management might be better incorporated into policy guidance for future projects were valuable, Benga contended they were irrelevant to the panel’s mandate. Benga noted Mr. Olszynski’s opinion that the definition in the Agency’s 2009 operational policy statement for *Adaptive Management* does not go far enough to convey the important limitations of adaptive management. Benga submitted that while Mr. Olszynski may want adaptive management to be defined and applied differently than it is in current policy, this is not relevant to the review of this project under provincial legislation or *CEAA 2012*.

[166] We accept that the review process relies on data collection, models, and the use of professional judgement and therefore involves uncertainty. Even with best efforts and the use of current best practices in project design and environmental assessment methodology, it is not always possible to predict effects with a high level of certainty. Furthermore, the objective of the review process is not to eliminate

all uncertainty. We accept that adaptive management is an approach that can be used to address areas of uncertainty.

[167] While we recognize that the Agency's 2009 operational policy statement for *Adaptive Management* was not developed for application to environmental assessments under *CEAA 2012*, we considered it to the extent that it provides context for the elements of planning for adaptive management and Benga's proposed approach. We agree that the use of adaptive management does not guarantee positive environmental outcomes. We also agree that when properly designed and implemented, adaptive management should be a systematic and rigorous process.

[168] A commitment to implement adaptive management does not eliminate the need to provide sufficient information on the environmental effects of the project during the environmental assessment and decision-making process. Nor does it eliminate the need to describe the appropriate mitigation measures required to eliminate, reduce, or control those effects, and the extent of the significance of those effects. Throughout the environmental assessment and application review process, first AER and Agency staff, and then we ourselves, requested that Benga provide additional information to clarify its project design and mitigation measures and support its assessment conclusions. However, Benga did not always respond to these information requests in an adequate manner.

[169] Adaptive management must involve more than saying, effectively, that one will implement one approach, and if that approach turns out not to work then one will try something else at a future stage of project development. Adaptive management also means more than simply following best management practices. We recognize that different definitions of adaptive management exist in the academic literature and are used differently by practitioners.

[170] For our purposes, we did not adopt one particular definition from the academic literature. Instead, when reviewing Benga's proposed adaptive management, we relied on key elements of the adaptive management cycle as described by CPAWS, as well as the considerations in planning for adaptive management in the Agency's 2009 operational policy statement for *Adaptive Management*. We considered whether Benga's adaptive management proposals

- defined the issues, including the nature of key uncertainties for which adaptive management is required and associated management objectives;
- described whether there is a sufficient baseline of information to understand baseline conditions and to allow for measurement of change;
- identified key indicators that will be used to assess and address predictions, assumptions, and uncertainties;
- identified thresholds for action at which corrective adaptive management action would be taken,
- identified adaptive management options that can be implemented if assessment predictions vary from what was expected or a mitigation measure does not work as intended; and
- provided sufficient information to enable us to assess the technical feasibility and cost-effectiveness of alternative adaptive management options as required by the precautionary principle.

[171] Our assessments of Benga's proposed monitoring and adaptive management plans for specific valued components can be found in the sections that address project effects on those valued components.

[172] We accept that not all relevant information may be available at this stage of the regulatory process and that the environmental assessment process is not intended to eliminate all uncertainty. We recognize that follow-up monitoring and adaptive management programs are common and accepted means of dealing with uncertainty. We also understand that if the project were to be approved, subsequent regulatory processes would provide further opportunities to review and approve project elements, including proposed monitoring and adaptive management plans.

[173] However, consistent with the review panel's decision for the Taseko New Prosperity Gold-Copper Mine, which was upheld by the Federal Court in *Taseko Mines Limited v Canada (Environment)*, 2017 FC 1099, we do not accept that this means we can or should defer important matters or decisions to a later stage of the process. Our terms of reference require us to assess the environmental effects of the project, including the significance of effects, and, in our capacity as the AER, determine whether the project meets application requirements and is in the public interest.

[174] While the use of adaptive management is an appropriate approach for addressing uncertainty, the uncritical acceptance of adaptive management proposals would call into question the value of the entire review panel process.

Effects on species at risk

[175] Under subparagraph 5(1)(a)(ii) of *CEAA 2012*, we are required to assess the potential environmental effects of the project on aquatic species as defined in subsection 2(1) of *SARA*. Our terms of reference also required us to consider the effects of the project on *SARA*-listed wildlife species and their critical habitat. Critical habitat is defined in *SARA* as habitat necessary for the survival or recovery of a listed wildlife species and identified as the species' critical habitat in the recovery strategy or in an action plan for the species.

[176] As required by section 79(1) of *SARA*, we notified ECCC and DFO that the project has the potential to affect ten species listed under *SARA* based on the information provided by Benga at the time of our appointment. The species included the barn swallow (*Hirundo rustica*), common nighthawk (*Chordeiles minor*), grizzly bear, little brown bat, olive-sided flycatcher (*Contopus cooperi*), short-eared owl (*Asio flammeus*), western toad (*Anaxyrus boreas*), westslope cutthroat trout, whitebark pine, and wolverine (*Gulo gulo*). In response to our notification letter, ECCC identified limber pine as an additional species that is potentially affected by the project and is identified as endangered by COSEWIC.

[177] Over the course of our review, two additional species at risk that may occur in the project area were listed: Baird's sparrow (*Ammodramus bairdii*) and the American badger (*Taxidea taxus*). We also determined that the project has the potential to affect bull trout (*Salvelinus confluentus*).

[178] In this report, we discuss the potential effects of the project on species listed under *SARA* in the chapters on conservation, reclamation and closure; surface water quality; fish and aquatic habitat; vegetation and wetlands; wildlife; and wildlife health.

Assessment of cumulative effects

[179] Numerous participants expressed concern regarding the methodology used by Benga to carry out its cumulative effects assessment. The following sections describe the requirements for cumulative effects, Benga's approach to the assessment of cumulative effects, and participants' concerns regarding that approach. We also provide our views on the adequacy of Benga's cumulative effects assessment, and our approach to assessing cumulative effects. We then make recommendations for improvement. We evaluate concerns regarding the cumulative effects assessment of specific valued components in their respective chapters.

[180] From a federal perspective, paragraph 19(1)(a) of *CEAA 2012* specifies that the environmental assessment of a project must take into account environmental effects, including the cumulative effects that are likely to result from the project in combination with other physical activities that have been or will be carried out. To help proponents prepare EIAs, the Agency has published several guidance documents on the assessment of cumulative effects under *CEAA 2012*, including:

- *An Operational Policy Statement for Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012* – March 2015
- Interim technical guidance for *Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012* – March 2018

[181] Provincially, section 49(d) of the *EPEA* requires a description of the potential positive and negative environmental, social, economic, and cultural impacts of the proposed activity, including cumulative, regional, temporal, and spatial considerations. To assist proponents in preparing their EIA, the Government of Alberta has published guidance documents on the assessment of cumulative effects under the *EPEA*, including:

- *Guide to Preparing Environmental Impact Assessment Reports in Alberta* – March 2013
- *Cumulative Effects Assessment in Environmental Impact Assessment Reports Required under the Alberta Environmental Protection and Enhancement Act* – January 2000

[182] While the *EPEA* and the final provincial terms of reference for the project EIA require that Benga assess cumulative effects, Alberta guidance does not prescribe the use of specific cumulative effects assessment methodologies that must be used by proponents.

[183] Because multiple cumulative effects assessments were provided by Benga during the review, we relied on the cumulative effects assessment in the Eighth Addendum. This was the most comprehensive cumulative effects assessment, and superseded previous assessments. We also relied on qualitative information provided by Benga on past activities throughout the EIA, as well as Benga's responses to our information requests related to cumulative effects.

Consideration of past activities in the cumulative effects assessment

[184] Both the Agency and provincial guidance refer to the concept of a cumulative effects assessment, in which the cumulative effects of a proposed project need to be considered in combination with other past, present, and certain and reasonably foreseeable projects and activities. We understand this to mean the effects of the project would be added to the effects of past, present, and future activities.

[185] Benga considered three scenarios in its assessment of the potential environmental effects of the project:

- Past and existing situations (baseline case): includes an assessment of the current environmental conditions that takes into account past and existing conditions
- Project effects assessment (application case): takes into consideration the findings and trends of the baseline case and incorporates the effects of the proposed project activities
- Certain and reasonably foreseeable projects assessment (planned development case): includes certain and/or reasonably foreseeable projects or activities that could act in combination with past, existing, and project activities

[186] For some valued components, Benga also considered a project-only case (e.g., air quality).

[187] These scenarios are generally consistent with the assessment scenarios described in the provincial *Guide to Preparing EIA Reports*. However, unlike federal guidance, the planned development-case scenario as described under the provincial guide does not require explicit descriptions of past effects on valued components.

[188] Based on a review of the original EIA in 2015, the Agency determined that the information provided by Benga did not adequately address cumulative effects. On several occasions in the pre-panel phase of the review, the Agency requested that Benga carry out a cumulative effects assessment consistent with Agency guidance. On January 13, 2016, the Agency issued the first of four information requests to Benga, outlining some of the methodological issues with the cumulative effects assessment, and requested that Benga provide a revised cumulative effects assessment that met the requirements of the Agency and *CEAA 2012*. Following Benga's response, the Agency issued three follow-up information requests on December 5, 2016; February 28, 2018; and August 3, 2018. On August 22, 2018, after we were appointed to the joint review panel, we requested that Benga address its responses to the Agency's questions to us, including those related to cumulative effects.

[189] In the information requests to Benga, the Agency noted that, among other methodological issues, Benga had integrated the effects of past projects and activities into the baseline assessment. As a result, the assessment did not explicitly examine past effects in the context of cumulative effects. The Agency further explained that, while existing conditions were shaped by effects of past projects and activities, using only the current state of a valued component in combination with future effects did not always provide a full understanding of the cumulative effects of successive projects from the past, present and future. The Agency noted that past effects could be considered qualitatively by describing how they had affected known trends in the condition of the valued component. This description could be prepared using readily available information, such as trends in the condition of the valued component, Indigenous traditional knowledge, and historical data.

[190] Although Benga provided a description of past activities in the Eighth Addendum, it did not explicitly consider how those past activities may have influenced the criteria for determining the significance of cumulative effects. For example, in the case of species at risk, many of the species potentially affected by the project are listed under *SARA* because of the effects of past projects, activities,

and stressors. For all valued components, Benga concluded that there would be no significant cumulative effects. We are of the view that if past projects and activities are not properly considered in the cumulative effects assessment, then cumulative effects on certain valued components that are already significant could be missed; the project would then add to an already significant effect.

[191] Participants expressed concern about the project's contribution to cumulative effects. The Coalition stated that the region for the proposed mine has been disturbed in many ways that cumulatively exceed existing scientific thresholds for the recovery of species at risk and the maintenance of healthy biodiversity. The Coalition stated that Benga inadequately considered the cumulative effects of the project with reference to a pre-industrial baseline. The Oldman Watershed Council also expressed concern about cumulative effects in the headwaters of the Oldman River, where the cumulative effects of multiple use have resulted in a decline in watershed integrity across approximately 95 per cent of the landscape. The Ktunaxa Nation stated that the eastern portion of their territory is already experiencing environmental impacts, primarily from coal mining, that threaten to exceed thresholds of significance for water quality, spatial disturbance, and other factors that affect their rights and interests. The Siksika Nation expressed concern with respect to accessibility to the land for traditional activities and ongoing loss of habitat, and they provided an assessment of the cumulative effects of land development on ecological indicators of cultural importance.

[192] In the cumulative effects assessment in the Eighth Addendum, Benga presented quantitative assessments of some valued components. It is nevertheless difficult to discern how Benga calculated the cumulative interactions on a valued component of the proposed project, or of other existing or planned developments. For situations where Benga did not identify any certain or reasonably foreseeable projects or activities that could affect a valued component, Benga stated that the planned development case was similar to the application case. As a result, Benga used the same criteria ratings to determine the significance of some valued components for both the application case and the planned development case.

[193] In the absence of explicit consideration of past effects by Benga, we used our judgement and considered the qualitative information provided by Benga and participants to determine the significance of cumulative effects for valued components for which we predicted residual effects. Where a comprehensive consideration of cumulative effects for a valued component with residual effects was not possible, we indicate this in the text.

[194] We find that to meet the requirements of the federal guidance for cumulative effects, proponents should be required to provide a description of the pre-industrial (historical) baseline in their EIA. This information would facilitate consideration of past effects in the analysis of cumulative effects and the significance of those effects. The pre-industrial baseline should be a separate description in order to document any changes in a valued component over time. This is particularly important in areas that have faced historical disturbances from industrial activity, as is the case with the current project.

Consideration of certain and reasonably foreseeable projects and activities in the cumulative effects assessment

[195] Over the course of the review, several participants commented on the inclusion of additional certain and reasonably foreseeable project activities in the cumulative effects assessment. The Agency's *Operational Policy Statement for Assessing Cumulative Environmental Effects* states: “[a] cumulative

environmental effects assessment of a designated project must include future physical activities that are certain and should generally include physical activities that are reasonably foreseeable.” These concepts are defined as follows:

- **Certain:** the physical activity will proceed or there is a high probability that the physical activity will proceed, e.g. the proponent has received the necessary authorizations or is in the process of obtaining those authorizations.
- **Reasonably foreseeable:** the physical activity is expected to proceed, e.g. the proponent has publicly disclosed its intention to seek the necessary environmental assessment or other authorizations to proceed.

[196] Our terms of reference required us to consider the cumulative effects from such certain or reasonably foreseeable physical activities as of the date of its issuance on August 17, 2018.

[197] CPAWS, the Coalition, and other participants expressed concerns about Benga’s failure to include Atrum Coal Limited’s (Atrum) Elan South coal project in the cumulative effects assessment for the Grassy Mountain project. In the Eighth Addendum, Benga stated that potential impacts from the Elan South project were excluded from the cumulative effects assessment as the project had not been defined or officially announced by Atrum as of August 17, 2018.

[198] In December 2019, prior to the hearing, CPAWS wrote to us requesting that we direct Benga to include the Elan South project in the cumulative effects assessment for the Grassy Mountain project. In our January 24, 2020, response letter to CPAWS, we confirmed that we did not consider the Elan South project to be “reasonably foreseeable,” as defined in the Agency’s operational policy statement for *Assessing Cumulative Environmental Effects* under *CEAA 2012*. Our rationale was: “At this time, the Panel is not aware of Atrum having publicly disclosed its intention to apply for necessary environmental assessment or impact assessment permits and authorizations for the Elan South Coal Project and the scope of any planned future project has not been defined. The Elan South Coal Project is not included in Alberta’s listing of all environmental assessment information for current projects. The most recent regulatory development is the issuance of Deep Drilling Permit No C 2019-5 on October 15, 2019, which authorizes coal exploration drilling for exploratory purposes. This permit expires two years after issuance” (CIAR 308, PDF p. 2).

[199] Our January 24, 2020, letter confirmed that Benga was required to include activities related to the exploratory phase of Atrum’s Elan South project in the cumulative effects assessment for the Grassy Mountain project. Permits had been issued for these activities, making them certain or reasonably foreseeable. We assess the extent to which Benga considered these activities throughout this report when we discuss cumulative effects for individual valued components.

[200] CPAWS, the Livingstone Landowners Group, the Crowsnest Conservation Society, and other participants expressed concern about the Government of Alberta’s decision, effective June 1, 2020, to rescind the 1976 *Coal Development Policy for Alberta*, which restricted coal development in Alberta’s Eastern Slopes. Participants noted that in addition to the Elan South project, a number of other coal exploration projects that could contribute to additional cumulative effects are underway in the Crowsnest

Pass. The Oldman Watershed Council stated that its members are aware of at least four other companies exploring the region, and believed this project would set a precedent.

[201] The M.D. of Ranchland suggested the project could open the door to increased mining for generations on the east side of the Rocky Mountains, replicating the progression of Teck Coal in the Elk Valley. Concerns were expressed about other exploration projects now active in the Crowsnest Pass and in the M.D. of Ranchland. The Crowsnest Conservation Society stated that developing these projects would raise many concerns similar to those of the Grassy Mountain project from environmental, landscape preservation and use, and socio-economic perspectives. Many participants stated they believed our decision on the Grassy Mountain project would set a precedent for other projects in the region.

[202] CPAWS argued that because Benga took so many years to provide information sufficient to advance its application to a hearing, the environmental assessment does not include the cumulative impacts of projects that became reasonably foreseeable after August 17, 2018, more than two years before the hearing began. They said this limitation means that the final report of the panel will not account for the cumulative environmental impacts of other mines, including Elan South, which is immediately north of the Grassy Mountain site. CPAWS also suggested that as a result, the assessment of the economic need for the Grassy Mountain project did not account for the other coal projects now advancing in Alberta. CPAWS stated that a strategic policy to control the environmental and economic impacts of coal mines is required.

[203] CPAWS argued that Benga ignored Agency guidance when it included only projects for which an application to a regulator had been made. CPAWS contended that Benga erred in assuming that gathering baseline information to prepare for a regulatory application fell short of making a project reasonably foreseeable. CPAWS further argued that Benga should have known that the submission for a regulatory review of Elan South was imminent, as at least two of Benga's experts are collecting data for Atrum's applications.

[204] Benga stated that it addressed the impact of exploration activities associated with Atrum's Elan South project in the cumulative effects assessment. In the assessment, Benga included existing linear disturbance such as access roads or trails in the wildlife and vegetation models' regional study area. Benga stated that the greatest impacts from exploration activities arise from the roads or trails used to transport a drill rig to the site, and that exploration activities would use existing access roads. Benga contended that participants have asked the panel to effectively shift the goalposts to require Benga to provide an updated cumulative effects assessment that takes into account currently undefined and speculative projects.

[205] At the time of our January 24, 2020, letter to CPAWS, and up until the start of the public hearing in October 2020, Atrum had not submitted a project description, specific plans, or regulatory applications for a coal mine for its Elan South property. A key purpose of exploration activities is to determine whether the resources are sufficient to warrant development, to assess the commercial feasibility of a project, and to assist in the conceptual or preliminary design of a project. While we considered the exploratory activity disclosed in the record, the existence of coal exploration activities does not provide a necessary expectation, or a reasonable likelihood, that a mine application will follow, although we accept that it is a possible outcome.

[206] DFO advised us on June 1, 2020 that they received an application on behalf of Atrum for a *SARA* permit on March 12, 2020, in relation to the potential advance of a coal-mining project in two distinct areas: Isolation South and Elan South. The activities described in the application “aimed to generate a comprehensive dataset to inform an Environmental Impact Assessment (EIA) for a proposed coal mine.” (CIAR 357, PDF pp. 1–2). DFO indicated that they would make a decision on the issuance of the permit by July 4, 2020. The permit granted by DFO to Elan Coal in relation to the potential advancement of a coal mining project in Isolation South and Elan South was for assessment of baseline fish populations and non-lethal tissue sampling of westslope cutthroat and bull trout in the Daisy Creek watershed.

[207] Based on the evidence available to us, we find that the Elan South project is still in the exploration and feasibility stage. Consequently, it is neither certain nor reasonably foreseeable that a mining project will proceed, and therefore Benga was not required to include a potential future mining project at Elan South in its cumulative effects assessment. Until such a time as a project description or conceptual design is available, sufficient information would not likely be available to allow for an informed understanding of a proposed project or to identify potential effects that should be included in a cumulative effects assessment.

[208] DFO also notified us that they received an application for a *SARA* permit on August 25, 2020, on behalf of Cabin Ridge Project Ltd. in relation to the Cabin Ridge Project, on a property about 50 km north of Coleman, Alberta. The activities described in the application are to collect fish sampling data and habitat data to “inform mine planning, and would be used to characterize existing conditions in the event the project progresses and an environmental assessment is required” (CIAR 501, PDF p. 2). DFO indicated that they would make a decision on the issuance of the permit by November 16, 2020. Although the status of this project was not explored further at the hearing, the limited evidence available on the record suggests that, like Elan South, this project is also still in the exploration phase and consequently Benga was not required to consider it in its cumulative effects assessment as reasonably foreseeable project.

[209] We recognize that the application case, as defined by Benga, considers cumulative effects that include base-case conditions (existing and approved projects and activities) plus the project. The planned development case represents an additional cumulative effects case that considers the application case (existing and approved projects/activities plus the project) plus other reasonably foreseeable projects. There may indeed be value in considering the cumulative effects resulting from other reasonably foreseeable projects in the planned development case. But the planned development case involves a higher degree of uncertainty compared with the application case, as some projects that are considered reasonably foreseeable may not occur. How much emphasis should be placed on the planned development case when assessing the potential for cumulative effects and making decisions related to the current project under review is therefore a judgement call.

[210] Benga stated that the potential future northward expansion of the mine pit on Grassy Mountain is not a reasonably foreseeable physical activity. Benga did not include this expansion in the cumulative effects assessment as it had not been proposed as part of the present application submitted for regulatory approval by the AER and environmental assessment under *CEAA 2012*. Instead, it would be the subject of a separate application for regulatory approval should Benga elect to expand the project. Such an

expansion would depend on several factors, including the price of coal, the bulking factor of the rock, and other geological and geotechnical information. Should any expansion be pursued, Benga indicated it would go through the proper regulatory processes at that time.

[211] The Ktunaxa Nation stated that Benga’s cumulative effects assessment did not adequately consider the regional context. The Ktunaxa recommended that an Indigenous-led cumulative effects management strategy be prepared. They indicated that Indigenous groups could, in collaboration with governments and proponents, set the parameters for assessing and managing environmental effects on a regional level, given the proximity of the project to the already ecologically compromised landscape of the Elk Valley and the eastern foothills.

[212] We recognize that it is challenging for proponents such as Benga to conduct cumulative effects assessments in the context of project-specific assessments. We agree with the Ktunaxa that the assessment and management of regional cumulative environmental effects should be undertaken at a regional level and in a collaborative manner that involves affected stakeholders.

Overestimating the effectiveness of mitigation measures results in the inappropriate elimination of some effects pathways from the cumulative effects assessment

[213] Benga stated that if a residual effect after mitigation was identified, then the effect on that valued component was carried forward to the cumulative effects assessment. It did so regardless of whether the effect was determined to be significant. This approach is consistent with the Agency’s technical guidance and operational policy statement for *Assessing Cumulative Environmental Effects under CEAA 2012*.

[214] Benga indicated in several instances that mitigation would eliminate a potential effects pathway (i.e., there would be no residual effect), even when the effectiveness of the proposed mitigation was uncertain. For example, Benga designated some aquatic resource pathways as “secondary” because they would have “negligible residual effect” after mitigation. These pathways were not advanced for further assessment. Examples of pathways not advanced include the pathway or linkage between surface water quality and westslope cutthroat trout. Benga’s determination of negligible residual effects resulted in these effects pathways not being considered in the cumulative effects assessment. However, several participants were of the view that Benga’s mitigation would not completely eliminate certain effects pathways.

[215] As described in the chapter on surface water quality, we find that the effectiveness of mitigation to reduce water quality effects was overestimated. Benga underestimated the potential project effects related to water pathways, and by extension also underestimated the cumulative effects. We find that in several instances, Benga made overly optimistic assumptions regarding the effectiveness of proposed mitigation measures, resulting in certain effects pathways not being considered in the cumulative effects assessment. We find that this resulted in an underestimate of the potential cumulative effects on some valued components, which is important when assessing sensitive valued components such as species at risk. In cases where there was uncertainty in the effectiveness of mitigation measures, a more conservative approach would have been to indicate that there was a residual effect, and to carry that pathway forward to the cumulative effect assessment.

[216] Proponents should carefully consider the effectiveness of their proposed mitigation measures in determining whether there would be a residual effect. They should include all effects pathways that could potentially affect a valued component in the cumulative effects assessment. This is particularly important for sensitive valued components such as species at risk.

Organization of the EIA

[217] Several participants commented on the difficulty of navigating the EIA and related submissions, which included the assessment submitted in 2016 and the 12 addenda. Prior to the hearing, CPAWS, the Coalition, and the Livingstone Landowners Group requested that the applicant be required to provide a reorganized and updated EIA that consolidated all the information generated for the assessment. The group noted that “the sheer volume of the EIA makes it extremely difficult to work with, even for consultants and experts” (CIAR 367, PDF p. 3). CPAWS considered a comprehensive and logically organized EIA essential for effective public participation at the hearing.

[218] In April 2020, we advised Benga of these concerns and indicated that it was at times unclear whether the more recent information it provided was meant to supersede previously filed information or be considered supplemental. We did not require Benga to submit a completely updated and consolidated EIA given the level of effort and time that would be required and the lack of regulatory guidance or precedence for such a request. We recognize that this issue is not unique to Benga’s EIA.

[219] To help participants, and ourselves, navigate the material on the record, we required Benga to provide a reference list indicating where information on each valued component could be found in the record for the assessment. We asked for updated consolidated tables of commitments and mitigation measures that reference where in the record the commitment was made. Benga submitted this information in June 2020 as the Twelfth Addendum.

[220] In their final argument, CPAWS stated that Benga’s refusal to reorganize and resubmit its EIA and addenda prior to the hearing stage contributed to the length and complexity of the hearing. Benga’s decision not to repackage and resubmit its material meant that the hearing discussed material that included duplication, out-of-date material due to changes in the project plan, and 12 addenda with no internal organization. In one instance, material that contained math errors was submitted twice. In another, information that was incorrectly copied and pasted created the wrong context.

[221] We agree that the volume of information and its changing nature over the five years of the review process made it difficult at times to locate the most current information and to understand how it related to other previously provided information. This added to the complexity and length of the review process, including the public hearing. While this issue is not unique to the current application, it did pose challenges for participants in the review process and for decision makers.

Recommendation 1: We recommend that the Impact Assessment Agency of Canada direct proponents to provide a pre-industrial (historical) baseline in their EIA report. This should be incorporated into the tailored impact statement guidelines for future impact assessments.

A pre-industrial baseline would have improved our ability to consider the effects of previous activities in an area when assessing cumulative effects.

Recommendation 2: We recommend that the Impact Assessment Agency of Canada and the Alberta Energy Regulator consider modifying their EIA requirements to require proponents provide a consolidated impact assessment that incorporates all project modifications and information updates into a single package prior to public hearings and decisions by regulators and responsible authorities.

A number of participants reported that the format of Benga's application information was confusing because information was spread over an original application package submitted in 2016 and 12 addenda submitted between 2017 and 2020. In these addenda, Benga updated or revised some information presented in the original application package.

3. Purpose of and Need for the Project

[222] As stated by Benga, the purpose of the project under review is to establish a coal mine on the Grassy Mountain site and ship metallurgical coal to overseas steel markets. Benga indicated that the project would provide a significant economic stimulus to the Municipality of Crowsnest Pass and the M.D. of Ranchland, as well as other communities in the region and in British Columbia.

[223] According to the Agency's operational policy statement *Addressing "Purpose of" and "Alternative Means" under CEAA 2012* (updated March 2015): "The purpose of the designated project is defined as the rationale or reasons for which the designated project would be carried out from the proponent's perspective. It conveys what the proponent intends to achieve by carrying out the designated project." The purpose should also cover what problems the project intends to solve, or what opportunities it intends to seize.

[224] Benga intended to develop a world-class steel-making coal mine to supply global seaborne markets and further enhance Canada's reputation as a supplier of high-quality metallurgical coal to the world's largest markets. At full production, Grassy Mountain would be one of the largest single-site sources of steel-making coal in Canada.

[225] Benga completed an engineering feasibility study to ensure the project is economically sustainable and is confident the mine would continue to operate throughout its approximately 23-year life. It secured contracts for future port space for coal at Westshore Terminals in the Vancouver area, and engaged in discussions with overseas steel makers for sales to Asian and South American markets.

[226] In describing the purpose for the project, Benga identified seven main benefits:

- receipt of revenue in the form of production royalties, licence fees, and taxes by municipal, provincial, and federal governments
- material diversification of revenue for both the municipal and provincial governments given the limited metallurgical coal developments in Crowsnest Pass and Alberta
- material economic development in southwest Alberta, an area that is trailing the remainder of the province economically
- use of goods and services provided by local, regional and provincial contractors and retailers, and opportunities for Albertan and Canadian engineering firms, contractors, manufacturers, and suppliers to compete in the supply of goods and services, with a focus on the local public and Indigenous groups
- skilled, well-paid, full-time employment opportunities
- development of the project in an environmentally responsible manner that would preserve the social and economic values of the Crowsnest Pass area
- full rehabilitation of the Grassy Mountain area at the conclusion of the project, which would ensure the surrounding area remains an attractive place to live and recreate

[227] Benga estimated that its annual operating expenditures would be approximately \$225 million. It also stated that the project would attract new residents to the Crowsnest Pass region, which would create opportunities in the housing construction industry and support local businesses.

[228] The Municipality of Crowsnest Pass expressed its support for the project, subject to Benga committing to the mitigation measures outlined in its assessment. It proposed a number of recommendations for us to consider as conditions of any approval for the project. The Town of Pincher Creek stated at the hearing that it is well equipped with highly skilled workers and related service providers who can offer the necessary expertise to support a new coal mine.

[229] The Crowsnest Conservation Society, the Coalition, and the Livingstone Landowners Group expressed concerns regarding the economic viability of the project at current coal prices and the long-term market sustainability due to emerging lower-carbon steel-making technologies. These participants noted it was highly questionable whether the project was in the public interest, and whether its benefits would outweigh its social, economic, and environmental costs. Several participants indicated that the project is driven by international, rather than Canadian, demand.

[230] Benga stated that the project would produce metallurgical coal, which is a key component required to produce steel. Steel remains the world's most important engineering and construction material. Benga argued that there is no evidence that the global or Canadian use of steel is in decline. Benga indicated that Canadians will continue to require steel for construction activities and to purchase goods manufactured elsewhere that are made from steel.

[231] At the hearing, Benga reported that China and India are leading the demand for metallurgical coal. Benga said it expects other Asian, South American, and African countries to increase their demand for metallurgical coal. Benga commented that Canadians should benefit as much as possible from the global and domestic demand for steel by producing metallurgical coal in an environmentally responsible way. In addition, the Coal Association of Canada stated that Canada was the third largest metallurgical-coal-exporting economy and noted that it expected coal exports to increase by more than 20 million tonnes over the next ten years.

[232] We note that in equating a strong demand for steel in the coming decades to an ongoing, strong demand for metallurgical coal, Benga did not acknowledge that international pressure to reduce greenhouse gas emissions could cause steelmakers to find ways to produce steel using alternative raw materials and technologies that have a lower greenhouse gas intensity. This has the potential to reduce global demand for metallurgical coal later in the lifetime of the mine.

[233] CPAWS expressed concerns that Benga's expected coal quality is below that of prime hard-coking coal, and its analysis of Benga's information revealed a number of inconsistencies and conflicting coal-quality data. CPAWS also noted that the optimal blend of all three coal seams, which is required to produce the coal quality that Benga anticipates, would become unavailable as the project proceeds over its lifecycle.

[234] Benga confirmed that the coal it will produce at Grassy Mountain is bituminous, with qualities consistent with a high-grade of coking coal. At the hearing, Benga asserted that it was confident it would find a market for all the coal produced from the mine, and it expected to be able to blend coal seams to

yield a high-quality product over the life of the mine. We discuss coal quality in the chapter on coal mining, handling, and processing and in the chapter on social and economic effects. We understand that considerable uncertainty exists with regard to forecasts of future coal prices and markets, or how the steel sector will respond to the future challenge of climate change. We examine the above issues in greater detail in the social and economic effects chapter.

[235] We find that the objectives for the project described by Benga are consistent with the Agency's operational policy statement. Benga has conveyed what it intended to achieve by carrying out the project, the opportunities it intended to seize (recover coal resources to advance the interests of Indigenous and non-Indigenous local communities, Albertans, Canadians, and its shareholders), and a problem it intended to solve (how to maximize the value of a product essential to everyday life).

4. Alternative Means of Carrying Out the Project

Benga considered alternative means of carrying out the project

[236] Benga used the Agency’s operational policy statement *Addressing “Purpose of” and “Alternative Means”* under *CEAA 2012* (updated March 2015), as the basis for its assessment of alternative means of carrying out the project. According to the operational policy statement, alternative means are the various technically and economically feasible options under consideration by the proponent that would allow a designated project to be carried out. As identified by the proponent, the alternative means include options for locations, development and/or implementation methods, routes, designs, technologies, and mitigation measures.

[237] Benga’s alternative means assessment included options for mining type, mine configuration, rail and loadout facility location, clean coal transport, coal-handling and processing plant fines management, water and selenium management, coal-lease development, rail haul, energy source, water supply, construction camp, employee accommodation, and non-rail transportation.

[238] Benga stated it evaluated the alternative means options against the technical and economic criteria listed in Table 4-1.

Table 4-1. Technical and economic criteria for alternative means options

Technical criteria	Economic criteria
Operability and constructability	Construction/capital cost
Flexibility	Operating cost
Safety	Scheduling risks
Resource recovery	Impact on community
	Low safety / security hazard / undesirable

[239] Only alternative means options that were both technically and economically feasible were assessed for potential environmental effects on valued components of the project.

Mining type

[240] Benga considered four types of mining in its alternative means assessment: long-wall underground mining; room-and-pillar mining, surface strip-mining (dragline), and open-pit (truck/shovel) mining. Only open-pit mining was deemed both technically and economically feasible.

Mine configuration for waste rock disposal areas

[241] Benga assessed different potential waste rock disposal areas within the project footprint. The following locations were evaluated: north rock disposal area 1, north rock disposal area 2, west rock disposal area, east rock disposal area, south rock disposal area, and central rock disposal area.

[242] In selecting the locations for the waste rock disposal, Benga included four environmental and economic goals:

- minimize ex-pit disturbance
- maximize in-pit backfill
- reduce impacts on Blairmore Creek and Gold Creek
- maintain a mine sequence that is achievable both operationally and economically

[243] Benga selected north rock disposal area 2, the south rock disposal area, and the central rock disposal area as the preferred options for waste rock management. These areas were chosen because they are technically, economically, and environmentally feasible. Further discussion of the waste rock disposal areas for the project is provided in the chapter on coal mining, handling, and processing.

[244] Benga indicated that the west rock disposal area and north rock disposal area 1 were not selected because they could affect water quality, water flow, and aquatic species in the Blairmore Creek watershed. Benga also noted that the east rock disposal area would have the potential to affect water quality, water flow, and aquatic species in the Gold Creek watershed and was therefore not considered further.

Rail loadout facility location

[245] Benga evaluated five potential sites for the location of the rail loadout facility in the alternative means assessment:

- Blairmore Creek Trail Track
- Golf Course Figure 8 Loop
- Coleman Rail Siding
- Frank Industrial Area Loop
- Gas Plant Loop

[246] In evaluating these locations, Benga included additional economic and environmental criteria in its alternative means assessment:

- rail grade at loading
- distance from coal-handling processing plant
- coal storage at loadout
- use of public roads by coal trucks
- environmental risk

[247] All five locations were assessed as being technically feasible. Benga removed the Blairmore Creek Trail Track, Frank Industrial Area Loop, and Gas Plant Loop options from further consideration because they were not considered economically feasible. Benga noted that the Golf Course Figure 8 Loop and Coleman Rail Siding options were comparable in the environmental effects analysis and would have

the potential to affect air quality, noise, and aesthetics. They could also have socioeconomic effects related to recreational use, residential property values, and land development. Benga concluded that the most economically feasible option for the rail loadout facility was the Coleman Rail Siding location. However, Benga selected the Golf Course Figure 8 Loop as the preferred option based on multi-stakeholder feedback.

Clean coal transport

[248] Benga considered two options for the transportation of clean coal from the coal-handling and processing plant to the rail loadout facility: covered conveyor and truck haulage. Benga concluded that both transportation options were technically and economically feasible. The covered conveyor was selected because it resulted in fewer potential environmental effects on air quality, noise, wildlife movement, and public safety.

Coal-handling and processing plant fines management

[249] Benga considered two options for the management of coal-processing fines: a conventional tailings pond and mechanical de-watering. Benga stated that both management options were technically feasible; however, the project's site conditions made the development of a conventional tailings pond uneconomical. Benga's preferred design for fines management is mechanical de-watering as it provides immediate water conservation, eliminates the need for a tailings pond, and limits liability during the project's lifecycle.

Water and selenium management

[250] In its alternative means assessment, Benga included two options for water and selenium management: a passive subsurface saturated backfill zone (saturated backfill zone) and an active water treatment plant. Benga stated that the options were both technically and economically feasible and were evaluated for their potential environmental effects. Benga said that while both options resulted in similar potential effects on water quality and aquatic habitat, a saturated backfill zone was the preferred option because of its higher economic feasibility. This option resulted in lower capital and operating costs for the project.

Coal lease development

[251] Benga assessed four coal properties (Grassy Mountain, Bellevue, Adanac, and Lynx) in its alternative means assessment to determine which one had the best coal reserves for surface mining development. Benga selected the Grassy Mountain property as the most economically viable for development as it had the most complete geological drilling data. A decision on the technical and economic feasibility of the other coal leases could not be made and they were not evaluated further by Benga.

Rail haul

[252] Benga evaluated two marine rail terminals in its alternative means assessment to determine which one was optimal to receive rail hauled coal that could be loaded on marine vessels and shipped to markets. Westshore Terminals, in the Vancouver area, and the Ridley Terminal, in the Prince Rupert area, were both found to be technically feasible by Benga. Because of Benga's planned use of the existing Canadian Pacific Railway line and future reservation of port space for coal supplies, Benga selected the

Westshore Terminals as the preferred option because of its technical and economic feasibility. In the alternative means assessment, Benga did not evaluate the Ridley Terminal option further because it was not determined to be economically viable.

Energy source

[253] The project would utilize two types of equipment, both requiring power sources: the fixed-plant and the mobile mining fleet. Benga evaluated the options of using diesel engines or electricity to power its equipment. Both options were assessed as technically and economically feasible. Benga selected the diesel option to power the mobile mining fleet because of the flexibility it could provide during project operations. Diesel-fueled vehicles are considered more mobile and allow for rapid responses to changes in the operating plan and mine sequencing. Benga selected the electricity option to power all fixed-plant facilities and the conveyor for the project.

Water supply

[254] Benga completed a project site-wide water balance and determined that all surface runoff from the project would need to be managed. It also determined that much of the water could be treated and released to the environment, although some would have to be collected and treated to remove selenium. Benga considered two options for water supply: groundwater and surface water sources. Benga deemed both options technically and economically feasible; however, surface water was selected as the preferred supply option. Benga indicated that the volume of water that will require additional management will be equivalent to the project's water needs. By using the collected surface water to meet the needs of the coal-handling and processing plant, the surface water supply option is best suited to managing selenium-enriched water for the project. Benga stated that by using the selenium-enriched water, the project would not result in direct release of contaminated water that could potentially affect water quality and aquatic habitat.

Construction camp

[255] Benga considered three options to accommodate the construction workforce for the project: accommodation in local towns, on-site construction camps, and a combination of on-site construction camps and off-site accommodations. Benga indicated that a combination of on-site camps and off-site accommodations was the preferred option; this option would provide flexibility during construction and result in a smaller project footprint.

Employee accommodation

[256] Benga did not propose alternative options for the operational workforce other than what was selected for the project, a combination of on-site and off-site facilities.

Non-rail transportation

[257] Benga reported that rail was the only technically feasible option to transport coal to the west coast of Canada. Coal would be loaded into rail cars at a loading facility and taken to the Port of Vancouver. While Benga considered long-term trucking as an option, it indicated that trucking was not economically viable and was not further assessed.

The location of the rail loadout facility is a concern for some members of the community

[258] Prior to the hearing, some community members expressed concern that Benga excluded the Blairmore Creek Trail Track option for the rail loadout facility from its alternative means assessment based on high costs. At the hearing, Benga stated that the Golf Course Figure 8 Loop was the most expensive option of the top three locations. It also noted that recent construction activities at the golf course location have excluded the Blairmore Creek Trail from further consideration.

[259] Some participants expressed concern that the effects of the project's rail loadout facility on other attributes and priorities would be greater than the proponent described. They indicated there could be greater effects on visual and landscape aesthetics, noise, air quality, and the local recreational and tourism economy. Although supportive of the Golf Course Figure 8 Loop option, the Municipality of Crowsnest Pass noted that there would be impacts on the visual environment. It provided several recommendations to Benga to mitigate these impacts, such as the use of non-reflective coatings on buildings, proper grading of the site, and landscaping and enclosure of all rail loadout infrastructure. The chapter on noise, light, and visual aesthetics and the chapter on air quality provide additional information and discussion related to these issues.

[260] At the hearing, Ms. Janusz expressed concern that the rail loadout facility would negatively affect the Municipality of Crowsnest Pass and discourage tourists from taking part in recreational opportunities in the area. As part of its public consultation plan, Benga said it would continue to consult with the community to address ideas for landscaping and other measures that would diminish concerns related to the visual impact of the rail loadout facility.

[261] We recognize that construction of the new golf course and access road may preclude selection of the Blairmore Creek Trail option. However, the economic feasibility of the various options for the rail loadout facility were not presented in a comprehensive and transparent manner. Without seeing cost estimates for each location, it was not possible to make a detailed comparison of the costs of Benga's top three rail loadout locations (Coleman Rail Siding, Golf Course Figure 8 Loop, and Blairmore Creek Trail Track). However, we accept that Benga consulted with stakeholders and used the results of multi-stakeholder feedback to inform its choice of the Golf Course Figure 8 Loop. We realize that any location selected is likely to be of concern to some, and we note that the Municipality of Crowsnest Pass supports the proposed location.

The efficacy of saturated backfill zones for the treatment of selenium has yet to be proven at the proposed scale

[262] The Livingstone Landowners Group, CPAWS, and many other participants raised concerns about the efficacy of saturated backfill zones to manage selenium concentrations resulting from project activities. Specifically, participants raised concerns about potential impacts from selenium exposure on surface water quality and westslope cutthroat trout. These issues are discussed extensively in the chapter on surface water quality and the chapter on fish and aquatic habitat.

[263] Benga selected saturated backfill zones as the preferred water treatment option for selenium. However, significant uncertainty exists over whether a saturated backfill zone can achieve the treatment levels necessary to protect surface water quality, aquatic habitat, and westslope cutthroat trout at the scale

required for the project. Elsewhere in this report, we find that Benga has not provided sufficient information to demonstrate that the proposed saturated backfill zones will achieve the treatment levels predicted by Benga. Benga did identify active water treatment (a metals treatment plant) as an option that could be deployed if the saturated backfill zones do not perform as expected. However, it provided little information on this option and did not consider using both technologies. A detailed discussion of saturated backfill zones and the potential impacts on surface and groundwater quality are provided in the chapter on groundwater quantity, flow, and quality and the chapter on surface water quality.

The option of not proceeding with the project was evaluated in the alternative means assessment [264] Section 3.2.1 [A](b) of the provincial terms of reference required that Benga evaluate the option of not proceeding with the proposed activity as part of its alternative means assessment. Benga concluded that if it did not proceed with the Grassy Mountain Project, the local and regional population would not enjoy the economic development, employment opportunities, and community benefits that the project would bring to the area. In addition, Benga stated that the proposed project would be located on a previously disturbed mining site, some of which has not been reclaimed. At the conclusion of the project's mine life, the site would be rehabilitated to a better state than its current condition. However, were the proposed project not to proceed, the site would remain disturbed and contain legacy mine waste piles.

[265] Notwithstanding some of the limitations of Benga's assessment discussed above, we find that Benga identified and assessed various alternative means for carrying out the project in accordance with the Agency's operational policy statement *Addressing "Purpose of" and "Alternative Means"* under *CEAA 2012* (updated March 2015). We accept that Benga provided sufficient information on the alternatives and selected adequate options based on the criteria that it identified.

5. Coal Mining, Handling, and Processing

[266] Benga applied to the AER under the *Coal Conservation Act* for a mine site permit, a pit licence, three external discard (waste) rock dump licences, and approval for a coal processing plant. Application 1844520 was registered on November 19, 2015. In this application, Benga applied for: a permit to develop a surface metallurgical coal mine; a coal-mine pit licence; and licences to construct three external mine discard dumps within the permit area, referred to as the north, central, and south rock disposal areas. Application 1902073 was registered on October 31, 2017. This application updated and amended Application 1844522 and included an application for approval to construct and operate a coal processing plant.

Benga's proposed approach to mining and mine planning is reasonable

[267] Benga proposes to develop the mine using a truck-and-shovel method. The proposed open pit follows the ridgeline of Grassy Mountain where outcrops of the target coal seams appear. It is approximately 6 km long and varies in width, reaching a maximum width of 1.8 km. The greatest depth of the pit is expected to be approximately 430 m. The proposed mining methodology is suitable considering the geology and topography of the project area.

[268] The proposed coal production over the life of the mine is described in Table C.1.3-1 of Benga's EIA:

- total in situ raw coal: 163.8 million tonnes
- total clean coal (10 per cent moisture): 92.6 million tonnes
- total waste to be moved: 833.3 million bench m³ with a 30 per cent swell factor for loose cubic metres in respect to dump volumes
- total waste rehandle: 20.8 million bench m³
- average strip ratio: 9.2:1 for bench m³/clean tonne

[269] The expected mine life is approximately 24 years, with the mine reaching maximum production by year 4. This includes a development period during which overburden removal and coal mining commences followed by 23 years of full production operations. The annual raw coal production would reach 8 million tonnes by year 4 with the absolute maximum production in year 9 at 8.26 million tonnes. Thereafter, annual production declines gradually, averaging 6.9 million tonnes during the last four years of production. The mine would operate 24 hours a day, 365 days a year. Although daily numbers may fluctuate, the projected absolute maximum production (reached in year 9) is 22 630 raw tonnes of coal per day and 12 800 clean tonnes processed per day.

[270] The pit was designed using a target price for coal of US\$100/tonne. The project is limited by the availability of the mineable coal at the southern extent of the mine pit (CIAR 42, Section C, Figure C.1.2-1, PDF p. 190) and by the progressively increasing stripping ratio toward the north.

[271] Mining of coal and waste rock will proceed in nine phases, as shown in Figure 5-1. The pit will start at phase 1 in the southwest of the pit and generally progress toward the northeast, with more than one phase opened for mining simultaneously to make space for in-pit backfilling as soon as possible. Initially

the waste rock will be deposited in the south rock disposal area followed by backfilling the pit northward behind the pit's advance. Eventually the south rock and north rock disposal areas will tie into each other through the backfilled pit to form a single disposal area. An estimated 74 per cent of the open pit will receive backfill, with the balance of the material diverted to external waste disposal areas. In some of its materials, Benga refers to the northern portion of the south rock disposal area as the central rock disposal area.

KEY TECHNICAL TERMS

Volatile matter content: Gases such as carbon dioxide, water, or sulfur dioxide (SO₂) that leave a sample when it is heated. They mostly come from the organic matter within the coal. Higher rank coals contain less volatile matter.

Maceral: Altered remains of plant material in coal. Macerals are classified by their appearance under the microscope into inertinite (flakes of fossilized charcoal), liptinite (finely ground plant matter), and vitrinite (glassy remains of roots, wood, and bark).

Plasticity: Plasticity is a term to describe the behaviour of coal when it is melted above 300°C in the absence of air and begins to behave as a liquid.

Reactives: Coal contains both inert (non-reactive) and reactive material. The reactive component includes macerals, which become soft when heated and then solidify into a solid mass of carbon that is porous and fused together. This fusion binds inert components, which remain unaltered.

Coking strength: The physical ability of a coke, made from coal, to support the mix of coke and iron ore in a blast furnace.

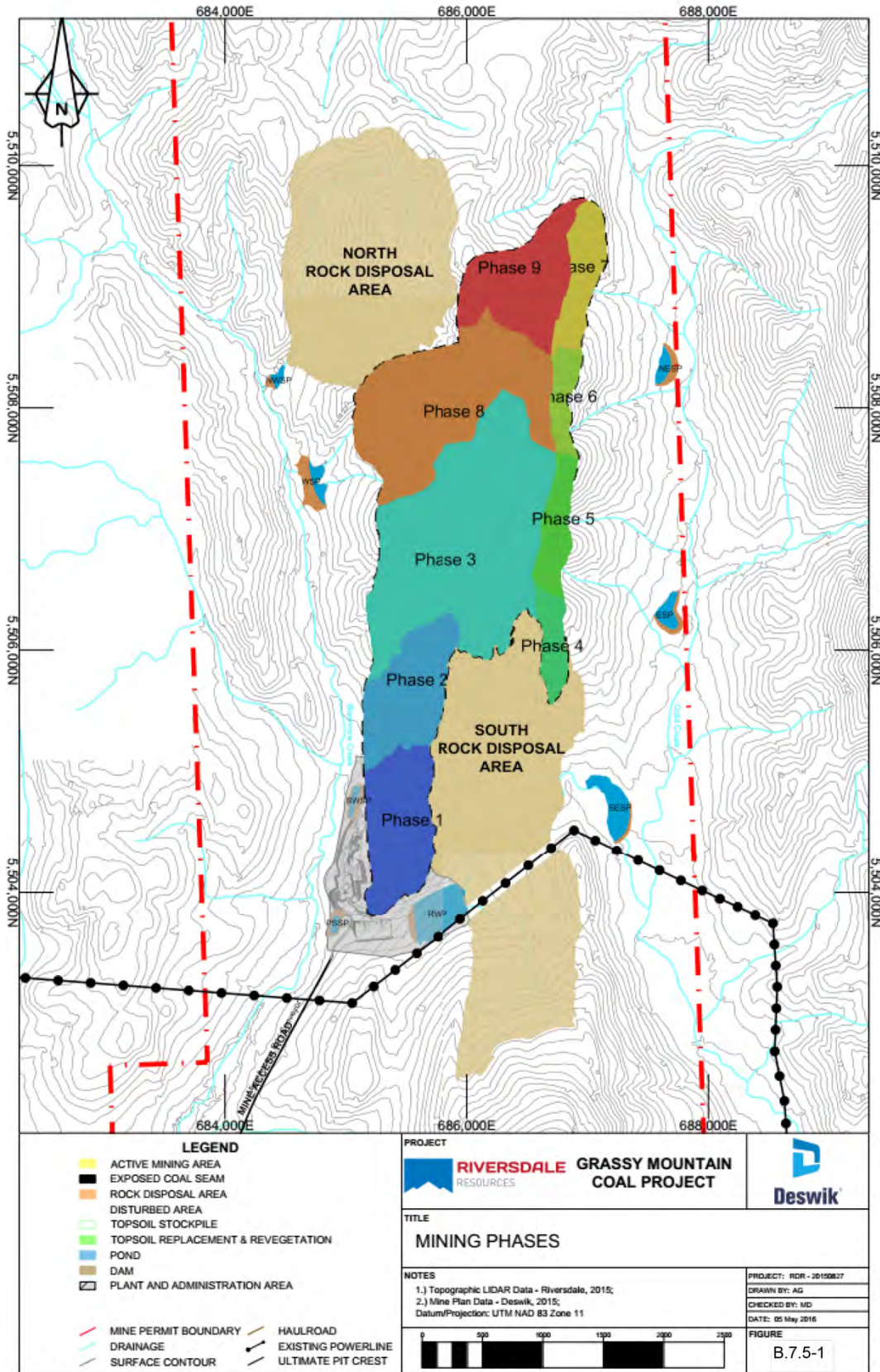


Figure 5-1. Phases of mining. Source: CIAR 42, Section B, Figure B.7.5-1, PDF p. 123.

[272] The proposed mine's equipment fleet consists of primary backhoes for coal/waste mining, smaller backhoes for greater selectivity in challenging geological areas, and 220-tonne-capacity rear-dumping trucks and dozers for waste removal and reclamation work. The fleet size reaches a maximum near year 5 as production approaches its maximum average. The size of the equipment fleet is sufficient to run the proposed project. The list of equipment is in Table 5-1.

Table 5-1. Primary equipment fleet summary

Equipment type	Size class	Duty	Year 1	Year 5	Year 10	Maximum
Hydraulic backhoe	490 tonne (28 m ³)	Waste removal	0	1	1	2
Hydraulic backhoe	394 tonne (22 m ³)	Waste/coal removal	2	3	3	4
Hydraulic backhoe	122 tonne (5 m ³)	Waste/parting/coal removal	2	2	2	2
Wheel loader	218 tonne (20 m ³)	ROM/rejects maintenance	1	1	1	1
Trucks – rear dump	220 tonne	Waste/coal/rejects hauling	15	30	30	39
Backhoe	71 tonne (2.5 m ³)	Topsoil handling	1	1	1	1
Backhoe	34 tonne (1.1 m ³)	Topsoil/utility handling	1	1	1	1
Trucks – articulated	37 tonne	Topsoil hauling	3	3	3	3
Dozer – track	664 kW	Waste removal/reclamation	4	5	6	6
Dozer – track	391 kW	Waste removal/reclamation	3	5	5	5
Drills – diesel	270 mm	Waste/parting removal	2	3	3	4
Dozer – rubber tired	49 kW	Bench maintenance/operations support	1	2	2	2
Motor graders	7.5 m blade	Road maintenance	3	3	3	3

Source: CIAR 42, Section C, Table C.1.4-1, PDF p. 34.

[273] The haul roads will be used primarily by the 200-tonne rear-dump trucks. The maximum grade will be 8 per cent. The running surface of the 26 m haul road is designed to be three times the width of fleet vehicles to allow trucks to pass in opposite directions. Berms will be developed with a minimum height of 1.5 m. Run-off ramps will be placed on all haul roads with a grade steeper than 5 per cent and will be placed at every 30 m of elevation difference. The run-off ramps will be graded at 25 per cent uphill, with an approximate length of 100 to 200 m to safely stop out-of-control vehicles. The haul road design is satisfactory, with escape routes present at road grades exceeding 5 per cent. The haul road design appears to meet the criteria set out in Section 539 of the *Occupational Health and Safety Code*. The highwalls are designed to be either a single bench or a double bench with bench angles of between 60 and 70 degrees, depending upon the competency of the wall materials. The geology of the central highwall allows for a steepest double-bench angle of 70 degrees. The pit-wall design criteria are consistent with the mining methodology for the project.

[274] Benga described the preliminary (pre-feasibility and feasibility) studies that were completed for the mine-pit slope, waste dumps, and water impoundment structures as the project developed. Benga indicated that

- additional investigations would be planned as needed when the mine pits are being established;
- as mining progresses, geotechnical data and performance data from existing rock dumps would be utilized to re-evaluate future rock dumps; and
- geotechnical investigations required for fluid-retaining structures would be evaluated and completed as part of the detailed design.

[275] During the review process, Benga provided substantial additional geotechnical information in response to AER requests. In general, the information provided with respect to the pit walls and dumps is acceptable. It is understood that the design of these geotechnical structures would be refined during operations, depending on additional geological and geotechnical data and other selenium-management strategies.

The applied-for mine permit boundary includes lands not controlled by Benga

[276] Figure 5-2 shows the mine permit boundary Benga applied for and the location of private and public lands.

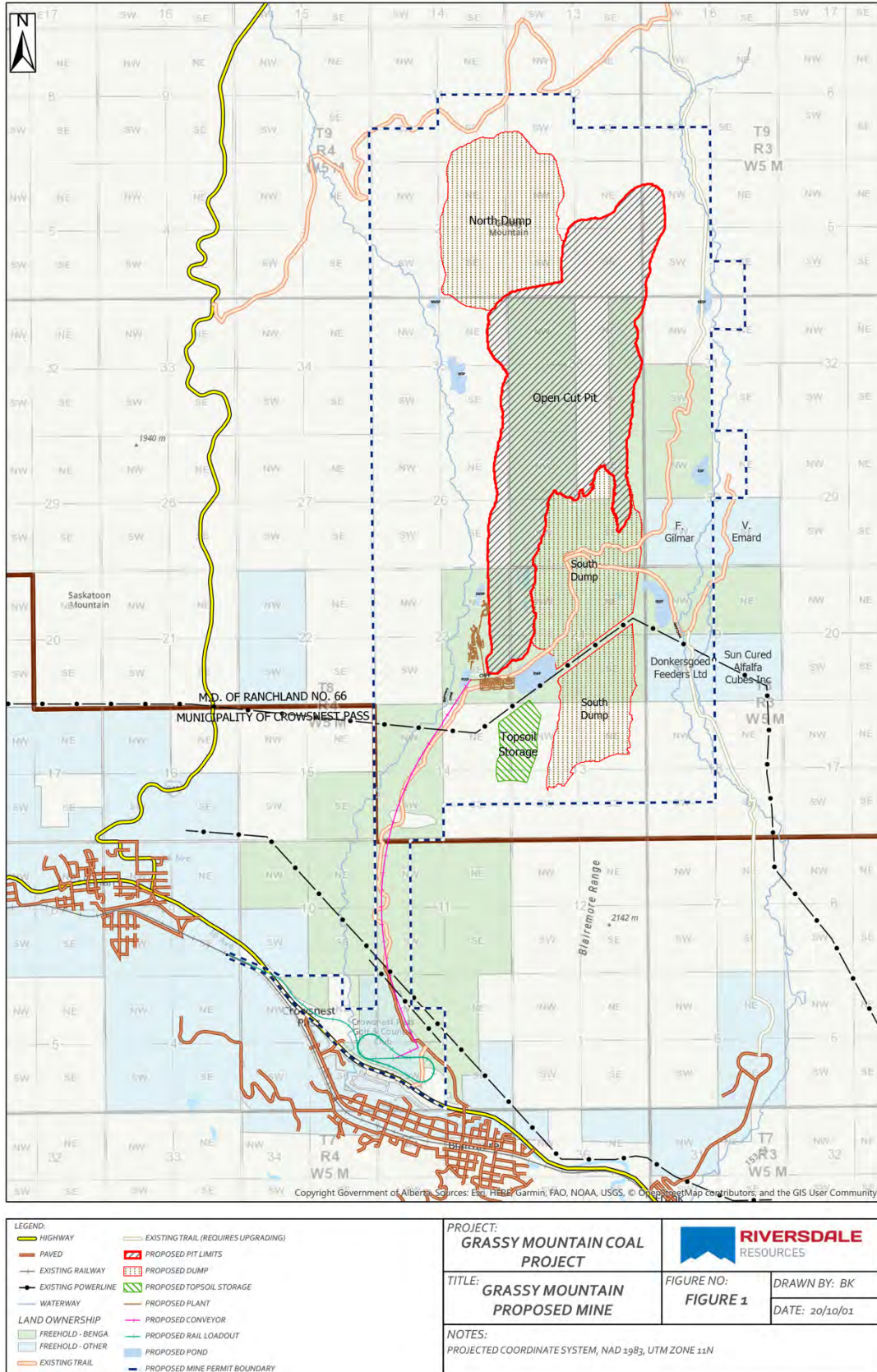


Figure 5-2. Mine permit boundary. Source: CIAR 571, Appendix A, Figure 1, PDF p. 38.

[277] In response to questions at the hearing, Benga confirmed that the mine permit boundary it applied for includes private lands belonging to F. Gilmar and Donkersgoed Feeders Ltd. Benga also confirmed that the Gilmar and Donkersgoed lands are not essential to mining at Grassy Mountain and could be excluded from the permit area. In response to questions at the hearing, Benga also confirmed that it does not control and has not submitted applications under the *PLA* to make use of areas west of Blairmore Creek or east of Gold Creek as these areas are not required for mining.

[278] The AER would not normally approve mine permit boundaries that include private lands not controlled by the applicant. Similarly, public lands within a proposed mine permit boundary cannot be used by an applicant unless applications are made and approvals issued under the *PLA* for the proposed activities. Had we decided to approve the project, it would have been necessary for us to adjust the mine permit boundary to exclude the private and public lands that Benga does not control and are not necessary for the project. Alternatively, we could have included conditions that prevented the use of those lands without the written consent of the landowners or the necessary authorizations being issued under the *PLA*.

Pre-existing underground mine workings within the mine footprint

[279] Pre-existing underground mine workings lie within the mine footprint. Benga provided a plan-view map showing its understanding of the pre-existing underground workings based on historical records and exploration data Benga generated by drilling and ground-penetrating radar. Benga committed to taking the following risk mitigation measures while mining in the southwestern portion of the pit where old underground workings exist:

- reviewing in detail all available documentation, surface mapping data, exploration data, historic records and a review of methods for locating shallow voids
- reviewing the hydrogeological model along with a geotechnical review of the overall highwall stability combined with local bench stability
- following guidelines for safe operations in areas of old underground workings as described in the application, including geotechnical guidelines for vertical standoff distances over potential voids to prevent collapse; continuous updating of historic data based on exploration, field observation, operational drilling and survey; and emergency response plans to cater for risks associated with historic workings

[280] The presence of historical underground workings below Benga's proposed open-pit mining operation adds an additional layer of complexity and uncertainty to the proposed mine. Benga would need to exercise a high degree of caution when mining in areas that may be located above former underground workings, as the full extent of these workings might not be known. In addition to the potential safety hazards to personnel encountering underground workings unexpectedly, the presence of historical underground workings may influence groundwater flow pathways and the effectiveness of the proposed saturated backfill zones. This issue is discussed further in the chapter on groundwater quantity, flow, and quality.

[281] With respect to potential safety hazards, the mitigation measures proposed by Benga appear to be feasible and reasonable. Benga proposed to use drilling, ground-penetrating radar, local bench stability reviews and geotechnical and hydrogeology model reviews while mining in the area. Combined with

equipment offset, collapsing the voids prior to mining and overhand digging, these measures would ensure a safe mining operation in these areas.

Benga's use of the US\$100/tonne pit shell for preliminary mine planning and the EIA was reasonable

[282] The pit limit used as the basis for the proposed mine plan, the applications under the *Coal Conservation Act*, and the EIA were established using a target price for coal of US\$100/tonne.

The Livingstone Landowners Group questioned why a target coal price of US\$100/tonne was used to define the pit limit; in its economic analysis, Benga predicted a target price of US\$140/tonne over the life of the project. The group was concerned about the potential for a future expansion of the proposed mine to the north.

[283] Benga confirmed it is only applying for the project as described in the applications and the EIA and has no specific plans for expansion of the mine. Benga said that the US\$100/tonne pit shell was selected as optimal as it provides for sufficient reserves, maintains an acceptable stripping ratio throughout the life of the mine, and provides sufficient room for waste rock disposal. However, Benga acknowledged that if the mine were approved and the economics were favourable during the life of the project, a future expansion of the mine could be considered. Benga also acknowledged that, if the mine were to be expanded and the size of the mine pit increased, it might face challenges with waste rock disposal due to constraints posed by Blairmore Creek and Gold Creek and the associated setbacks that limit the area available for waste rock disposal.

[284] The location of the north rock disposal area could also affect Benga's ability to expand the mine to the north. Benga said that any future expansion of the project was speculative at this point. In the event an expansion was considered, Benga said it would examine existing dump properties and performance and potential environmental impacts. It would also conduct an economic analysis. Benga noted that expansion of the mine pit would require an amendment to the design of the mine pit and the mine-pit licence, which would require a technical application, including an EIA.

[285] We find that Benga's selection of the US\$100/tonne pit shell as the basis for its preliminary mine design to be reasonable and supported by the analysis provided. It seeks to maximize mineable reserves while maintaining an acceptable stripping ratio and providing sufficient room for waste rock disposal. We recognize that environmental site constraints, such as Blairmore Creek and Gold Creek and their associated setbacks, limit the size of the pit that can be developed. We agree with Benga that any potential future expansion of the project is hypothetical at this point. Our task is to consider and decide the applications before us. If Benga were to decide to expand the mine pit in the future, it would need to submit the necessary amendment application(s) and supporting technical information to the AER for regulatory review.

Noise and vibration associated with blasting is a concern for area residents

[286] Mining operations will utilize blasting to break up overburden, interburden, and coal to facilitate excavation. Benga proposes to use ammonium nitrate–fuel oil as the explosive for blasting and to manufacture it on site. Benga will be contracting a third-party explosives contractor for all blasting needs for the project. The contractor will be responsible for seeking all appropriate licences or permits from

NRC pursuant to the *Explosives Act*. The contractor will also be responsible for the manufacturing, storage, and delivery services of all explosives at the project site.

[287] Several participants expressed concern about potential noise and vibration resulting from blasting. Details on drilling and blast design were not included in Benga's original application. Benga made the following commitments related to blasting in the Fifth Addendum:

- Blasting would occur during the day shift during weekdays only. Monitoring of the size of the blast would be required to ensure that all steps (loading, wiring, stemming, and blasting) associated with that day's blasting operations can be completed during daylight hours.
- Minimal blasting would occur during cloud cover to minimize vibration impacts.
- Blasting would be limited to smaller, more localized blasts, which reduces the amount of explosive used at any one time.
- Benga would be subject to the noise control provisions of AER's *Directive 038*.

[288] During the hearing, Benga committed to the following concerning blasting and vibration controls:

- Modern through-seam blasting techniques would be used to reduce the noise and vibration from blasting at the Grassy Mountain project.
- Benga would optimize the timing of the individual blasts as well as the spacing between blast holes, with the aim of further reducing the vibrations, noise, and air emissions associated with blasting.
- Benga would seek feedback from the community in the Crowsnest Pass when blasting occurs and this feedback will be part of Benga's Blasting Management Plan.
- Benga would be monitoring shear-wave velocities at the project and will modify its seismicity analysis based on the actual shear-wave velocities. Benga said it will measure vibrations during the blasting process and monitor peak particle-velocity limits.

[289] We understand that details of Benga's proposed blasting program have not yet been developed. These details would be refined closer to the commencement of operations and evolve with the experience gained during mining operations. However, we find that the level of information provided is sufficient to evaluate potential project effects related to blasting.

[290] We note that AER *Directive 038*'s noise provisions do not have any specific requirements relating to blasting. However, Benga did model impulsive noise impacts associated with blasting using criteria derived from *NPC-119: Blasting*, which was issued by the Ontario Ministry of Environment. This is discussed in the chapter on noise, light and visual aesthetics.

[291] The risk of blasting at the project site triggering a landslide at Turtle Mountain is discussed in the chapter on accidents and malfunctions. That chapter also addresses the potential for accidents and spills related to ammonium nitrate–fuel oil operations.

The project location and design result in low sensitivities to geophysical and geotechnical hazards

[292] Benga submitted that the project location and design lead to low sensitivities to geophysical and geotechnical hazards, such as seismic events, landslides, and subsidence. The project is located in a relatively low-seismic-hazard zone, while construction areas and the camp are not located in areas sensitive to landslides. Geotechnical designs for the rail loop, loadout facility, in-pit/ex-pit waste disposal areas, and pit walls were completed using results from numerous field investigations at appropriate factors of safety to reduce project sensitivities to landslides. Infrastructure components were designed around legacy mining areas to minimize the risk of subsidence.

[293] Benga committed to the following mitigation measures: a foot survey to identify geomorphic features; a diagnostic of landslides in areas of potential concern; a field-mapping exercise; annual ground-condition inspections with increased frequency after major precipitation events; and a ground-monitoring program for areas of potential concern. NRCan's expert, Dr. A. Plouffe, said that Benga's proposed mitigation measures for potential effects of landslides are satisfactory, and restated NRCan's recommendation that the panel request that the proponent implement its commitments. NRCan also recommended that Benga adhere to its commitment to use the most current *National Building Code of Canada* and Canadian Dam Association guidelines during the construction phase of the project.

[294] We accept Benga's assessment that the project is in an area of low seismic hazards and that project infrastructure is not in areas susceptible to landslides. We find that Benga's proposed measures to monitor changing conditions and areas of potential concern are reasonable and appropriate and should provide early warning of any increased risk of landslides to the project. We recognize that some community members are concerned about the potential for the project to trigger another landslide at Turtle Mountain. This issue is discussed in the chapter on accidents and malfunctions.

No testing data were obtained for the shales of the Fernie Group that underlie the project

[295] Benga's pit-slope stability assessment included an analysis of the Blairmore Group and the Mist Mountain Formation. The Fernie Formation was not included, despite being identified as being part of the pit slope. As shown in EIA Figures B.2.04 and B.2.05, the contribution of the Fernie Formation to the pit slope is substantial. The Fernie Formation contains siltstone and shale and therefore may undermine slope stability.

[296] Benga said that the exposure of the Fernie Formation was a part of the pit that would be later backfilled and therefore it would not be exposed for any substantial length of time. Benga explained that pit stability was assessed by assuming that the portion of the pit where the Fernie Formation was exposed would be backfilled shortly after exposure. When asked if the analysis is still valid if the Fernie Formation is excluded, Benga replied that it is unusual to undertake a full geomechanical analysis of an entire mine before commencement.

[297] Benga said that it conducted geomechanical studies of the southern portion of the pit, which will be mined first. Benga said that it is confident that enough work has been done and sufficient information gathered for short-term mine planning. Benga indicated that, as mining approaches the section of the pit containing the Fernie Formation, the company will analyze Fernie samples for rock strength. If the Fernie

Formation is found to be of a different strength regime because of varying lithologies, Benga will flatten the pit slopes in those areas and add additional benches and flatter phases.

[298] The Coalition's expert, Dr. J. Fennell, commented on the absence of information on the Fernie Formation and noted that this was the formation upon which Benga would be placing waste rock, ponds, and submerged backfill zones. He said the Fernie Formation should be studied in detail from a perspective that incorporates hydrogeology, groundwater/surface interaction, geochemistry, geology, and geotechnical issues.

[299] Benga's decision to omit an assessment of the Fernie Formation in its pit slope assessment represents a limitation of its pit-slope stability assessment, causing some uncertainty. However, we find this decision does not raise substantial concerns. Exposure of the Fernie Formation would not occur until later in the mine's operation. Were the project approved, Benga would be expected to carry out additional investigations as the mine pits are being established. If necessary, the additional geological and geotechnical information collected could then be used to refine the design of the pit walls. It is common practice to refine pit-wall design during operations based on the acquisition of new information during operations. Further discussion of the Fernie Formation with respect to potential effects on surface water quality is provided in the surface water quality chapter.

Open-pit walls have been designed to minimize the potential for slope failure

[300] Benga said that it will perform routine geologic mapping during excavation. This mapping will be done to compare the orientation of the pit walls with what is expected in the geologic model and to look for the presence and orientation of faults in the pit walls. A review of groundwater monitoring will be performed on an on-going basis to determine groundwater trends prior to mining.

[301] Benga said that small, localized wall failures or sloughing are likely to occur. The magnitude for a small failure was rated as low, which resulted in a low risk rating. Given the knowledge gained in a similar geotechnical environment in the Elk Valley, Benga gave a large-scale wall failure a likelihood rating of rare and a moderate magnitude, resulting in a moderate overall risk.

[302] We find that the geotechnical design of the open pit walls is acceptable. The number of benches and their respective minimum widths meet the target factor of safety. Benga modelled the slopes of the highwall's depth of occurrence and lateral extent to anticipate global and toe failure under static and seismic loading conditions. The results of the analyses confirmed the adequacy of the slopes for the selected sections. We acknowledge that small wedges may form within the highwall benches. During mining operations, Benga would need to monitor pit-wall stability, collect additional information, and implement mitigation measures if stability issues were identified. The environmental consequences of a potential pit wall failure are discussed in the chapter on accidents and malfunctions.

Waste rock disposal areas have been designed to minimize the potential for slope failure

[303] Benga said the proposed mine plan was developed to provide saturated backfill zones as early as possible in the mine life. The pit design was also optimized to maximize in-pit backfill and reduce the volume of waste rock requiring out-of-pit (external) disposal. At closure, approximately 74 per cent of the ultimate pit's area will have some level of in-pit backfill.

[304] The preliminary waste rock dump design features provided by Benga in the Fifth Addendum are summarized in Table 5-2. Benga said that waste rock dump construction includes removal of any organic materials, regrading to improve drainage, and construction of under-drains in the lower elevations. Mixed ascending and descending construction methods with a lift thickness of 25 m to 50 m will be implemented.

Table 5-2. Waste rock dump design features

	North waste rock dump	Central waste rock dump	South waste rock dump
Storage volume (loose m ³)	253 746 653	710 836 277	87 370 384
Minimum elevation (m)	1600	1360	1500
Maximum elevation (m)	2025	1875	1815
Maximum design height (m)	425	515	315
Footprint area (ha)	245	585	138

Source: CIAR 69, PDF pp. 254 and 258.

[305] Benga said that waste rock disposal areas will be equipped with monitoring devices to alert the operator to any potential issues and the need for mitigative measures. Such measures could include directing the rock to alternative disposal areas or lowering the height of each successive dump lift. As disposal areas are completed, they will be re-sloped to 23 degrees, which will help with disposal area integrity. Given the high factor of safety assigned to these dumps in the preliminary geotechnical assessment, dump failure was considered unlikely. However, considering the large number of valued components that would be affected, Benga assigned a high magnitude, resulting in an overall risk rating of moderate.

[306] Benga conducted testing as part of the site evaluation for the rock disposal areas. Benga reported that three test pits, two hand auger holes, and three bore holes were created within the footprint of the south rock disposal area during the 2015 geotechnical program. During the 2016 and 2017 geotechnical programs, geotechnical boreholes and test pits were created within and around the footprint area of the south rock disposal area. Subsurface conditions were inferred from the test pits, hand auger holes, and boreholes.

[307] The Livingstone Landowners Group argued that the waste rock dump designs should be revisited to reduce ex-pit waste rock volumes and surface area. The group noted that the project currently proposes three external disposal areas: the south, central, and north rock disposal areas. The south and central areas are adjacent but separated by an electrical power transmission line. The group suggested the design of the south and central areas should be revisited in favour of a single disposal area, which would involve relocating the power line and using the valley between the two dumps for waste rock placement. The group believes this would create less disturbance and be less expensive to reclaim. The group also said Benga should consider building higher in-pit dumps, thus reducing the footprint of the north dump and the volume of out-of-pit water rock. The group added that the economic and environmental trade-offs of this approach need to be reviewed. The group also raised concern that the external dumps were not located on high ground, as claimed by Benga, but in valley bottoms.

[308] The landowners group also noted that Benga did not adequately account for surface water drainage for the waste rock dumps. The group submitted that while one might expect a drainage density in the post-reclamation landscape (the total length of watercourses divided by the area) to be similar to that prior to disturbance, watercourses are often overlooked in mine reclamation (McKenna 2002). Yet they are critical to controlling erosion and geotechnical stability and represent a substantial portion of the reclamation costs.

[309] We acknowledge that the geotechnical design parameters used for the stability analyses were derived from limited field investigation, observation, and index testing. Overall, we find that Benga made reasonable assumptions for material parameters, including the unit weight, friction angle, cohesion, and water table. The slopes of the waste rock dumps were modelled for slips passing through weak foundation units, with respect to the depth of occurrence and the lateral extent under the dump's footprint. The results of the analyses confirmed the adequacy of the provided slopes for the selected cross-sections, as well as the boundary and foundation conditions. It is standard practice to collect additional data during mining operations and, as necessary, refine the design parameters.

[310] Benga did not respond directly to concerns the Livingstone Landowners Group expressed during the hearing regarding the location of the external dumps. We recognize that mountain mining may involve the use of adjacent valleys for external waste rock disposal, potentially creating negative effects on surface water quality and other valued environmental components. Depending on the topographic features and space constraints in the project area, some valley fill may be unavoidable. The proposed use of valley fills for external waste rock storage requires adequate mitigation measures, drainage, and landform designs. The environmental consequences of a potential failure of an external waste rock dump is discussed in the chapter on accidents and malfunctions.

Given the environmental setting and concerns related to selenium leaching, a higher level of design detail for the waste rock dumps and closure landforms would have been appropriate

[311] The Livingstone Landowners Group submitted that the EIA for the project downplays inherent uncertainties, uses complex numerical models to predict performance, and relies too heavily on adaptive management to reduce residual uncertainties. The group argued that adaptive management has a poor track record and is often ineffectually applied as a trial-and-error approach. The group's expert, Dr. G. McKenna, recommended an alternative approach that involves using an expanded geotechnical observational method that employs a design basis memorandum to clearly define goals, design objectives, and design criteria. The resulting pre-feasibility or feasibility-level designs include reclamation design, qualitative and quantitative performance predictions, an engineering risk assessment of the likelihood of achieving the required performance, and contingency plans to address residual risks. The group recommended that Benga be required to produce prefeasibility-level landform designs for each element during the pre-mining phase.

[312] Benga indicated that the closure and reclamation plan, along with monitoring and oversight, would allow it to achieve the project's stated objective. The plan would be finalized through continued consultation with Indigenous groups and the AER. As an example, Benga noted that Suncor Pond 1 final landform designs for reclamation were not provided at the pre-mining stage to ensure success. Benga pointed out that Dr. McKenna's organization (the Landform Design Institute) aims to make landform

design routine in the mining industry by 2030. Benga noted that, while the Livingstone Landowners Group did not recommend such a design approach prior to retaining Dr. McKenna, there is merit in the concepts being advanced by Dr. McKenna. Benga's mining expert, Mr. M. Youl, said the concepts were similar to the "geomorphic approach" currently evolving in Australia for dump design, in which the intention is to establish a more sustainable landform from the outset. However, Benga argued that this level of landform design could be completed later during the pre-mining or operational mining phase.

[313] We agree that developing pre-feasibility landform designs using a design basis memorandum or similar approach during the pre-mining phase is a reasonable approach. It would provide an increased understanding of how to minimize water infiltration into and outflows from the waste dumps. Developing these designs during the pre-mining phase would allow Benga to complete surface water drainage designs (including for dumps) and to prepare for progressive reclamation.

[314] We recognize it is common practice for project proponents to submit final landform designs for waste dumps to the AER later in the operational life of a project. The *Coal Conservation Act* does not require applicants to provide detailed plans prior to project approval. However, we found the level of detail provided by Benga for its dump design to be limited in some areas, particularly with respect to cap and surface drainage design. Given the project's location, it would have been appropriate for Benga to put additional effort into its preliminary dump designs. And it could have provided further information to support its applications for the dump licenses. The project is in a sensitive mountain environment within the eastern slopes of the Rocky Mountains, with known concerns related to selenium leaching from waste rock, including predicted exceedances of water quality criteria for selenium in adjacent surface water bodies.

[315] With additional information, we could have better assessed the likely effectiveness of Benga's proposed mitigation measures for selenium leaching from waste rock dumps, and the significance of residual effects. As emphasized by the Livingstone Landowners Group, minimizing the inflows and outflows of water within the waste rock dumps can be addressed through landform design. Minimizing these inflows and outflows is key to helping control selenium loading in groundwater and surface water bodies. This issue is discussed in detail in the chapter on surface water quality.

Dams and water retention ponds have been designed to minimize the risk of catastrophic failure

[316] In its preliminary assessment, Benga proposed four sediment ponds and four surge ponds. The maximum heights of the containment dams for the ponds vary from 8.5 m to 23 m. The properties of the proposed dams are summarized in Table 5-3. The containment dams for the west, east, northeast, and plant site sediment ponds will have overall consequence classifications of significant, very high, very high, and low, respectively. The containment dams for the northwest, southwest, raw water, and southeast surge ponds will have overall consequence classifications of significant, low, very high, and very high, respectively.

Table 5-3. Properties of proposed dams

Pond name	Operating years	Water quality design flood (m ³ /s)	Inflow design flood – dam safety (m ³ /s)	Water storage volume (m ³)	Dam crest (masl)	Maximum dam height (m)	Dam length (m)	Diameter of discharge pipe (mm)	Overall dam classification
West sedimentation pond	1 to 27	13	33	109 000	1600.5	20.5	456.5	500	Significant
East sedimentation pond	6 to 27	13	36	125 000	1581.5	11.5	626	500	Very high
Northeast sedimentation pond	14 to 27	11	59	115 000	1645.4	17	429.5	600	Very high
Plant site sediment pond	1 to 27+	–	–	20 000	1461.0	8.5	430	350	Low-
Northwest surge pond	8 to 27+	–	24	35 000	1600.5	12.5	129	–	Significant
Southwest surge pond	1 to 27	–	12	34 000	1495.0	10	475	–	Low
Raw water pond	0 to 27+	–	37	1 200 000	1503.0	23	330	–	Very high ^a
Southeast surge pond	0 to 27+	–	21	280 360	1509.2	9.2	390	–	Very high

^a The original EIA had an overall dam classification of *high* for the raw water pond. This was amended to *very high* with the submission of the Fourth Addendum.

Source: CIAR 42, Section C, Tables C.5.5-3, C.5.5-4, and C.5.5-8; CIAR 42, Appendix 9, Table 20, PDF p. 53; and CIAR 55 Attachment 2, PDF p. 72.

[317] The primary method to prevent catastrophic failure of a water management dam is through engineering design and site selection. Benga confirmed that the dams will be constructed in accordance with the current Canadian Dam Association *Guidelines for Mining Dams*. Benga said that possible changes to precipitation and evaporation patterns and extreme precipitation will be considered over the life of each facility. As part of the detailed engineering design, each dam will be considered separately, reflecting the function of the dam (e.g., sediment or surge dam) and the design criteria for environmental protection and structural integrity. Each dam will be designed to meet two design criteria: (1) to retain a design flood based on local guidelines and (2) to protect the dam structure by either retaining the Canadian Dam Association inflow design flood or designing a spillway to safely pass that event.

[318] Sediment pond capacities and discharge pipes have been sized to provide the required retention for specified water quality design flood. For dam safety, the sediment ponds will also have emergency overflow spillways to convey the inflow flood design. Both the water quality design flood and the inflow design flood were estimated using hydrologic modelling for the largest catchment area reporting to each of the ponds during its life.

[319] For dam safety, the surge ponds will have emergency overflow spillways sized to convey the inflow design flood, which was estimated for the largest catchment area reporting to each of the ponds during its operating life. Additional mitigation measures beyond engineering design include routine inspection, implementation of the Benga's emergency response plan, and implementation of Benga's standard operating policies and procedures.

[320] Benga confirmed that a detailed design report, including final design criteria and calculations for each dam, will be provided to the AER prior to construction as part of the Canadian Dam Association application(s). The detailed dam design will be in accordance with the *Alberta Dam and Canal Safety Directive* and follow the Canadian Dam Association guidelines.

[321] Ms. J. Lawson stated that Benga acknowledged the possibility of a seismic event. But should one occur, Benga has not provided a plan for responding to a breach of contaminated water containment structures. Similarly, Ms. Lawson noted that there is no response plan in place for major flooding events that could contribute to the release of contaminated water.

[322] The Livingstone Landowners Group noted that waste rock placement and the saturated backfill zones rely on in-pit dams built from waste rock. Yet the designs of these facilities are lacking and it is unclear whether the permeability of an over-compacted zone of waste rock will be low enough everywhere to act as a dam. The group said this concept should be revisited; it is critical to the staged nature of the design, the performance of the initial bioreactors, and perhaps to the operation and performance of the mine and the end-pit lake.

[323] We accept that detailed or final engineering designs for dams are not required at this stage of the review process. Prior to constructing any structure that meets the definition of a dam under the *Alberta Water (Ministerial) Regulation*, including in-pit structures, Benga is required to submit detailed engineering plans to the AER for approval. We accept Benga's commitment that all structures that meet the definition of a dam will be designed and constructed to meet the most recent version of the Canadian Dam Association guidelines. We find that this is an appropriate mitigation measure for minimizing the risk of potential dam failure. The environmental consequences of a dam failure are discussed in the chapter on accidents and malfunctions.

Blending of waste rock is required to mitigate acid generation

[324] Waste rock produced by mining is expected to include material that has the potential to be acid-generating due to the presence of sulphides. The oxidation of sulphides can produce acid. Therefore, this acid-generating rock must be handled in a manner that will minimize acid generation. Benga proposed to mitigate acid generation primarily by blending and subaqueous disposal (backfilling pits) of potentially acid-generating and non-potentially acid-generating rock. Blending is required because of the amount of acid-generating rock produced. The mixing ratios necessary to achieve blending are high: 50:50 for the Mutz and Moose Members and 75:25 for the Cadomin Formation and Adanac Member. Benga's consultant, SRK, recommended in-pit co-disposal of processing-plant refuse (coal rejects) as a long-term carbon source in backfills. Performance monitoring using groundwater wells and repeated additions of carbon to maintain suboxic backfill conditions were also recommended.

[325] Benga was asked whether the blending ratios for potentially acid-generating / non-potentially acid-generating rock were high. Benga's expert, Mr. S. Day, responded that they are not unusual and are fairly typical. When asked whether any potentially acid-generating rock will not be stored subaqueously, Mr. Day replied that some of it will be blended in the external rock dumps. Mr. Youl further clarified that in the early years all of the waste will go to out-of-pit dumps and therefore Benga will need to work on blending and containment of the potentially acid-generating material within the waste dump. Mr. Day was asked if there is a possibility of oxygen infiltration into the pits through snow melt or rainfall and how that would be managed. He confirmed that oxygen will enter but would be consumed quickly. When asked about a cover for the saturated backfill zone, Mr. Day said that one would not be needed. Mr. G. Houston clarified that topsoil and vegetation will be placed over the saturated backfill zones.

[326] Mr. Day confirmed that the saturated backfill zones will be monitored for acid generation. He was asked whether crushing and mixing potentially acid-generating and non-potentially acid-generating layers to create a homogenous blend would be more effective. Mr. Day indicated that this process would not be necessary and, in fact, because crushing creates more surface area and makes things more reactive, it is not recommended. When asked about the sequence of layers presented by Benga, in which a non-PAG layer forms the base of the blended sequence, Mr. Day responded that the presented diagram only illustrates the concept of layering potentially acid-generating and non-potentially acid-generating layers and the exact order of dumping does not matter.

[327] While blending can be effective at mitigating acid generation, we find that there are some uncertainties about the potential effectiveness of Benga's plans. Benga confirmed that there is more acid-generating rock than can be accommodated by blending but did not present any plans for obtaining additional non-potentially acid-generating rock for blending. Additionally, Benga has indicated it will not be processing the waste rock to uniform size. Because the waste rock is expected to range in grain size from that of boulders to sand, the reactive surface area of the waste rock will also vary. As many of the rock units containing pyrite at Grassy Mountain are fine-grained with a larger surface area, acid generation may occur at a faster rate compared with carbonate dissolution.

[328] Additionally, Benga indicated that proper disposal will have to begin immediately to mitigate the risk of acid generation. This is because some of the waste rock will produce acid within one year of exposure. We are therefore uncertain whether Benga's proposed mitigation measures will be sufficient to prevent or control acid generation. It is likely that some acid generation will occur, which has implications for the leaching of metals and the effects on groundwater and surface water quality. These issues are discussed in the groundwater and surface water quality chapters.

The design of the processing plant minimizes make-up water demand and eliminates the need for fluid tailings storage

[329] Raw mined coal contains materials such as sandstone, mudstone, carbonaceous shale and clays that need to be removed to make a saleable product. The coal-handling and processing plant washes impurities from the raw coal and then dewateres the cleaned coal. The coal handling and processing plant is designed to receive 8.3 million tonnes per year of run-of-mine coal to produce 4.5 million tonnes per year of clean metallurgical coking coal at full production levels. The clean coal would be transported to the train loadout facility via an overland conveyor 5 km long.

[330] The process design is based on a traditional coarse/fines/ultrafines processing plant. Product dewatering design includes centrifuges, thickener, and hyperbaric disc filters to reduce the product clean coal total moisture content to 8.3 per cent. Reject dewatering design includes screens, a centrifuge, and belt-press filters. The design is similar to plants built in recent years, with the exception of the hyperbaric disc filter, which was chosen as an alternative to a thermal dryer. Ultrafine coal will be dewatered via the hyperbaric disc filter.

[331] Various process chemicals are used in the processing plant. The chemicals include flocculants, magnetite, diesel, and methyl isobutyl carbinol. These are added to the process to promote cleaning and separation and to maximize recovery. For this project, Benga is proposing no fluid tailings storage ponds. Mechanical dewatering of the product and reject streams occurs within the plant to minimize product moisture content and make up water requirements. The dry tailings reject stream is co-deposited with the rock in the waste rock disposal areas.

[332] Benga's initial application (dated August 2016) included a plant water balance that identified a make-up water need of 110 litres (L) per raw metric tonne of coal for the process plant. In February 2018, Benga amended the plant water balance in the Fifth Addendum. In the updated water balance, the make-up water requirement for the plant was 57 L per raw metric tonne of coal. Benga explained that this was the result of incorporating coarse reject centrifuge and reject water collection into the processing plant design to increase water recycling and reduce the make-up water demand for the plant. The revised annual make-up water demand for the plant is 478 million L per year, a 48 per cent reduction from the original design. The reduction in make-up water demand is discussed in further detail in the surface water quantity chapter. The updated water balance reflects the plant water balance during operation and does not include pre-startup requirements (i.e., filling of raw water pond).

[333] In response to questions at the hearing, Benga confirmed that in the event of a dewatering component outage, the coal feed rate to the plant would be reduced or stopped until the outage is resolved. Benga said that if extra water is needed, Benga can look at operational process parameter changes to equipment, such as centrifuges and disc filters, and consider larger or additional equipment. Benga said it would be normal during the detailed design to conduct a reliability study that would inform any decisions on the need for standby units.

[334] The design parameters for the processing plant appear to be reasonable. We understand that the process plant design is based on the expected geology, design moisture content, yield, and product and reject sizing profiles. The success of the design and performance of the dewatering circuit and dry tailings depends on the actual operating parameters being consistent with the design parameters.

Careful blending of coal seams will be required to produce a product with premium hard-coking-coal properties

[335] Benga is proposing to mine three coal seams. Seams 1 and 2 are in the Mutz Member of the Mist Mountain Formation and Seam 4 is in the Adanac Member of the Mist Mountain Formation. Seam 1 is stratigraphically highest and comprises three main coal plies (1A, 1B, and 1C) interbedded with carbonaceous claystone and siltstone, although Benga noted that Seam 1 contains several discontinuous coal plies that pinch and swell. The average thickness of Seam 1 is reportedly 5 to 20 m, although the thicknesses of the individual coal plies are up to 2 m (average = 0.6 m) for 1A, up to 5 m (average =

2.1 m) for 1B, and up to 4 m (average = 1.5 m) for 1C. Isopachs of Seams 1B and 1C provided by Benga indicate that Seam 1 is only present in the southern half of the mine footprint and generally 2 to 5 m thick. Seam 1C appears patchy in occurrence. In describing the quality of the individual coal plies, Benga indicated that Seam 1A is a high-ash, carbonaceous, high-density coal; the ash content of Seam 1B (the thickest) is between 10 and 40 per cent (average = 20 per cent); and the raw ash content of Seam 1C is about 25 per cent. The sulphur content of 1B and 1C is less than 1 per cent (average = 0.5 per cent). Benga stated that Seam 1 is composed of potentially excellent metallurgical coal after processing.

[336] Coal Seam 2 comprised two plies, 2A and 2B, and is the thickest of the three seams at 5 to 15 m, with an average thickness of 8 m; however, it can be overthickened (structurally controlled) and reach thicknesses of 25 m. This seam is laterally extensive and occurs throughout the mine footprint. Seam 2 has a raw ash content of about 20 per cent, although Benga noted that contamination seems evident adjacent to reverse faults. The sulphur content is less than 1 per cent and Benga stated that Seam 2 has excellent metallurgical properties after processing.

[337] Seam 4 contains three coal plies: 4C (uppermost), 4B, and 4A. The thickness of 4A and 4C is 2 to 5 m in general, but occasionally reaches a thickness of 10 m. Seam 4B is usually 1 m thick but can be up to 3 m thick. Seam 4A is patchy in occurrence and largely absent from the north half of the mine footprint. Seam 4B occurs primarily in the southern portion of the mine footprint and in patches farther north. Seam 4C appears to occur throughout the mine footprint. Seam 4 is described by Benga as having a raw ash content of 10 to 48 per cent and a sulphur content of 0.5 per cent. Benga stated that, after processing, Seam 4 will potentially provide excellent metallurgical coal.

[338] In its evaluation of coal quality, Benga provided free swelling index (FSI) values for each coal seam to be mined. These values are summarized in Table 5-4 below. The index values reproduced in the first row appear to be average values calculated from numerous samples. Six to seven samples taken by Benga from Seams 1, 2, and 4 were analyzed for coal quality and index value; these values are also reported in Table 5-4 (individual sample values). The highest FSI value (6.5) within Seam 2 occurs in the southern-most portion of the mine. The highest FSI values in Seam 4 appear to occur in the northern half of the mine.

[339] In addition to the samples collected and analyzed by Benga, 650 historical samples collected between 1971 and 1975 were used to create a raw coal quality database. Benga indicated that, using this historical database, raw quality data were available for many more samples. Benga said that this database was used to create quality grids of ash, density, and sulphur, and suggested other grids were created as well. A historical analysis included moisture, ash, volatile matter, fixed carbon content, sulphur content, calorific value, and FSI values. Benga said these data were all included in a raw quality model, which was used to produce a table of average raw coal quality characteristics.

Table 5-4. Published FSI values and the numbers of additional (unpublished) sample data Benga used in support of its coal quality evaluation

	Seam 1	Seam 2	Seam 4	Source
FSI value given	7	3 ^a	5	CIAR 42, Section B, Table B.4.2-1. PDF p. 32 CIAR 799, PDF p. 112
FSI values from individual samples analyzed by Benga	7.5 5.5 5.5 7.5 2.5 0.3–3.5	1 2.5 3.5 4.0 4.5 1.5 6.5	2.0–4.0 1 2 3.5 3.0–4.5 4.0	CIAR 42, Section B, Figure B.2.1-3, “Seam 1 Wash Quality,” PDF p. 105 CIAR 42, Section B, Figure B.2.2-2, “Seam 2 Wash Quality,” PDF p. 107 CIAR 42, Section B, Figure 2.3-4, “Seam 4 Wash Quality,” PDF p. 111.
Number of samples from the raw coal quality database	55	77	49	CIAR 42, Section B, PDF p. 31

^a Benga clarified during questioning that this value should be 5.

[340] Benga confirmed that the coal at Grassy Mountain is bituminous, with volatile and maceral content in keeping with a high-grade coking coal. Benga described Seam 1 as possessing higher volatile and vitrinite content, enhancing plasticity. Seam 2 was described as having moderately high reactive content and lower volatile content, adding to coking strength. Seam 4 was described as being similar to Seam 2, with the exception of a higher vitrinite content and the potential to add plasticity and enhance coke strength. Benga indicated that the three seams are amenable to blending.

[341] In response to questions by the AER, Benga confirmed that the FSI value of Seam 2 is, in fact, 5, and the value of 3 given in EIA Table B.4.2-1 is an error. Benga said this error was caused by inclusion of some oxidized samples, which have since been removed from the dataset. Benga stated that “we’re confident that the overall average blended quality will be in the 7 – 7 range” (CIAR 799, PDF p. 112). When asked if Seam 2 is of appropriate value for coking coal, Benga said that it is not planning on selling coal from Seam 2 separately, and that it will be blended to produce a marketable product. Benga asserted that it will find a home for the coal from Seam 2 in the market.

[342] Under cross-examination by CPAWS, Benga acknowledged that Phase 7 of the mining plan, which is the last phase of the mining plan, will have the lowest percentage of Seam 1 coal. Benga also indicated that it would not be storing quantities of Seam 1 coal for mixing in later years. Benga said that while Seam 1 does get thinner and becomes a smaller proportion of the overall product, the company’s blending analysis indicated that the thinning is manageable. Benga also stated that it has a plan to sell a single blended product, but that may change in the future as the mine evolves.

[343] CPAWS’ expert witness, Mr. C. Kolijn, said that Benga’s product quality value is below that of the prime hard coking coal products of the Elk Valley in British Columbia and of the Bowen Basin in Queensland, Australia. He said that an analysis of the information made available by the company reveals a number of inconsistencies and conflicting information about the product’s quality. Furthermore, the composition of the measured reserves—based on material differences in the three seams’ quality attributes and variability within the seams—make it unlikely a single product will be available during the life of the mine. He submitted that the optimal blend of all three seams will not be available as the seams

are produced and as parts of Seam 1 thin out. He suggested this was all the more critical given that Seam 1 only represents 16 per cent of the resource to be mined. On this basis, he disagreed with Benga's contention that the measured resources can be considered high-quality hard coking coal.

[344] During cross examination, Benga asked Mr. Kolijn if he would expect that Benga would have carried out an additional, confidential quality analysis upon which it is basing its projections. Mr. Kolijn agreed it was possible. When asked by CPAWS if coal quality will decrease over time, Mr. Youl indicated that there are variations within the deposit, but that Benga is confident that the product will be a hard coking coal. He also indicated that Benga was testing 35 large-diameter cores comprising in excess of 40 tonnes of large bulk samples. However, this was later contradicted by Benga during further questioning by CPAWS, where Mr. Youl stated, "We've been doing bulk samples in recent years, and we're still looking at those. But—but, by and large, the results that were published in the EIA still reflect our knowledge of the coke quality for a blend of the three seams" (CIAR 762, PDF p.188).

[345] The provided information on coal quality suggests that the quality of the coal blend will decline over time, as the availability of Seam 1 decreases. While Benga maintains that the quality of the other two seams is high, the data provided are inconsistent and suggest a lower quality, specifically when the FSI values of samples analyzed by Benga are evaluated. While we accept that Benga may have additional, proprietary information indicating that these seams will be of high quality, that information was not provided for evaluation.

[346] We note that the decline of Seam 1 occurs in conjunction with an increase in the strip ratio over time. Benga confirmed that the first three phases of mining operations are expected to have the highest percentage of Seam 1 coal and the lowest strip ratios. Later mine phases, such as phase 7, have a low amount of coal from Seam No. 1 and have a high strip ratio. Still later phases, such as 8 and 9, use no coal from Seam 1 and a high strip ratio. This suggests that, as the quality of the coal blend declines over time, the strip ratio, and therefore the operating cost, will increase and this effect is most pronounced after year 10.

[347] While Benga indicated these circumstances are manageable, we find that careful blending of the coal will be required. Based on the evidence provided, it is unclear whether Benga will be able to produce a premium hard coking coal over the life of the project. If the development and marketing of products with poorer coking properties becomes necessary during the life of the project, this may affect the price received and the predicted economic benefits of the project. The potential impact of changes in coal quality over the life of the project on the predicted economic benefits of the project are discussed in the chapter on social and economic effects.

6. Conservation, Reclamation, and Closure

Benga's conservation and reclamation plan is intended to return the project footprint to equivalent land capability

[348] The proposed project would directly affect the landforms, soils, vegetation communities, wildlife habitat, and traditional and other land-use practices within its footprint. Beyond that, it would also result in indirect effects on vegetation, wildlife habitat, and land-use practices in the LSA during the project's construction, operation, and closure. Section 137 of Alberta's EPEA requires that all disturbed lands (specified lands) be reclaimed to equivalent land capability. All approval holders are held to this requirement.

[349] In 2016, as a component of its EIA, Benga provided a conceptual conservation and reclamation plan. In response to our information request, in August 2019 Benga provided an updated conservation and reclamation plan. It provided information about the planning process for reclamation and the ultimate closure of the project, and stated the goals and endpoints for the development and reclamation of the project.

[350] Benga would rely on reclamation as the key measure to mitigate the effects of the project on soils and terrain, vegetation, wildlife, and biodiversity. Successful reclamation and closure are required to ensure that the lands are returned to a state that allows equivalent land use, that public lands can be returned to the Crown, and that future liability to the public is minimized.

[351] The conservation and reclamation plan describes how the footprint of the project will be returned to equivalent land capability and meet targeted end land uses similar to what is now carried out on the land. Benga has committed to progressively reclaiming the mine by phasing in development and reclamation over time. The plan does not specify a closure date.

[352] Benga's conservation and reclamation plan is expected to evolve over time in response to

- changes in regulatory guidelines and requirements,
- mining advance planning and materials handling,
- changes in end land use objectives,
- ongoing consultation with Indigenous communities, and
- future advances in soil reconstruction, revegetation, and water management practices.

[353] Benga stated during the hearing that it would incorporate changes in reclamation technology into its adaptive management process. However, the conservation and reclamation plan does not specify what technological advances would relate to reclamation. Benga's conservation and reclamation plan is divided into a conservation and reclamation section and a closure section. Benga stated that "the mine reclamation plan identifies efforts needed to maintain the development area's biodiversity, to sustain ecological conditions, and to achieve equivalent land capability. Following mine closure, the project Footprint will maintain comparable distribution of upland forests, grasslands, and wetlands" (CIAR 251, Package 2, PDF p. 100).

Conservation and reclamation plan

[354] The conservation plan discusses site preparation prior to construction and the conservation of vegetation and soil resources during project operations. The project footprint covers 1520.7 ha and reflects the anticipated limit of disturbance at the completion of operations and reclamation at the end of 27 years. The maximum disturbance area will occur in year 14, with no additional spatial disturbance to follow. Benga stated that the following goals and principles have been incorporated into the conservation and reclamation plan:

- Progressive reclamation will be undertaken within the requirements of the mine plan.
- Topsoil/reclamation material will be salvaged during site construction and preserved for reclamation activities.
- Where possible, project construction and operations will minimize impacts on established communities.
- Direct placement of reclamation material will be undertaken, whenever practical, to maximize the potential viability of native seed banks and propagules.
- Landforms will be geotechnically stable and integrated into surrounding natural landforms.
- A variety of landforms (slopes and aspects) will be included in the reclamation landscape.
- Surface water drainage will be designed to minimize erosion rates and sediment loading.
- Placement of reclamation materials will follow landform construction.
- Undisturbed areas of the mine site in which the original soil profile is intact will not require additional soil placement.
- Reclamation materials will be sourced from active mining areas if direct placement opportunities exist or hauled from stockpile locations on the mine.
- Direct placement of reclamation materials will be undertaken, whenever practical, to maximize potential viability of native seed banks.
- Reclamation materials will be replaced over the overburden and left in a rough or mounded state.
- The average depth of the replaced reclamation material will be 20 centimetres (cm) but is expected to vary from 10 cm to about 30 cm.
- Reclaimed areas will be developed into self-sustaining ecosystems with an acceptable degree of biodiversity; relative numbers of native species and structural layers will serve as an early-stage target community.
- Forest capability, including commercial forestry potential, will be equivalent to predevelopment conditions.
- Natural encroachment of native vegetation will be encouraged in ecologically receptive areas.
- Local native seed sources will be used where practical to maintain the genetic integrity of re-established plant communities.

- Creation of habitat features will benefit or help re-establish wildlife species known or reported to occur in the area.
- Features that support *SARA*-listed species (both vegetation and wildlife) known or reported to occur in the area will be created.
- Features that promote traditional use or the establishment of valued components for traditional use will be created.
- Continued consultation with nearby Indigenous communities will be carried out to ensure incorporation of vegetation important for traditional uses.
- Disturbance to Human Resource Impact Assessment sites DjPo-98 and DjPo-130 will be avoided to preserve their importance to Indigenous groups and to reclaim the adjacent areas to create an area rich in traditional ceremonial value.
- The end-pit lake will be ecologically sustainable.

[355] According to Benga, site disturbance, including the clearance of vegetation, timber salvage (where applicable), soil salvage, and surface drainage (where applicable) will occur prior to the start of mining and continue progressively over time. Construction of surface water management systems in an area will be completed prior to soil salvage.

Vegetation clearing and conservation

[356] Prior to soil salvage, Benga proposes to clear all vegetation and salvage available merchantable timber within the project footprint. Benga indicated that timber removed from Crown land will be made available to the local timber rights holders, while timber from private land will be made available to Indigenous groups. Non-merchantable timber and slash material will be disposed of, incorporated into soil, or stored for use during reclamation.

Soil conservation

[357] The goal of Benga's soil conservation program is to ensure that sufficient volumes of suitable reclamation material are available to support the self-sustaining vegetation communities required to achieve the planned end land uses.

- Benga proposes to salvage reclamation materials in one lift to generate the volumes of suitable material necessary to create the planned end land uses and closure land capability classes.
- While some areas within the project footprint do not have sufficient soil to be salvaged, Benga stated that 1102 ha of land has salvageable upland surface soil and salvageable organic soil present.
- Salvageability of wet soils and soils located on slopes steeper than 23 degrees may be limited due to access and safety restrictions.
- Reclamation material will be salvaged according to pre-determined depths according to surface soil textures and the depth of available soil.
- Stockpiled soil will be revegetated as soon as practical following material placement to stabilize the surface and limit erosional loss.

- In situ overburden has been analyzed for reclamation suitability and most of the samples have been rated as suitable for reclamation.
- Overburden material will not be separately salvaged.
- All overburden material will be sampled prior to reclamation material placement to determine the suitability of the material and unsuitable material will be covered by at least 1 m of suitable material prior to replacement.
- All salvaged overburden will be stored and resampled prior to being used in reclamation.
- Salvaged reclamation material balances will be tracked to ensure sufficient volumes of reclamation material to meet reclamation needs.

[358] Table 6-1 summarizes Benga's reclamation and reclamation material handling schedule, based on Benga's updated conservation and reclamation plan. The column for Reclamation area provides the number of hectares Benga plans to reclaim in a given year.

Table 6-1. Annual reclamation material balance of mining areas

Mine year	Disturbance area (ha)	Cumulative disturbance area (ha)	Soil stripping area (ha)	Total salvaged reclamation material (m ³)	Reclamation area ^a (ha)	Cumulative reclamation area ^a (ha)	Reclamation material replacement volume (m ³)
Y00	625.1	625.1	537.2	1 613 649	0	0	0
Y01	93.0	718.2	74.1	238 528	1.9	1.9	3846
Y02	101.2	819.4	81.1	199 995	17.4	19.4	34 890
Y03	124.6	944.0	83.2	372 734	19.6	39.0	39 197
Y04	62.0	1006.0	21.6	75 560	10.0	49.0	20 006
Y05	223.9	1229.8	156.5	440 697	15.3	64.2	30 550
Y06	61.6	1291.5	32.0	97 599	19.2	83.4	38 349
Y07	56.6	1348.1	32.8	67 678	71.8	155.2	143 515
Y08	51.6	1399.7	26.2	78 419	61.4	216.6	122 804
Y09	0	1399.7	0	–	21.1	237.7	42 148
Y10	0	1399.7	0	–	24.1	261.7	48 124
Y11	25.6	1425.3	19.2	64 916	30.3	292.0	60 574
Y12	0	1425.3	0	–	35.7	327.7	71 436
Y13	0	1425.3	0	–	112.3	440.0	224 653
Y14	55.8	1481.0	38.2	99 933	23.4	463.4	46 731
Y15	0	1481.0	0	–	27.2	490.7	54 499
Y17 ^b	0	1481.0	0	–	13.2	503.9	26 492
Y18	0	1481.0	0	–	11.5	515.4	23 035
Y19	0	1481.0	0	–	111.2	626.7	222 499
Y20	0	1481.0	0	–	104.3	730.9	208 512

Mine year	Disturbance area (ha)	Cumulative disturbance area (ha)	Soil stripping area (ha)	Total salvaged reclamation material (m ³)	Reclamation area ^a (ha)	Cumulative reclamation area ^a (ha)	Reclamation material replacement volume (m ³)
Y21	0	1481.0	0	–	140.7	871.6	281 403
Y22	0	1481.0	0	–	40.9	912.5	81 716
Y23	0	1481.0	0	–	17.6	930.1	35 204
Y24	0	1481.0	0	–	160.3	1090.4	320 580
Y25	0	1481.0	0	–	206.8	1297.1	413 516
Y26	0	1481.0	0	–	0	1297.1	0
Y27	0	1481.0	0	–	133.3	1430.5	266 654
End of reclamation	0	1481.0	0	–	32.2	1462.6	64 324
Grand total		1481.0	1102.0	3 349 707	1462.6	1462.6	2 925 256

^a At start of reclamation activities.

^b Year 16 was omitted.

Source: Adapted from CIAR 251, Package 2, Table F.2.2-2, PDF p. 71.

[359] The salvage volumes in Table 6-1 appear to be in excess of what Benga will require to achieve adequate surface soil placement across the project footprint. However, Benga acknowledged that it may not be possible for construction equipment to safely salvage reclamation materials from some areas due to the steep terrain. It is therefore possible that the actual total volume of available soil may be less than expected.

Progressive reclamation

[360] Benga proposed to progressively initiate reclamation as soon as areas became available for reclamation. The following general milestones are specific to reclamation of all disturbed areas with the exception of the selenium management areas:

- Site preparation activities begin soon after receipt of all operating approvals and licences for site clearing, surface drainage, and initial salvage of reclamation material and overburden
- Start of reclamation activities in year 2 of project operations beginning with the waste rock disposal areas and some parts of the mine
- One-third of the mine or 500 ha to be reclaimed by year 15
- Two-thirds of the mine or 1000 ha to be reclaimed by the end of mine life (year 24)
- End of reclamation for all facilities except the selenium management structures is year 27
- Unknown timeline for reclamation of the selenium management structures

[361] Table 6-2 summarizes Benga’s proposed sequential steps and general timing to conduct reclamation activities as mining operations within an area are completed and progressive reclamation commences.

Table 6-2. Reclamation activities upon completion of mining activities

Reclamation activity	Timing
TERRESTRIAL RECLAMATION	
Resloping and reclamation material placement	Year 0
Initial revegetation	Year 1
Fertilization	Year 1–3
Woody species planting	Year 2–4
Biophysical monitoring	Year 1–12
Reclamation certification	Year 15–20
Release back to the Crown	Site-dependent
LAKE RECLAMATION	
Resloping and channel construction	Year 0
Final water line reached	Site dependent
Revegetation	Year 1–4

Source: Reproduced from CIAR 251, Package 2, Table F.2.2-1, PDF p. 68.

Final grading and recontouring

[362] According to Benga, all areas will be recontoured to a maximum slope angle of 23 degrees (2.5:1) while the standing highwall on the north end of the pit will retain steeper slopes. The external rock disposal areas and the majority of the pit will be backfilled with rock. The final topography and reclamation landforms will include ridges, benches, valleys, and steep inclines that will be integrated with the surrounding undisturbed landscape. At a smaller scale, the final reclamation landform will consist of micro- and macro-scale topographies that support revegetation and provide valuable wildlife habitat components.

Reclamation material prescriptions

[363] For areas with suitable overburden/subsoil, Benga provided the following preliminary reclamation material replacement prescriptions for the replacement plan:

- Upland soils: 20 cm average replacement depth of reclamation material
- Wetland soils: 20 cm average replacement depth of reclamation material on
 - areas reclaimed as wetlands; and
 - lake littoral zones, where mineral soils will be replaced.
- No soil replacement required on
 - Open-water sections of surge ponds (areas that are unsuitable for revegetation because the water depth is greater than 2 m);
 - End-pit lake area;

- Standing highwall area; and
- Areas with no disturbance to the soil profile.
- For areas that may have overburden or subsoil that is classed as unsuitable, 1 m of suitable material will be placed over the unsuitable material before the reclamation material will be replaced.

[364] The Livingstone Landowners Group noted that Benga's reclamation and closure plan lacks a cover design, other than a volumetric balance indicating a cover 20 cm deep. Yet guidance is available on cover designs for mine wastes and the use of covers to control selenium sources. The group also stated that Benga provided no soil profile analyses that examine the moisture or nutrient conditions for reclaimed profiles even though this is the fundamental basis for equivalent capacity and vegetation/ecosite performance. Alberta definitions for ecosites are based on soil moisture and nutrient regimes, but a discussion of these regimes is largely absent from the EIA. The landowners group's expert, Dr. McKenna, recommended that Benga be required to revisit the cover design. In doing so, he suggested Benga should pay more attention to the soil prescriptions, provide clarity on the salvage of overburden, and offer a rationalization of the cover prescriptions against target ecosystems.

Revegetation

[365] Benga utilized ecosites and ecosite phases to describe baseline vegetation communities in the project area. Ecosites are functional units used by the province of Alberta to describe ecological units that develop under similar climatic conditions and defined by moisture and nutrient regime. An ecosite phase is a subdivision of an ecosite based on the dominant tree species in the canopy, as defined in *Field Guide to Ecosites of South Western Alberta* (Archibald et al. 1996). Designations used to describe ecosite phases differ between the Montane and Subalpine Natural Subregions of the project footprint.

[366] The post-mining ecological units included in Benga's revegetation plan are shown in Table 6-3. The corresponding pre-mining ecosite phases are also shown. Benga's revegetation plan includes six reclaimed ecological units; four revegetated units plus open water and barren land. In addition, some areas will remain as anthropogenic (disturbed) units and will not be revegetated.

Table 6-3. Correlation of pre-mining ecosite phases to reclaimed ecological units

Pre-mine ecosite phase	Reclaimed ecological unit
Montane: b1, c1, c2, d2, d3, e1, e3	Closed conifer forest
Subalpine: (most all sampled ecosite phases)	
Grass- and herb-dominated (HG), shrub-dominated open (SO), shrub-dominated closed (SC)	Grassland open forest
Montane: a1-Douglas fir and limber pine dominated limber pine/juniper	
Subalpine: d1-Engelmann spruce dominated with spruce and heather understory	
Montane: aspen dominated bearberry, b2, bearberry Aw-Sw-P (b3), Canada buffalo-berry/hairy wild rye Aw (c3), Canada buffalo-berry/hairy wild rye Aw-Sw-PI-Fd (c4), creeping mahonia – white meadowsweet Fd (d1), thimbleberry/pine grass Aw (e2), balsam poplar Pb (f1), horsetail Sw-Pb (g1), horsetail Sw (g2)	Mixed-wood forest
Non-patterned, open graminoid dominated fens / non-patterned open graminoid dominated marshes, non-patterned open shrub dominated fens, non-patterned treed fens, and non-patterned treed swamps ^a	Treed wetland
Subalpine: g1, horsetail Se (h2)	
Aquatic features (flooded areas, lakes, creek/stream/river, open water)	Open water
Rock, barren land	Barren land
Anthropogenic vegetated land (wellsite, industrial sites, forage crops) and non-vegetated land (permanent rights of way, surface mines, settlements, clear cuts, pipelines, linear clearings and unspecified clearings) created by human activities	Anthropogenic

Source: Adapted from CIAR 251, Package 2, Table F.3.6-1, PDF p. 119.

[367] Benga has not clearly described how the reclaimed anthropogenic features fit into the reclaimed landscape.

Planting Prescriptions

[368] Table 6-4 summarizes Benga's conceptual revegetation plan for the four broad vegetated ecological units in its reclamation plan (closed coniferous forest, mixed-wood forest, open grassland forest, and treed wetland). We note that baseline conditions of the project footprint included 523.9 ha (50.2 per cent) of ecosite phases located in the higher elevation Subalpine Natural Subregion. Yet Benga's planting prescriptions primarily target vegetation communities in the Montane Subregion, with only treed wetlands corresponding to the Subalpine Subregion.

Table 6-4. Target species of reclaimed ecological communities

Reclaimed ecological unit	Topographic position	Aspect	Ecosite expected (Montane)	Naturally occurring plant species to be encouraged	Species to be established – planting and natural recovery
CONIFEROUS CLOSED FOREST					
Dry	Level, crest, upper to mid-slope	Level, north, east, south	d	Shrubs: snowberry, creeping mahonia, white meadowsweet	Trees: lodgepole pine, white spruce Shrubs: green alder, prickly rose Forbs and grasses: seed mix 1, 2
Moist	Mid-slope	All aspects	e	Shrubs: snowberry, Saskatoon, thimbleberry Forbs and grasses: hairy wild rye, pine grass	Trees: lodgepole pine, white spruce Shrubs: prickly rose Forbs and grasses: seed mix 3
GRASSLAND, OPEN FOREST					
Dry	Mid-slope	Level and south	b	Shrubs: Canada buffalo-berry, bearberry Forbs and grasses: hairy wild rye	Trees: lodgepole pine Shrubs: prickly rose, ground juniper Forbs and Grasses: seed mix 1, 2
moist	Mid slope	West	c	Shrubs: Canada buffalo-berry Forbs and grasses: hairy wild rye, rough fescue	Trees: white spruce, lodgepole pine Shrubs: willow, prickly rose Forbs and Grasses: seed mix 3
MIXED-WOOD FOREST					
Moist	Mid to lower slope	South, east, north	e and c	Shrubs: Canada buffalo berry, snowberry, Saskatoon, thimbleberry Forbs and grasses: hairy wild rye, pine grass	Trees: aspen, balsam poplar, white spruce, lodgepole pine Shrubs: willow, prickly rose Forbs and Grasses: seed mix 3
TREED WETLAND					
Moist	Depression to level	Level	h (Subalpine)	Trees: Engelmann spruce, dwarf birch	Trees: white spruce Shrubs: prickly rose Forbs and grasses: seed mix 4

Note: Open water, barren land and areas that remain anthropological will not be revegetated.

Source: Reproduced from CIAR 251, Package 2, Table F.3.6-2, PDF p. 120.

[369] Table 6-5, containing information provided by Benga, summarizes the area and relative cover of pre-disturbance and post reclamation ecological units within the project footprint. We note that it does not clearly distinguish the areas in each broad vegetation group that will contain vegetation types or ecosites that have either dry or moist conditions as shown in Table 6-4. Because ecosite phases are not identical between the Montane and Subalpine Subregions, it is unclear why Benga's ecological units are compared with baseline ecosite phases when such units are not reflective of the soil moisture conditions of the final reclaimed ecological unit.

Table 6-5. Comparison of cover of pre-disturbance and post-reclamation ecological units in project footprint

Ecological unit	Applicable ecosite phases (at baseline)	Baseline cover		Post-reclamation cover	
		Area (ha)	Relative cover (%)	Area (ha)	Relative cover (%)
CLOSED CONIFER FOREST					
Montane	b1, c1, c2, d2, d3, e1, e3	874.4	57.5	987.9	65.0
Subalpine	a1, b1, e1, e2, e3, e4, f1, f2, h1				
GRASSLAND OPEN FOREST					
Montane	a1 ^a	160.0	10.5	276.7	18.2
Subalpine	d1 HG, SO, SC				
MIXED FOREST					
Montane	b2, b3, c3, c4, d1, e2, f1, g1, g2	139.7	9.2	141.8	9.3
TREED WETLAND					
Subalpine	g1 ^a h2 ^a FONG/MONG, ^a FONS, ^a FTNN, ^a and STNN ^a	0	0	18.2	1.2
OPEN WATER					
	NWF, NWL, and NWR ^a (WONN ^a)	0.1	0.01	18.4	1.2
BARREN LAND/DAM					
	AIH, AII ^a , AIM, ASC, CC, CIP, CIW, CL, CO, CP, NMR	306.8	20.2	38.0	2.5
INCIDENTAL PHYSICAL ACTIVITY (GOLF COURSE AND HELIPAD ACCESS)					
		39.7	2.6	39.7	2.6
TOTAL		1520.7		1520.7	100

^a Ecosite phase or AVI unit mapped outside of the project footprint but within the terrestrial LSA.

Source: Reproduced from CIAR 251, Package 2, Table F.4.3-1, PDF p. 149.

[370] Benga stated that at year 27, all reclamation activities will be completed, with the exception of three surge ponds that will be retained as part of the selenium control and management program. Benga said that when the ponds are ready for reclamation, the margins of the ponds will be recontoured to retain shallower margins that will be less than 2 m deep. Benga proposed to reclaim these shallower areas to treed wetlands.

Reclamation monitoring

[371] Benga presented a reclamation monitoring program that focuses on the following biophysical aspects of the reclamation program:

- soil replacement characteristics (e.g., depth and quality)

- spoil/regolith characteristics
- revegetation patterns and performance
- wildlife response to reclamation

[372] Benga's conceptual reclamation monitoring program is intended to monitor the biophysical aspects of reclamation. Benga proposed to establish long-term monitoring of undisturbed and reclaimed sites in the project area. Benga stated that monitoring of the post-reclamation landscapes for stability, drainage, and the interaction of the vegetation communities will be completed after reclamation and revegetation. Revegetation patterns and characteristics will be assessed using a number of methods, including permanent transects (e.g., modified Whittaker sampling) and temporary plots. Plots will also monitor the responses of wildlife to the newly created habitats, and how they change over time.

[373] Monitoring specific to reforestation will include temporary plots established at the time of planting to measure planting density, planting quality, and initial species composition; permanent transects; and modified Alberta forest regeneration surveys. The forest regeneration surveys will be conducted between years 4 and 8 following planting, and between years 10 and 14, with at least five years between each survey. Benga stated that it will integrate both soils and vegetation monitoring programs, where possible, to allow analysis and evaluation of reclamation performance. A summary of the targets and indicators Benga will use to assess reclamation success is presented in the conservation and reclamation plan. The monitoring program as applied to selected valued components assessed during the EIA is also presented in the plan.

Adaptive management

[374] Benga stated that its adaptive management approach will involve establishing end land-use objectives according to pre-development land use capability, site-specific conditions, improved practices based on research and monitoring results, and input from the public engagement and Indigenous consultation programs. Benga expects that as reclamation proceeds, monitoring of reclamation and revegetation performance will allow land-use objectives to be reviewed. If necessary, modifications will be made to site expectations according to natural revegetation processes. Benga said that experience gained during the development of the project and other successes reported by regional coal operators over the next 24 years will also be used to manage and implement an effective reclamation program.

Closure

[375] Benga's closure plan describes principles, objectives, and techniques that define the reclamation end points needed to achieve equivalent land capability. They include terrain features and proportions of post-closure vegetation communities. Closure drainage is depicted as arrows that show the direction of drainage at closure. According to Benga, an appropriate soil management plan will be used to ensure that unsuitable overburden materials will not be present in the rooting zone. Benga further stated that established revegetation procedures will be used for the project's revegetation program.

[376] At closure, the following components disturbed by the project will be reclaimed to equivalent land capability:

- powerline, access road, and conveyor right of way
- coal-handling and processing plant and associated infrastructure
- temporary construction camp
- sediment ponds, streams, and wetlands
- coal loadout and railway loop
- pit and rock disposal areas
- end-pit lake
- highwall and escape terrain feature
- miscellaneous features such as haul roads, powerlines, and other corridors

[377] Benga noted that the sediment ponds will be fully decommissioned and reclaimed once it has been demonstrated that sedimentation in the reclaimed landscape has been reduced to natural levels. Reclamation of the sediment ponds will occur within a few years of mining completion. Most of the wetlands on the closure landscape will consist of former surge ponds used for selenium treatment. The timeline for their reclamation is uncertain; it depends on the selenium treatment achieving successful mitigation and meeting acceptable water quality standards. According to Benga, monitoring of the surge ponds could last for 20 to 50 years after the end of mine life. The final closure landscape of the project will contain slopes purposely levelled to a maximum angle of 23 degrees, and highwall areas with slopes of approximately 55 to 60 degrees on the north side of the pit area that will be left standing as barren land.

[378] Table 6-6 compares the slope class, percent slope, slope angle, and the area occupied by each slope class between the pre-disturbance and reclaimed landscape at closure.

Table 6-6. Pre-mining and reclaimed terrain at closure

Slope class	Slope (%)	Approximate slope (degrees)	Pre-disturbance (ha)	Pre-disturbance (%)	Post-reclamation (ha)	Post-reclamation (%)
1	0–0.5	0	3	0.17	232	15.24
2	>0.5–2	0.3–1.1	13	0.84	104	6.83
3	>2–5	>1.1–3	51	3.35	77	5.04
4	>5–10	>3–5	68	4.45	95	6.24
5	>10–15	>5–8.5	139	9.16	88	5.8
6	>15–30	>8.5–16.5	338	22.21	798	52.50
7	>30–45	>16.5–24	360	23.66	67	4.38
8	>45–70	>24–35	441	28.98	53	3.49
9	>70–100	>35–45	109	7.18	7	0.48
Total			1520.7	100.00	1520.7	100

Source: Reproduced from CIAR 251, Package 2, Table F.4.1-1, PDF p. 147.

[379] Across the disturbed area, Benga will rely on soil salvaged from areas of the project footprint to provide adequate soil for revegetation. According to Benga, the total volume of reclamation material available for salvage within the project footprint is approximately 3.35 million m³ and the total required for replacement will be approximately 2.9 million m³. Benga plans to spread the reclamation material across 1426 ha of the project footprint at an average depth of 20 cm. As the project operations proceed, Benga's adaptive management decisions may result in reductions in the depth of reclamation material placed prior to revegetation. Open-water areas and barren lands do not require soil placement.

[380] Following reclamation material placement in each area, revegetation will occur. Open water and barren land will not be revegetated. Barren land includes permanent rights of way and exposed rock. The reclaimed landscape consists of the following ecological units, totalling 1481 ha:

- 987.9 ha of closed conifer forest (increase of 7.5 per cent)
- 276.7 ha of grassland open forest (increase of 7.7 per cent)
- 141.8 ha of mixed forest (increase of 0.1 per cent)
- 18.2 ha of treed wetlands (increase of 1.2 per cent)
- 18.4 ha of open water (increase of 1.1 per cent)
- 38 ha of barren lands/dam (reduction of 17.7 per cent)

[381] Benga also stated that 39.7 ha represents a golf course and a landing strip (airport).

Reclamation effectiveness and climate change

[382] Benga assessed the effects of climate change on reclamation by evaluating potential future temperatures, precipitation, and frequency and intensity of fire events. Benga examined how these trends might affect whitebark pine, rough fescue (*Festuca* spp.) communities, and traditionally used vegetation species. Benga's climate change modelling for reclamation effectiveness concludes that the expected direct impact on individual species due to changes in climate parameters are negligible, given that the time from disturbance to reclamation is short. According to Benga, in ecological terms, the time from the initial project disturbance to reclamation is within one rotation for the lodgepole pine forests that represent the dominant plant community.

[383] Benga also believes that species such as whitebark pine, which are slow maturing and long-lived (500 years or more), once established, will effectively resist change if the climate remains within the tolerable range for the species. Neither limber pine nor whitebark pine adapt well to fire, and both are slow to mature compared with other pine species. Benga believes the indirect effect of climate change on the fire regime may over time reduce their numbers—particularly where they occur in mixed species stands.

[384] Benga also reviewed the literature on the response of rough fescue communities to fire. This revealed that rough fescue may be reduced where fire is excluded, allowing fuel to build up and resulting in increased fire severity and the spread of competing woody species. Benga concluded that a change in climatic parameters due to global climate change is not anticipated to result in wholesale changes in plant communities, particularly as the natural communities already present are driven largely

by terrain (slope and aspect) and occur across naturally steep gradients in local and micro-climates. Benga said it anticipates that the indirect effect of climate change on the fire regime may have the largest impact on individual species abundance. Benga stated that adaptive management will provide the flexibility to identify and implement new mitigation measures or to modify existing measures should the climate change drastically during the life of the project.

Adequacy of the conservation and reclamation plan

[385] We find that Benga provided the major elements expected in a preliminary conservation and reclamation plan, with the exception of drainage for the closure landscape, which is discussed below. However, we find that Benga's conservation plan was not organized in a clear and systematic way, and doesn't provide a coherent story of how conservation, reclamation, and closure activities will be implemented. Additionally, in some areas we found the plan lacks sufficient detail to provide confidence that reclamation outcomes can be achieved. Given the project's location in steep mountain terrain and within the Montane and Subalpine Natural Subregions, careful analysis and planning are required to ensure reclamation and closure objectives are appropriate and can be met. We discuss the key limitations and uncertainties in the proposed plan in the following sections of this chapter.

Reclamation is the primary mitigation measure for many project effects

[386] For the project, Benga stated it would rely on reclamation to mitigate many effects. Implementing its proposed conservation and reclamation plan would, according to Benga, sufficiently mitigate a range of negative environmental effects. This includes effects on soils and terrain, vegetation and wetlands (including biodiversity), wildlife habitat, and traditional land use. Benga submitted that its conservation and reclamation plan was developed to ensure the achievement of equivalent or improved land capability compared with what currently exists. Moreover, it plans to leave the lands in a state that is maintenance-free and self-sustaining. Benga also stated that by reclaiming previously disturbed sites within the proposed project footprint, the area's land capability will be improved.

[387] Benga expressed confidence that effects on landforms, soils, vegetation, wildlife habitat, and traditional use would be effectively mitigated by its proposed reclamation and associated adaptive management measures. As a result, the project would not result in significant adverse environmental effects on those valued components. Benga's confidence in achieving successful reclamation is based in part on perceived reclamation successes at other coal mines in Alberta. Benga stated that, while recognizing that reclaiming disturbed sites comes with challenges, coal mines in Alberta have a proven track record of successful reclamation. Benga provided several examples to support its position.

[388] The Coalition asked how similar the examples Benga provided of vegetation currently in post-mining areas are to the vegetation that existed prior to mining. Benga stated that, while unable to confirm which vegetation species or communities were present before the mines were disturbed, it believed what is now growing on the reclaimed mine pit and rock disposal areas is similar to the surrounding unmined areas. The Coalition pointed out that no trees were present on the reclaimed portions of either the Gregg River Mine or Luscar Mine, the two mines that have the closest (but not identical) growing conditions to the project. The Coalition further noted that none of the mine sites used as examples of successful reclamation are found in the Montane Subregion and therefore would have different vegetation types, climate, and ecosystems in operation before and after mining. In its final argument, the Coalition stated

that examples of mines provided by Benga do not demonstrate that the project site will achieve equivalent land capability given that Benga could not verify through approved reclamation permits that equivalent land capability had been achieved in any of the mine sites illustrated; that none of the mine sites have similar vegetation to the Grassy Mountain's Montane vegetation; and none are located in the Montane natural subregion as the project site.

[389] We accept that Benga's proposed conservation and reclamation plan is likely to achieve some degree of equivalent land capability due to landform reconstruction following mining, placement of reclamation materials, and re-establishment of vegetative cover. However, Benga's plan does not provide sufficient detail or supporting information to provide confidence that all of the goals outlined in the plan will be achieved or that all of the effects of the project will be effectively mitigated by reclamation. Specifically, we are not confident that the plan will effectively mitigate project effects resulting from the loss of vegetation species, community and landscape biodiversity, rare plant occurrence, rough fescue grassland communities, and whitebark pine and limber pine.

[390] We note that the reclamation examples Benga relied on represent historical efforts within a regulatory system that did not require operators to conserve soil for reclamation, revegetate using native plant species, or plant trees. In contrast, Benga's conservation and reclamation plan proposes reclamation that includes revegetation with native species and tree planting within one to five years of topsoil placement. The examples only provide comparisons for landform construction and re-contouring, soil placement, and planting of a limited number of species. They then rely on natural succession to allow species and community diversity to increase over time. On most of the mine sites given as examples, the species planted are not representative of the surrounding native communities because agronomic species were largely used to revegetate the sites.

[391] We also find that the growing conditions at the reclaimed mines west of Edmonton are not directly comparable to conditions found in the southern portion of the Rocky Mountains of Alberta. The Obed Mine and Coal Valley Mine are in the Foothills Natural Region of Alberta, an area that has a longer growing season and milder temperatures compared with the Rocky Mountain Natural Region. The longer growing season and higher average temperatures makes the Foothills Natural Region more conducive to the growth of vegetation compared with the higher elevations of the Rocky Mountain Natural Region.

[392] While the Gregg River Mine and Luscar Mine are in the Rocky Mountain Natural Region, the eastern slopes of southwest Alberta are affected by stronger prevailing westerly winds than are the Gregg River and Luscar mines to the north. The short growing seasons and strong prevailing winds in the project area may contribute to slower or stunted growth or revegetation failure. The long-term performance of species and vegetation communities in the reclaimed landscape is critical to achieving an ecosystem that supports the return of high levels of vegetation species and community and landscape biodiversity. The harsher climatic conditions in the Rocky Mountain Natural Region are likely to prolong the time required to reach levels of biodiversity that approach those of the pre-disturbance landscape. Even if a timeline of 200 years beyond mine closure is considered, species and community biodiversity and rare plants may remain affected.

[393] We recognize it is an overall project benefit for Benga to reclaim the 274.2 ha of disturbed land within the project footprint (including 185 ha of legacy mines). However, it is a regulatory requirement that if a party disturbs any designated land, whether intact or disturbed, the party must reclaim it to current reclamation standards. All approval holders are held to this requirement.

The level of detail provided in the conservation and reclamation plan is insufficient to provide confidence that reclamation will effectively mitigate all effects on terrestrial resources

[394] Several participants expressed concern about the level of detail in the conservation and reclamation plan for the project. The Ktunaxa Nation stated that Benga's proposed mitigations and commitments lack sufficient detail and scope to confirm that revegetation objectives will be met and residual impacts mitigated. The Livingstone Landowners Group contended that, while achieving equivalent land capability may be possible, Benga will not achieve it through the current reclamation plan which they considered too simplistic. The group noted an absence of soil profile analyses of the moisture or nutrient conditions for reclaimed profiles, which are a fundamental basis for equivalent capacity and vegetation or ecosite performance. The group further noted that, although Alberta definitions for ecosites are based on soil moisture and nutrient regimes, Benga's EIA includes little discussion of these regimes.

[395] The Livingstone Landowners Group further noted that the plan lacks a cover design, despite available guidance on cover designs for mine waste and the use of covers to control selenium contamination. The group expressed doubt about the adequacy of reclamation material available for reclamation because Benga employed a simple mathematical calculation that related the volume of material to be salvaged with the area to be reclaimed, and then decided on a uniform soil replacement depth of 20 cm. The group's expert, Dr. McKenna, stated: "The current mine plan reclamation plan uses a very simplistic design. The proponent has determined there's about 3.3 million cubic metres of available reclamation material needed to cover or to put on 15 million square metres of reclaimed land. That's 1,500 hectares. Long division provides the design in this case: 20 centimetres cover soil depth. This is the amount placed on all substrates at all elevations, on windy polygons and calm ones, on old roads, on waste rock dumps alike. This thinking is long out of date and insufficient to meet the lofty goals like equivalent capability, especially given the site conditions, not to mention the need to control the ingress of water and oxygen into waste rock dumps which impacts selenium generation" (CIAR 848, PDF pp. 33–34).

[396] The Livingstone Landowners Group also noted the lack of detail in the conservation and reclamation plan on surface water drainage in the closure landscape. The group argued that Benga's plan included little consideration of surface drainage for the waste rock dumps and end-pit lake, or any detail regarding creeks or watercourses in the closure landscape. Asked why the closure reclamation landscape did not show any reclaimed creek drainages or watercourses, Benga stated that the arrows shown in the figure were meant to show only direction of flow and could be moved up or down "and [were] not actually meant to be a location where a creek or drainage is being funnelled or directed" (CIAR 1351, PDF p. 77).

[397] The Coalition questioned Benga's lack of established goals for shrub planting, noting that introducing native shrubs early in the reclamation process can reduce impacts on wildlife. The Coalition argued that the EIA assumes that all reclamation activities will be entirely successful, and that once

habitat is reclaimed it will become instantly available. This assumption makes it seem as though reclamation activities will create an abundance of high-quality habitat that will immediately be occupied by multiple species. Benga acknowledged that the conservation and reclamation plan was still conceptual at this point, but agreed to develop and refine it further as the project progresses.

[398] We accept that Benga’s plan is conceptual at this stage and could be further developed as the project progresses, were the project approved. However, given its importance in mitigating project effects, it must contain sufficient detail to provide us with confidence that the measures and desired outcomes in the plan are technically and economically feasible and that proposed reclamation outcomes can be achieved. As part of an information request in 2019, we asked Benga to submit an updated conservation and reclamation plan to allow us to evaluate the adequacy of the effects assessment and the effectiveness of mitigation measures for each valued component. Specifically, we asked Benga to

- provide additional details on how reclamation success will be monitored and how adaptive management will be used to address reclamation outcomes that do not meet expectations;
- explain, in quantitative terms, how specific measures in the plan, as well as monitoring and adaptive management, will contribute to mitigation of the potential adverse effects on each valued component; and
- clarify how uncertainty related to reclamation effectiveness and the effects of climate change on the reclaimed landscape were taken into account.

[399] As part of the Tenth Addendum, Benga submitted its updated conservation and reclamation plan. Overall, we find that the plan still fails to demonstrate how Benga will sufficiently mitigate the effects on some valued ecosystem components. Nor do we see how the plan supports Benga’s conclusions that the reclamation program will bring about a post-closure landscape equivalent to or exceeding the current conditions of the project area. The updated plan does not demonstrate the level of planning required—or provide the detail necessary—to indicate the plan will be successful in the Rocky Mountain Natural Region of southern Alberta, which has harsh climatic conditions. Similarly, the detail provided is insufficient to evaluate whether the plan will mitigate the project’s environmental effects on the Montane and Subalpine environments of the project area.

[400] We accept that the conservation and reclamation plan will allow for the return of a variety of soil, vegetation, and wildlife resources to the project footprint over an extended period of time. However, we are not confident that the plan will result in self-sustaining ecosystems that are equivalent to and integrated with those that exist in the landscape surrounding the mine. The level of planning simply does not appear to account for the high level of existing biodiversity and unique reclamation challenges of the project area.

[401] This lack of adequate planning is evident in Benga’s approach to its revegetation plan, which includes just four broad vegetation classes as well as water features and barren land. Of the four vegetation classes, treed wetlands are not expected to be reclaimed until long after the end of mine life and after reclamation of most of the project footprint. First, selenium remediation needs to be completed. The plan also does not include comprehensive details of planting densities or targeted forest densities at

stand maturity. Benga’s planting prescriptions target broad vegetation groups and do not include deciduous forests, which were mapped in the LSA during baseline data collection.

[402] Benga asserted that it plans to mitigate the loss of species and community biodiversity through reclamation. Yet the proposed planting prescriptions do not indicate that Benga will aggressively plant shrub, tree, or herbaceous species that would promote species diversity and ultimately community diversity. Benga needs to account for the fact that areas located on different landforms evolve to enhance differential community development. As shown in Table 6-4, Benga indicated that many of the native shrub species in the area will be “encouraged.” It is unclear what Benga means by this term. To ensure that biodiversity is enhanced through reclamation, shrubs must be actively planted. Relying on ingress from surrounding vegetation communities would not result in a landscape where biodiversity equivalency can be attained within the timeline of a 92- to 116-year fire cycle, as Benga asserts. According to Benga, effects that are not mitigated within a natural fire cycle of an area are irreversible.

[403] The conservation and reclamation plan also does not include any soil profile analyses of the moisture or nutrient conditions for reclaimed profiles. Yet such profiles represent the fundamental basis for equivalent capacity and vegetation/ecosite performance. The Livingstone Landowners Group identified this omission in the plan. Without these profiles, it is difficult to assess how well Benga understands the reclamation challenges that may exist in the project area. And it makes it difficult to know whether the proposed reclamation approach is likely to achieve the stated outcomes with respect to vegetation species and community performance and diversity.

[404] The terms of reference for the EIA required Benga to describe and map post-development land capability with respect to a self-sustaining topography and surface watercourses and the existing and final reclaimed-site drainage plans. However, the conservation and reclamation plan does not include a drainage plan. We do not consider the arrows on some of the figures referenced by Benga to constitute a sufficiently detailed drainage plan for the post-closure landscape. Without additional information, we are not able to assess the potential for erosion in and sustainability of the closure landscape.

[405] In the updated conservation and reclamation plan, Benga described its general approach to adaptive management and identified some potential adaptive management strategies. But many of the proposed strategies are vaguely worded and appear to be based on trial and error, rather than a well-thought-out and rigorous approach to adaptive management. Proposed strategies in the plan include

- utilize various erosion control techniques, such as using different geotechnical materials, add water diversion and energy dissipation structures, modify revegetation techniques and patterns, utilize different equipment, change the recontouring procedures, reduce slopes;
- try different soil-replacement depths and combine different revegetation prescriptions;
- modify surface runoff drainage patterns;
- adjust planting and transplantation methodologies as required to implement any advances in planting and transplantation methodologies during the life of the operation and reclamation phases that may enhance the establishment of vegetation communities;

- modify the site conditions to achieve greater germination success and survival such as creating suitable microtopography conditions for seedlings to establish; and
- adjust the species composition to be planted if reclamation trends indicate it is required for successful regeneration or if required as a result of future consultation with regulators and stakeholders.

[406] The proposed strategies appear not to have been well thought out, and do not provide confidence that they will achieve the desired results if the reclamation plan is not successful. It is unclear how alternative mitigation measures would be selected and implemented. We note that progressive reclamation commences in year 2 of the project and that many of the proposed reclamation activities (recontouring, reclamation material placement, and revegetation) are proposed to occur shortly after mining is complete and the area becomes available for reclamation. Given the proposed pace of progressive reclamation and the time required to confirm whether reclamation outcomes are being achieved, we are uncertain how Benga will be able to effectively implement an adaptive management approach for reclamation. Specifically, we identified the following uncertainties:

- With no available information on the reclamation of rough fescue in the Rocky Mountain Natural Region, what will monitoring of reclaimed rough fescue communities accomplish if there are no examples to draw from?
- How will Benga be motivated to conduct research on or fully evaluate monitoring results and implement an adaptive management strategy for reclamation if it already has confidence in all its proposed mitigation strategies?
- Given that whitebark pine will not be revegetated until year 15 of project operations, and the short time remaining after that to the end of reclamation, how much time will be available for Benga to apply any adaptive management measures?
- Benga has stated that reclamation of the selenium-management surge ponds to treed wetlands will occur after selenium treatment is no longer necessary and water quality in the ponds meets acceptable water quality standards. Benga further indicated that it may take 20 to 50 years beyond the end of mine life to complete the necessary monitoring of selenium levels to achieve acceptable water quality standards. If selenium treatment and subsequent reclamation of surge ponds to treed wetlands are estimated to occur at some uncertain time in the future, when would any required adaptive management measures for the reclaimed wetlands be implemented?

[407] As a result of these limitations, we do not have confidence that the proposed conservation and reclamation plan will achieve all of the outcomes that Benga claims. Nor do we believe the plan will adequately mitigate some aspects of the project. In particular, we find that the plan is not likely to adequately mitigate effects related to the loss of ecosite phases, species and community biodiversity, rare plants, rough fescue grasslands, whitebark pine, and limber pine. These issues are discussed below and in the chapter on vegetation and wetlands.

Whitebark pine and limber pine reclamation may not be successful

[408] It is uncertain if the whitebark pine can be successfully reclaimed on the more subdued terrain of the closure landscape. Benga's closure plan includes shallower slopes (with a maximum angle of 23 degrees) that will be reduced from the steep slopes currently in the project footprint. While almost all the whitebark pine was found within the subalpine region of the LSA, Benga's closure vegetation communities have been targeted to Montane Subregion types. While some whitebark pine can be found scattered across the Montane Subregion at lower elevations with more gentle slopes, whitebark pine thrives in the harsh environments of the Rocky Mountain Subalpine Subregion, where slopes are steeper than the proposed slopes or revegetation targets in the closure landscape.

[409] We find that Benga's ability to restore whitebark pine in the closure landscape is uncertain given limited evidence of successful whitebark pine restoration projects to date. The restoration of whitebark pine is not comparable to reforestation of areas affected by logging. Logging operations revegetate with commercial trees that have been proven to grow rapidly on logged sites that have been otherwise minimally impacted. Logging sites cannot be compared to the degree of disturbance associated with a surface mine, where soil and overburden are stripped and later replaced and the terrain altered. In Alberta, provincial recovery strategies for whitebark pine have not been fully implemented. Existing examples of whitebark pine restoration are relatively recent and have not yet resulted in mature pine stands. Similarly, whitebark pine restoration programs in neighbouring regions are in their infancy. Successful reclamation to mature stands older than 20 years has not been demonstrated. Most examples of whitebark pine restoration provided by Benga are no more than five years old. Further discussion of whitebark pine reclamation is provided in the vegetation and wetlands chapter.

[410] Reclamation of limber pine is likely to face many of the same challenges as reclamation of whitebark pine.

Successful reclamation of rough fescue communities is unlikely

[411] Benga's vegetation assessments indicate that approximately 58 ha of grassland communities contain foothills rough fescue (*Festuca campestris*) within the project footprint. This equates to about 3.8 per cent of the project area. Because completely avoiding these grasslands is not possible, Benga has proposed several strategies based on best industry practices and key findings from successful reclamation efforts to restore foothills rough fescue on a post-development landscape. Benga said that it would prioritize direct placement of salvaged reclamation material to promote foothills rough fescue and native grasslands. Benga referenced a paper by Lancaster et al. (2016) as evidence of successful reclamation of fescue grassland communities. However, during cross-examination, Benga acknowledged that the Lancaster et al. paper addresses reclamation of disturbances at a wellsite scale and on areas where soil stripping did not occur.

[412] Several participants disputed Benga's contention that rough fescue communities could be successfully reclaimed. The Ktunaxa Nation's expert witness, Ms. Machmer, noted that Benga acknowledged that no successful reclamation of rare rough fescue grasslands had occurred. Yet Benga went on to predict that these grasslands would be reclaimed to an equivalent or greater level of land capability. For its part, the Livingstone Landowners Group stated that many past attempts to reclaim native fescue grasslands on disturbed pipeline rights of way, drilling sites, transmission lines, and private

land had been unsuccessful. Ms. B. Lambright, a member of the group, indicated that attempts to reclaim fescue grasslands on her property had been unsuccessful. The Coalition argued that no study shows successful re-establishment of rough fescue grasslands in the Montane Natural Subregion. The Coalition said examples of successful rough fescue re-establishment referenced in the Lancaster et al. paper were not applicable to the project; they either occurred on sites where topsoil had not been stripped, or were conducted in the Foothills Fescue Subregion of the province.

[413] Benga defended the use of the Lancaster et al. paper, yet was unable to provide an example of successful rough fescue restoration at a mine site. As a result, we are not confident that rough fescue grasslands will be successfully reclaimed in the project area. There are currently no examples of successful rough fescue grassland reclamation in the Montane Subregion where the topsoil has been removed.

[414] We are not confident that Benga's proposed direct placement of salvaged reclamation material will effectively mitigate the loss of rough fescue communities. This is due to the timing of soil salvage operations and the availability of suitable areas for direct replacement. When soil that may contain rough fescue propagules is salvaged, suitable areas may not be available for fescue community reclamation. Direct placement during project operations is often dictated by cost, proximity of salvaged soils to areas needing reclamation, and the availability of areas ready for reclamation. According to Benga's conservation and reclamation plan, the area planned to be reclaimed to rough fescue communities will be reclaimed long after the area where most of the existing communities are located is disturbed. Additionally, soils used for reclamation will be sourced from one stockpile of all salvaged topsoil.

The conservation and reclamation plan does not mitigate the loss of rare plants

[415] Construction and operation of the project will remove all vegetation, including all rare plants within the project footprint. The conservation and reclamation plan will not mitigate the loss of rare plants during construction because no viable mitigation measures can counter the loss of rare plants. Benga's revegetation plan primarily targets broad vegetation communities common to the Montane Subregion, with only one community common to the Subalpine Subregion. Rare plants such as lichens and mosses require mature diverse habitats with specialized niches, and they are difficult to relocate. We find that it is not likely that rare plants disturbed during project construction and operation will return to the LSA in the next 100 to 200 years. This is particularly true for mosses, liverworts, and lichens that require specialized plant communities at a mature successional stage.

The conservation and reclamation plan should adequately mitigate the loss of plants associated with traditional uses

[416] Benga proposed to revegetate using traditional-use species identified through Indigenous community consultation during reclamation. Benga stated that the included species are lodgepole pine (*Pinus contorta*), prickly rose (*Rosa acicularis*), ground juniper (*Juniperus communis*), willows (*Salix* spp.), aspen (*Populus tremuloides*) and balsam poplar (*Populus balsamifera*), saskatoon berry (*Amelanchier alnifolia*), thimbleberry (*Rubus parviflorus*), bearberries (*Arctostaphylos* spp.), dwarf birch (*Betula nana*), subalpine fir (*Abies lasiocarpa*), and dogwoods (*Cornus* spp.). We note that Table 6-4 shows that, while Benga's conservation and reclamation plan includes planting of lodgepole pine and some shrub species of value to Indigenous communities, it does not include many of the species

listed here that Benga said will be “encouraged.” Benga did not elaborate on how other species will be encouraged.

[417] We accept Benga’s commitment to continued engagement with Indigenous communities regarding its conservation, reclamation and closure plans throughout the life of the project. We also accept Benga’s commitment to use this engagement to understand and address the needs of Indigenous communities regarding revegetation programs that include species of value to them. And we acknowledge Benga’s efforts to incorporate these species into its planting prescriptions. We find that, while there will be a temporary loss of traditional-use species within the project footprint, Benga’s plans to incorporate such species into its planting prescriptions should mitigate project effects on traditional-use species.

There is significant uncertainty about whether treed wetlands will be successfully established in the closure landscape

[418] Benga plans to reclaim the surge ponds used for selenium management to treed wetlands. Benga also stated that treed wetlands will be established in the littoral (shallow-water) zone of the end-pit lake. We note that the design of the end-pit lake is largely conceptual and many details are not known at this time. As well, according to Benga, the timeline to the point when management of selenium concentrations in water is no longer needed is uncertain. Benga said its 25-year treatment estimate was based on professional judgement, and that it would know more about this issue closer to the end of mine life.

[419] There is inherent uncertainty about whether Benga will be present to reclaim the surge ponds to treed wetlands 25 years or more after mining ceases. Additionally, constructed wetlands succeed when either an organic soil or a peat-mineral soil mixture has been placed. Restoration of wetlands in the surge ponds will not occur until many years after soil salvage has been completed, and Benga’s soil salvage and storage plan does not include segregation and separate storage of organic soils from mineral soils. Benga could not confirm if suitable soils would be available to reclaim the surge ponds to treed wetlands when selenium mitigation is complete. This would occur only once testing shows that selenium levels in the ponds are below the criteria required to permit reclamation. Given the above uncertainties, it is unclear if surge ponds will be reclaimed as treed wetlands.

Climate change may affect long term reclamation success

[420] Benga noted that vegetation species’ responses to climate change would not be uniform. In Benga’s view, the anticipated effect of climate change on the fire regime would likely have the largest impact on individual species abundance. Benga estimated a moderately reduced confidence in reclamation efforts involving specific species re-establishment. Regarding whitebark pine, Benga noted a moderate reduction in its level of confidence in re-establishing whitebark pine due to uncertainty in the future fire regime associated with climate change. However, Benga went on to note that its confidence in revegetation techniques used for reclamation remained high. It expected that natural recovery, seeding, fertilization, tree and shrub plantings, and transplantation would be carried out as expected.

[421] ECCC did not provide any views on the potential effects of climate change on Benga’s proposed reclamation plans for vegetation, including whitebark pine. ECCC recommended that Benga monitor and apply adaptive management to ensure seedling success. The Coalition expressed concern regarding the predicted impacts of climate change on seedling re-establishment, including for whitebark pine. The Coalition noted that “the potential impacts on vegetation will be even more uncertain on disturbed lands than in native habitats where there is the full complement of soil mycorrhizae, soil structure, vegetation structure, and species diversity (flora and fauna) that will support greater resilience in the face of climate change than on disturbed sites” (CIAR 553, PDF p. 271).

[422] CPAWS expressed concerns regarding the whitebark pine’s vulnerability to climate change. The potential impacts of climate change include rising temperatures and more frequent extreme weather-related events, such as drought and forest fires. Increasing temperatures can also result in higher evapotranspiration rates, which may reduce soil moisture and prevent the establishment of vegetation.

[423] We do not agree with Benga that climate change is unlikely to affect reclamation effectiveness because of the short timeline for reclamation (about 25 years). While short-term effects due to climate change may not be observed during the reclamation timeline, the development of reclaimed ecosystems to maturity and the return of acceptable levels of biodiversity and successional trajectories toward more diverse vegetation communities for Benga’s proposed four broad vegetation communities may suffer if changes in annual temperature, precipitation, or increased evapotranspiration occur. This could affect growth and development, and may prevent some species in the reclaimed landscape from becoming established. The indirect effect of climate change on the fire regime is likely to have the largest impact on individual species’ abundance, potentially further delaying the return of rare plant species and biodiversity. However, we acknowledge that quantifying the magnitude of these effects is difficult.

The time required to achieve equivalent land capability and reclamation certification is uncertain

[424] Section 2 of the *Conservation and Reclamation Regulation* under the *EPEA* provides “The objective of the conservation and reclamation of specified land is to return the specified land to an equivalent land capability.” Equivalent land capability is defined in the regulation as “the ability of the land to support various land uses after conservation and reclamation is similar to the ability that existed prior to an activity being conducted on the land, but that the individual land uses will not necessarily be identical.”

[425] The *EPEA*’s definition of equivalent land capability is based primarily on end land use and does not define the level of species or vegetative diversity required to achieve equivalent land capability. What is required to achieve equivalent land use and reclamation certification is the presence of native species and acceptable soil depths (as defined in an approval) without excessive erosion, water and soil quality that meets acceptable levels, and a geotechnically stable reclaimed landscape. It is therefore possible that equivalent land capability can be satisfied while the level of ecological diversity and functionality may not be equivalent to pre-disturbance or adjacent communities.

[426] While Benga's conservation and reclamation plan will likely achieve equivalent land capability from a land use perspective at some point, it is uncertain whether equivalent land capability can be achieved in a timely manner. Benga indicates as much in its updated plan. Given the limitations of the proposed plan, considerable uncertainty exists about how long it may take for the project site to achieve a stable and self-sustaining state that satisfies the requirements for reclamation certification. This is particularly so in light of the potential need for ongoing use of some project features (such as surge ponds and saturated backfill zones) during the closure period for selenium management. These areas may not be available for reclamation until 25 years or more after mining operations cease. Like other coal mines that stopped operating more than 20 years ago, tracks of disturbed land that have not been certified may still be present for decades after mining ceases. Until reclamation has occurred and equivalent capability achieved, the land may fail to reach a state that would allow for certification and return of parts of the project that are on public lands to the Crown.

7. Effects of the Environment, including Climate Change, on the Project

The project assessment adequately accounts for possible adverse effects of the environment on the project through the life of mine

[427] Benga stated that the natural environment and a changing climate have the potential to affect the project. This could occur through delays or interruptions in construction and operations, damage to infrastructure, and an increased risk to the public or the environment. Benga indicated that it considered potential effects of the environment during project design, development of mitigation measures, and establishment of follow-up and monitoring plans. Benga designed the project to handle the effects of the following environmental conditions: extreme temperatures, strong winds, heavy precipitation, erosion, landslides, subsidence, seismicity, and fire events.

[428] Benga rated project sensitivities of project phases and components of the environment according to recommendations in the Federal-Provincial-Territorial Committee on Climate Change and Environmental Assessment's *Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners* (2003). It based this rating on project design, existing mitigation and monitoring plans, and professional judgement.

[429] Benga did not expect the project to be sensitive to extreme temperatures, heavy precipitation events, or wind. It designed project infrastructure, including the construction camp and water treatment plants, to handle winter, summer, and extreme weather conditions. The proposed water management system and mitigation measures would manage higher-than-usual annual precipitation (rain and snow). Benga indicated that extreme weather conditions and events have the potential to increase erosion in the project area. It planned to limit such effects through design standards, environmental management plans, mitigation measures, and elements of the closure and reclamation plan.

[430] Benga used various technical criteria to prevent a catastrophic failure of water management structures through engineering design, site selection, and mitigation measures. Benga suggested that the conservative nature of the designs and its overall water management plan would allow it to actively manage any potential future increases in extreme precipitation events over the short term. We discuss the design of dam and water retention ponds in the chapter on coal mining, handling, and processing. Further information about Benga's water management plan can be found in the chapters on surface water quality and accidents and malfunctions.

[431] Benga reported that the project would be located in a low-seismic-hazard zone and not be sensitive to landslides. Benga designed several infrastructure components, including water management structures, in-pit walls, waste disposal areas, dikes, and berms to withstand landslides, subsidence, and seismic events. NRCan determined that Benga's terrain assessment for landslide susceptibility in the local study area was satisfactory. We discuss the potential for seismic and landslide hazards in the chapter on coal mining, handling, and processing.

[432] Benga proposed to manage fire hazards through project design and mitigation measures, including the fire protection system and its wildfire control and prevention plan. This plan included on-site fire prevention and control equipment, communication procedures, as well as off-site communication with the public and firefighting authorities (AEP) and cooperative efforts in regional fire prevention and

control. Fire prevention, detection, reporting, and suppression measures were the basis of this plan. Benga followed Alberta's *FireSmart Guidebook for the Oil and Gas Industry* as a guideline for its wildfire control and prevention plan.

[433] The Municipality of Crowsnest Pass and the M.D. of Ranchland expressed concerns that Benga did not review or co-ordinate its wildfire control and prevention plan with their offices. Both participants pointed out that emergency management is a matter of regional interest that requires regional assets and resources. Benga stated that because local fire rescue teams would be a primary responder to mine rescue, it would work with the Municipality of Crowsnest Pass to develop emergency response plans as the overall mine plans evolve. It also noted that it would coordinate its emergency management plan with the M.D. of Ranchland.

[434] Some participants expressed concerns with Benga's ability to handle fire suppression on and off-site. Benga noted that, during construction and operations, appropriate procedures will be implemented to reduce the risk of fire. As well, Benga will develop response plans in conjunction with local emergency services in the event that fires occur within the mine pit boundary or surrounding area. Benga described how local fire/rescue and wildfire authorities will be regularly apprised of site characteristics, including the emergency muster point, and provided maps of the site trails. All local emergency response radios will be programmed with Benga's radio frequency, and site tours will be conducted with local authorities. It also indicated that prior to any operations or exploration activities, Wildfire Alberta will be contacted and advised of the locations and start and end dates. Benga's evacuation plan will outline procedures and routes, which will be reviewed annually with employees and contractors during their required safety training.

[435] CPAWS raised concerns about the potential for mining operations to increase the risk of wildfires in the project area. They noted that Benga did not assess this risk specifically in its assessment of the project. Benga agreed that it had not addressed this risk. However, it stated that with the implementation of its wildfire control and prevention plan, and with properly trained personnel and ample firefighting equipment on site, the risk of increasing wildfire potential would be minimal.

[436] Several participants and Indigenous groups expressed concerns regarding legacy waste piles on the east flank of Grassy Mountain and their potential impacts on surface water, fish, and aquatic habitat during extreme weather events. Some referred to a heavy rain event in July 2015 that resulted in a release of coal fines from a legacy coal pile into Gold Creek. Some also suggested that the release resulted in a significant fish kill in Gold Creek, with westslope cutthroat trout among the species affected. These piles will remain a concern, as will the potential for spills during extreme weather events.

[437] Benga indicated that it is its intention to clean up and reclaim areas within the project footprint affected by legacy mining activities. The existing legacy mining disturbances will be incorporated into the development and reclamation plans for the project. Benga identified legacy coal piles within 100 m of Gold Creek as candidates for habitat enhancements. Such enhancements would be part of offsetting measures designed to create critical habitat connectivity for westslope cutthroat trout.

Benga assessed the potential for climate change to affect the project

[438] Benga indicated that climate change may affect the construction, operation, decommissioning, and reclamation phases for the project. Benga utilized climate model data from the Prairie Climate Centre as the primary source to assess the effects of climate change on the project. Prairie Climate Centre predictions for Alberta, which cover the period 1950 to 2100, include temperatures (maximum and minimum) and total precipitation at a 10 km resolution for the Prairie provinces. Benga statistically downscaled the Prairie Climate Centre dataset to produce 10-kilometre-scale predictions for the Municipal District of Pincher Creek area from global climate models. These predictions included two emission scenarios that reflected a “high” and “low” carbon future. The data included maximum and minimum temperatures and a total precipitation value for the time period between 1950 and 2100.

[439] Benga’s assessment suggests that future climate conditions in the project area through 2100 will result in the following: an increase in mean annual temperature; an increase in frequency of days with temperatures greater than 30°C; a 3 per cent increase in precipitation (with an increase in spring and a decrease in summer); and a 15 per cent increase in the frost-free period. Benga stated these changes were largely independent of whether a “low” or “high” carbon future emission scenario was used in the assessment.

[440] Several participants raised concerns that Benga did not use climate data for the Crowsnest Pass region in its modelling of future climate conditions. They noted that using the data and 24 climate models from the Climate Atlas of Canada would have been more representative of the project area than data from the Prairie Climate Centre. Benga stated that at the time it was developing its assessment, climate prediction data for the M.D. of Pincher Creek was the most accessible. In a subsequent, more detailed analysis on future climate conditions, Benga used 29 climate models and incorporated data from locations closer to the project site. This provided a broader range of information and larger set of predictions for future climate scenarios.

[441] Benga stated that its assessment took into account potential climate change effects on hydrological resources, air quality, aquatic resources, reclamation and closure processes, and vegetation. We discuss these effects in further detail in the relevant chapters of this report.

Climate change could affect future extreme precipitation events and groundwater flow

[442] Benga designed the sedimentation ponds and surge ponds based on the Canadian Dam Association’s inflow design flood, which it selected based on the consequences of failure of the facility. Benga’s dam designs were at an early conceptual stage, and final engineering design would need to meet Alberta’s dam safety guidelines in a future regulatory process. These guidelines include a requirement to use the best available technology, and to apply the best available practices in hydrologic and hydraulic science to estimate the inflow design flood and its characteristics.

[443] Benga predicted increases in 200- and 1000-year extreme rainfall by 20 to 35 per cent, using the climate change tool developed by the Facility for Intelligent Decision Support at the University of Western Ontario. Benga’s pre-climate change estimate of 24-hour probable maximum precipitation event was 284.0 millimetres (mm). Because the climate change tool does not predict changes for probable maximum precipitation events, Benga estimated the probable maximum precipitation event in a future

climate change scenario by adding the increment predicted for a 1000-year event, which was 44.8 mm, to its pre-climate change estimate. Benga estimated the 24-hour probable maximum precipitation event in the future scenario to be 328.8 mm.

[444] The Coalition stated that, in the coming decades, the number of extreme events is likely to increase as the global climate shifts toward a new regime. This includes an increase in the risk of more extreme floods. The Coalition argued that the available scientific literature predicts a 29 per cent increase in future extreme precipitation in central Alberta in the final decades of this century. The Timberwolf Wilderness Society described the complexities of estimating extreme rainfall statistics in mountainous areas such as the Grassy Mountain site and dependence of climate change projections on the grid resolution of the models. The society's expert, Dr. K. Rasouli, described how precipitation is expected to increase with temperature. Timberwolf concluded that Benga's predictions of extreme precipitation were potentially underestimated, which could lead to more consequential failures of the water management infrastructure.

[445] ECCC said that future changes in short-duration precipitation extremes may have implications for the integrity of water management infrastructure. These changes could affect water quality if the design values of the project's water management infrastructure underestimate the severity and frequency of extreme weather events. ECCC advised that Benga should use the best available methods to characterize climate-related effects on the project. This approach will ensure that water management infrastructure is designed to withstand the effects of a changing climate over the next century.

[446] ECCC critiqued Benga's pre-hearing use of the climate change tool. This approach is based on statistical relationships between local-scale observations of extreme precipitation and modelled simulations. ECCC said it was unlikely to be robust because the changes in local observed extreme precipitation are small compared with the natural variability of extreme precipitation. Also, ECCC said that this lack of information on observed extremes means that a statistical model was unlikely to be well constrained (meaning the estimated extreme rainfall values would likely have a very high level of uncertainty). ECCC also criticized the use of the predicted incremental increase in the 1000-year 24-hour event (44.8 mm) as a means of deriving the probable maximum precipitation 24-hour event.

[447] ECCC recommended that Benga utilize a best-available methodology, such as the simple scaling technique to adjust precipitation based on projected temperatures. This technique is described in the 2019 *Canadian Standards Association Guidance on Intensity Duration Frequency for Canadian Water Resources Practitioners*. ECCC stated that this approach would provide a more robust and accurate analysis of predicted rates of change for extreme precipitation. At the hearing, Benga committed to following the Canadian Standards Association approach to adjusting extreme rainfall statistics for expected climate change. Benga provided updated statistics during the hearing that predicted increases of up to 17 per cent for a probable maximum precipitation event by 2050, and 55 per cent by 2100.

[448] We accept ECCC's description of the Canadian Standards Association approach as an example of a best-available practice. Alberta's *Dam and Canal Safety Directive* requires the use of best-available practices in hydrologic and hydraulic science to estimate the inflow design flood and its characteristics. We find that Benga's commitment to following the Alberta *Dam and Canal Safety Guidelines* and Canadian Dam Association safety guidelines, and to utilize Canadian Standards

Association guidance, would reduce the risk to the project posed by future changes in extreme precipitation arising from climate change.

[449] The Coalition also asserted that Benga did not adequately assess the potential implications that future climate change has for stream flow conditions, and for dilution of contaminants that may be released directly into groundwater. It argued that Benga did not rely on worst-case and conservative assumptions, and that Benga's claims were not backed up by the climate change data. The Coalition suggested that Benga relied on mean scenarios from the Pincher Creek region with a cut-off at 2050, and that Benga did not adequately consider long-term trends in climate variability in its climate-related assessments for the project area.

[450] The potential effects of climate change may be relevant to assessing changes to groundwater base flow to Blairmore and Gold Creeks, as well as impacts to surface water quantity and quality. Changes in the timing of snow melt or the timing frequency or intensity of precipitation events may affect the timing and magnitude of groundwater flow and contribution to base flow in the creeks. Changes in groundwater flow may also affect the amount of dilution that would occur for contaminants released to groundwater and surface water. We find that it is unclear whether or how Benga considered the potential effects of climate change on the project in the context of potential project effects on groundwater.

8. Air Quality

[451] The project could affect air quality as a result of various potential sources of substances of concern. Primarily, these sources are mobile equipment, locomotives, explosives blasting, and surface mining disturbances. Mobile equipment consists of bulldozers, loaders, graders, backhoes, drills, shovels, haul trucks, and support equipment that produce emissions from diesel combustion. Explosives generate dust from blasting and emissions from the combustion of the ammonium nitrate–fuel oil itself. Surface disturbances associated with mining activities and haul roads result in fugitive dust emissions, and generate wind-driven fugitive dust emissions. In addition to project operations, Benga indicated that project emissions would occur during construction and reclamation.

[452] The mine’s mobile equipment, locomotives, and explosives are all potential sources of nitrogen oxides (NO_x), sulphur dioxide (SO₂), and carbon monoxide (CO). Equipment that combusts diesel fuel are also potential emission sources of volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), and fine particulate matter (PM_{2.5}).

[453] Benga conducted an air quality assessment to evaluate the effects of project air emissions using the CALMET and CALPUFF regulatory dispersion models in accordance with the *Alberta Air Quality Model Guideline*. Benga chose a regional study area (RSA) of 30 km by 35 km to consider regional emissions, and a LSA of 12 km by 15 km to assess the area immediately adjacent to the project. The project footprint had a total disturbance area of about 1521 ha, which includes all infrastructure, pits, rights-of-way, and environmental management systems.

[454] The RSA is situated in a portion of the Rocky Mountains where the terrain elevation ranges from about 1250 to 2650 m above sea level. The project mining area elevation ranges from 1550 to 2000 m above sea level, with the terrain sloping downhill away from the mining area. Using an air dispersion model, Benga established model receptors in accordance with provincial guidelines and specified 14 special receptors. As discrete data points in the air dispersion model, the special receptors were used to represent residences, communities, traditional land use areas, and other sensitive elements. To supplement the dispersion modelling, Benga incorporated meteorology data and ambient air quality for all assessment scenarios.

[455] Benga evaluated four scenarios to assess project effects on air quality:

- The baseline case included all existing emissions from Highway 3 and four communities (Coleman, Blairmore, Frank, and Bellevue) where no industrial facilities were within the RSA.
- The project-only case using the year 19 emission scenario included emissions from mining and waste stripping, the north and south disposal areas, haul road, coal-processing facility, and transportation.
- The application case, which was intended primarily for use in regulatory applications, combined the baseline case and the project-only case for year 19.
- Benga stated that there were no other planned future industrial developments, so the planned development case was identical to the application case.

[456] Benga's air assessment modelling included air quality effects from the following substances of concern: NO_x, SO₂, CO, particulate matter (PM₁₀), PM_{2.5}, and total suspended particulates (TSPs), VOCs, and PAHs. Benga also assessed the emission of metals, primarily in dust from crustal disturbance and diesel combustion, and potential acid input as a result of combustion emissions, nitrogen deposition and acid deposition.

Benga's evaluation of baseline climate and air quality relied on limited local meteorological and ambient air quality monitoring data

[457] To compile background data, Benga examined ambient air quality and climate data sources near the RSA and downwind of existing Alberta coal mines. Benga considered data from the Devon Coleman site, which it expected to be the most representative based on the proximity of the project. But the measured air quality parameters were limited as that site was established to monitor a gas plant. It also considered the Zinio Place (Castlegar, B.C.) and Kutenai Place (Nelson, B.C.) stations, which Benga considered representative of rural concentrations similar to those of the project location. It considered as well the Lethbridge station, which is located in the city of Lethbridge, Alberta, and is surrounded mainly by food and agricultural-processing facilities. Benga examined historical climate and precipitation data from the ECCC Coleman, Connelly Creek, and Pincher Creek meteorological stations.

[458] Benga considered measurements downwind of coal mines elsewhere in Alberta, regardless of location, to determine how concentrations in the project's RSA might be affected by coal-mining near Sparwood, B.C. (approximately 30 km west of the RSA). Benga examined data from the Edson station (67 km east of the Coal Valley Obed Mine), the Steeper station (22 km northeast of the Teck Coal Cheviot Mine), and the Wagner station (10 km southeast of the Capital Power Genesee Mine).

[459] Benga selected ambient background concentrations to use in its air quality dispersion modelling in accordance with the *Alberta Air Quality Model Guideline*. For background NO_x, SO₂, and CO concentrations, Benga chose 2010–2014 Lethbridge station data. Benga chose the Kutenai station to derive ambient background concentrations for PM_{2.5} and PM₁₀. Benga's summary of background concentrations of criteria contaminants used in the air quality assessment is provided in Table 8-1.

Table 8-1. Ambient background concentrations for modelled criteria air contaminants

Compound	Hourly (µg/m ³)	8-hour (µg/m ³)	24-hour (µg/m ³)	Monthly (µg/m ³)	Annual (µg/m ³)	Data source
SO ₂	2.6	–	2.1	1.0	0.9	Lethbridge, 2010–2014 ^a
NO _x	32	–	–	–	17	Lethbridge, 2010–2014 ^a
NO ₂	24	–	–	–	11	Lethbridge, 2010–2014 ^a
CO	344	301	–	–	–	Lethbridge, 2010–2014 ^a
PM _{2.5}	8.0	–	6.8	–	4.0	Nelson Kutenai, 2009–2013 ^b
PM ₁₀	–	–	21	–	13	Nelson Kutenai, 2009–2013 ^b
TSP	–	–	42	–	26	2× PM ₁₀ background values

– Indicates no Alberta Ambient Air Quality Objective for this averaging period, therefore background concentrations not required.

^a CASA 2014.

^b NAPS 2014.

Source: CIAR 42, Section E, Table E.1.2.1, PDF p. 19.

[460] In April and May of 2016, Benga installed and operated six dust-fall samplers (on the project site and in the community) and one ambient air quality passive sampler (on the project site). The passive samplers measured SO₂, nitrogen dioxide (NO₂), and ozone. Benga compared the passive sampling results to the background NO₂ and SO₂ concentrations used for the air quality assessment, and found that the passive sampling concentrations were lower than the derived ambient background concentrations. Benga noted that with only two months of available data, it could not determine the extent to which local measurements were comparable to the ambient background concentrations used in the air quality assessment.

[461] In addition to background concentrations for criteria air contaminants, Benga derived average background potential acid input estimates from the Kananaskis Village measurement site. It derived ambient background VOCs and PAH concentrations from various sources (including documents from the Government of Alberta, the *Canadian Environmental Protection Act*, and the Fort Air Partnership), and it derived ambient background metals concentrations from the Genesee and Power stations in west-central Alberta.

[462] From June to November 2014, Benga conducted meteorological measurements at two locations near the project at a height of 2 m. Benga indicated that during this period, the wind directions were determined solely by the surrounding terrain in the immediate vicinity. Benga also examined wind data from monitoring stations in the Municipality of Crowsnest Pass and at Beaver Mines (at a height of 10 m), and indicated that those wind directions were also fully determined by the surrounding terrain.

[463] In the EIA, Benga proposed to establish an ambient air quality monitoring program to measure dust-fall and document the impacts of potential and localized fugitive dust from project operations. It indicated that details of the monitoring program would be a function of the operational configuration of the mine at any time. As such, the program would need to be developed once the mine plan was established and operations were under way, and then modified as mining progressed.

[464] In an information request prior to the hearing, we asked Benga to provide a draft air quality mitigation and monitoring plan, and to include details of how the monitoring will measure project effects. Benga's draft air quality monitoring and adaptive management plan indicated that the location of ambient air quality monitoring would be determined by the monitoring objectives. It recommended locating one station near the eastern edge of the lease and another in the community of Blairmore near the loadout facility. Benga specified that both sites would measure NO_x, PM_{2.5}, and PM₁₀ continuously.

[465] In its October 2020 hearing submission, Benga indicated that it had installed an air monitoring station in 2019 near Blairmore at the proposed rail loadout (across the highway from the Crowsnest Pass Medical Centre). Benga stated that it had collected more than a year of baseline data from this site to supplement its understanding of air quality at the townsite before beginning construction and operations. Benga committed to continue monitoring the air for the project's life at this location, or at another location in the townsite if both the Municipality of Crowsnest Pass and regulators agreed. Benga also committed to making the air monitoring data available to regulators, the Municipality, Indigenous communities, and the public.

[466] The Coalition indicated that the Crowsnest Pass was one of the regions in Alberta that has never had provincial air quality monitoring (the closest station being in Lethbridge). It argued that Benga utilized measured values from sites in British Columbia that cannot accurately reflect air quality conditions in the Crowsnest Pass. The Coalition expressed concerns that baseline air quality had not been established in the Crowsnest Pass and should be established before any mining operations commence.

[467] ECCC recommended that Benga conduct monitoring of NO₂ and PM_{2.5} in nearby communities for a minimum of one year prior to construction. This monitoring would enable an effective comparison with baseline regional air quality data. ECCC stated that the monitoring data collected so far (at the time of the hearing) was sufficient to inform baseline predictions. But ECCC noted that the air monitoring sensors used by Benga did not meet minimum performance specifications for detection limits and precision for continuous NO₂ monitoring, as established by the *Alberta Air Monitoring Directive*. ECCC reiterated the importance of generating air quality data using equipment, standards, and siting criteria that are robust, such as those described by the *Alberta Air Monitoring Directive*.

[468] In response to ECCC's recommendation, Benga reiterated that it installed an air monitoring station in 2019 at the site of the proposed rail loadout, near the Crowsnest Pass Medical Clinic. Benga committed to continue monitoring the air for the life of the project, either at this location or in the Blairmore townsite. Benga also indicated that it was willing to install a new monitoring station that meets *Alberta Air Monitoring Directive* requirements and to run that station in parallel with existing equipment for at least one year, which would facilitate a comparison of existing air quality data and readings from the new equipment.

[469] Collecting representative meteorological and ambient air quality data at rural locations that have limited historical data can be challenging. Benga attempted to examine and select existing data to best represent the project location, and established air monitoring sites to collect passive, rather than continuous, measurements.

[470] We find that Benga did not monitor ambient air and meteorological conditions for long enough to provide adequate baseline data. Benga primarily utilized the Alberta regulatory meteorological dataset and baseline climate and ambient air quality data to conduct its air quality assessment. Although we believe that using the best data possible is the ideal approach, it is not clear whether the use of more thorough and representative baseline data—instead of the regulatory baseline data used by Benga—would have produced a more reliable air quality dispersion modelling assessment.

[471] Benga has proposed an air monitoring program and commenced additional baseline ambient air quality monitoring. It has also committed to resolving concerns relating to the current air monitoring station. We accept that Benga has committed to ensuring the installed air monitoring station meets equipment and data quality standards; it has proposed an approach to ensure existing data can be reasonably used as baseline air quality information.

Benga's air modelling predictions suggest the project could contribute to exceedances of provincial and federal ambient air standards

[472] Benga conducted an air dispersion modelling assessment that incorporated project emissions associated with the combustion of fuel during drilling, blasting, bulldozing, and loading, as well as dust generation. It considered the following activities in developing its project emissions scenario:

- two coal mining areas – bulldozing and loading of coal
- two drilling areas – drilling, blasting of rock
- three waste removal areas – bulldozing and loading of overburden
- two waste disposal areas – unloading and bulldozing of overburden
- three overburden haul roads – two-way hauling of overburden from waste removal areas to disposal areas
- two coal haul roads – two-way hauling of raw coal from coal mining areas to the plant (including backhauling rejects)
- one reclamation area – loading topsoil from pile, unloading, and bulldozing of topsoil at a reclamation area
- plant area – loading and unloading at a raw coal pile, conveyor unloading, and bulldozing at the clean coal pile
- train loadout – unloading clean coal to train rail cars
- all open activity areas – wind-driven emissions from the piles, mining and strip area, and haul roads

[473] Benga derived mobile equipment emissions from engine power ratings and from the number of engine units required to meet the estimated coal and waste volumes to be moved according to the preliminary mine plan as of April 2016. Dust emissions were based on the total annual coal production and waste volume. Benga stated that slight differences in equipment would not change the conclusions of the air quality assessment. Its summary of the project's daily criteria air contaminant emissions for year 19 is provided in Table 8-2. Benga also provided project emissions relating to VOCs, PAHs, and metals.

Table 8-2. Summary of project daily criteria air contaminant emissions in year 19

Sources	Emission rate					
	SO ₂	NO _x	CO	PM _{2.5}	PM ₁₀	TSP
Maximum hourly emission (kg/h)						
Mine and plant operation	0.60	126	7.7	19	164	636
Train loadout	0.02	0.89	1.6	0.05	0.97	2.0
Blasting	7.1	394	1394	1.1	19	37
Total	7.7	521	1403	20	185	675
Maximum daily emission (kg/day)						
Mine and plant operation	10.4	2322	134	321	2807	10 880
Train loadout	0.2	7.1	13	0.4	7.7	16
Blasting	7.1	394	1394	1.1	19	37
Total	18	2724	1540	323	2834	10 933

Source: CIAR 42, CR 1, Table 4.2-5, PDF p. 44.

[474] To incorporate existing regional air emissions, Benga estimated and included air emissions from Highway 3 and the four communities in the Municipality of Crowsnest Pass within the RSA (Blairmore, Coleman, Bellevue, and Frank). Its summary of the annual average regional air emissions compared with the project emissions is provided in Table 8-3. Benga noted that baseline emissions were similar in magnitude to VOCs and PAH emissions associated with the project. It also noted that hourly and daily emissions of most metals associated with the project were 8 to 13 times greater than those of metal emissions from baseline emission sources.

Table 8-3. Summary of annual average emissions

Scenario	SO ₂	NO _x	CO	PM _{2.5}	PM ₁₀	TSP
Baseline emission (tonnes/year)	2.8	253	1395	35	117	568
Project (tonnes/year)	5.6	929	420	114	1001	3866
Application/PDC (tonnes/year)	8.4	1182	1815	149	1118	4343
Application/PDC increase relative to baseline (%)	201	367	30	322	856	680

PDC = planned development case.

Source: CIAR 42, CR 1, Table 6.2-1, PDF p. 114.

[475] Benga's summary of the dispersion model predictions for the RSA maximum point of impingement is provided in Table 8-4. Benga stated that the model resulted in no predicted exceedances of Alberta Ambient Air Quality Objectives (AAAQO) for NO₂ for any of the averaging periods. For the application case, it noted that the maximum hourly prediction in the RSA occurred east of the project area and was influenced by blasting activities, emissions from waste removal, and vehicle traffic on the haul road. Benga also noted that during hours when blasting was conducted, blasting was the greatest contributor to NO₂ from the project. The maximum annual prediction in the RSA was recorded at Blairmore (near Highway 3) and was primarily influenced by the regional highway and community emissions.

Table 8-4. Summary of key predicted air quality concentrations at the RSA maximum point of impingement

Contaminant	Averaging period	Project-only		Baseline	Application/ PDC	Application/ PDC increase over baseline (%)	AAAQO (µg/m ³)
		Prediction (µg/m ³)	Percentage of AAAQO	Prediction (µg/m ³)	Prediction (µg/m ³)		
SO ₂	9th highest 1-hour	29	6.5	8	32	299	450
	Maximum 24-hour	3.5	2.8	4.6	5.6	21	125
	Maximum 30-day	0.6	1.9	2.1	2.1	0	30
	Maximum annual	0.3	1.5	1.8	1.8	0	20
NO ₂	9th highest 1-hour	290	97	112	293	162	300
	Maximum annual	34	76	46	47	2	45
CO	9th highest 1-hour	5708	38	2241	6054	170	15 000
	Maximum 8-hour	2530	42	1638	2835	73	6000
PM _{2.5}	Maximum 24-hour	43	144	24	50	108	30
	98th percentile 24-hour	25	89	20	32	58	28
	Maximum annual	7.5	75	9.2	11.6	26	10
PM ₁₀	Maximum 24-hour	293	586	72	314	335	50
TSP	Maximum 24-hour	623	623	220	665	202	100
	Maximum annual	128	213	69	153	124	60

PDC = planned development case.

Source: CIAR 42, CR 1, Table 6.3-1, PDF p. 115.

[476] For PM_{2.5} model predictions, Benga did not predict exceedances of the AAAQO or Canadian Ambient Air Quality Standards (CAAQS) at or beyond the mine permit boundary. The modelled maximum point of impingement occurred at the eastern pit boundary as a result of project dust emissions from the haul road, which would be near the boundary of the pit area. It noted that all daily, monthly, and annual predictions for the mine permit boundary and special receptor locations were less than the corresponding AAAQO and CAAQS.

[477] Because there is no AAAQO for PM₁₀, standards from neighbouring jurisdictions are commonly used. Benga predicted the British Columbia Ambient Air Quality Objective for PM₁₀ would be exceeded at the eastern pit boundary as a result of dust emissions from the haul road near the boundary of the pit. Benga also predicted PM_{2.5} exceedances at three special receptors in Blairmore and Coleman, but noted that the exceedances occurred for both the baseline and application cases. Benga predicted TSP exceedances of both the daily and annual AAAQO. Benga noted that daily exceedances were already predicted for the baseline case as a result of emissions from the community and highway, but the application case exceedance shifted to the eastern side of the pit as a result of dust emissions from the haul road.

[478] During the review process, ECCC expressed concerns regarding Benga's air quality assessment. ECCC pointed out that:

- Benga did not compare the predicted modelling results to the CAAQS;
- the representativeness of the air monitoring stations Benga chose to use in determining the background ambient air concentrations for the assessment was questionable; and
- it was unclear if Canadian Pacific Railway line emissions were included in the air modelling assessment, and if not, ECCC requested that Benga provide an assessment of the increase in rail traffic and associated air emissions.

[479] In response to ECCC's information request, Benga summarized the project's air quality assessment predictions and compared them to the applicable CAAQS. Table 8-5 summarizes NO₂ concentrations, Table 8-6 summarizes SO₂ concentrations, and Table 8-7 summarizes PM_{2.5} concentrations.

Table 8-5. Summary of predicted NO₂ concentrations

NO ₂	Project only (µg/m ³)	Background (µg/m ³)	Baseline (µg/m ³)	Application (µg/m ³)	2025 CAAQS (µg/m ³)
98th percentile daily peak 1-hour concentration ^a					
Overall maximum (MPOI)	274	24	110	278	–
Mine permit boundary maximum	104	24	59	107	–
Special receptor maximum	86	24	106	106	79
Annual concentration ^b					
Overall maximum (MPOI)	34	11	46	47	–
Mine permit boundary maximum	12	11	20	28	–
Special receptor maximum	13	11	43	43	23

^a 3-year average of annual 98th percentile of the NO₂ daily maximum 1-hour average concentrations.

^b Average over a single calendar year of all 1-hour average NO₂ concentrations.

MPOI = maximum point of impingement.

Source: CIAR 70, Table ECCC 10-2, PDF p. 36

Table 8-6. Summary of predicted SO₂ concentrations

SO ₂	Project only (µg/m ³)	Background (µg/m ³)	Baseline (µg/m ³)	Application (µg/m ³)	2025 CAAQS (µg/m ³)
99th percentile daily peak 1-hour concentration ^a					
Overall maximum (MPOI)	41	2.6	8.2	44	–
Mine permit boundary maximum	4.8	2.6	2.8	7.4	–
Special receptor maximum	2.7	2.6	7.6	7.6	170
Annual concentration ^b					
Overall maximum (MPOI)	0.3	0.9	1.8	1.8	–
Mine permit boundary maximum	0.05	0.9	0.9	0.9	–
Special receptor maximum	0.05	0.9	1.6	1.6	10.5

^a 3-year average of annual 99th percentile of the SO₂ daily maximum 1-hour average concentrations.

^b Average over a single calendar year of all 1-hour average SO₂ concentrations.

MPOI = maximum point of impingement.

Source: CIAR 70, Table ECCC 11-2, PDF p. 38.

Table 8-7. Summary of predicted PM_{2.5} concentrations

PM _{2.5}	Project only (µg/m ³)	Background (µg/m ³)	Baseline (µg/m ³)	Application (µg/m ³)	2020 CAAQS (µg/m ³)
98th percentile 24-hour concentration ^a					
Overall maximum (MPOI)	24	6.8	20	31	–
Mine permit boundary maximum	5.8	6.8	7.7	13	–
Special receptor maximum	3.1	6.8	18	18	27
Annual concentration ^b					
Overall maximum (MPOI)	7.2	4.0	9.0	11	–
Mine permit boundary maximum	0.9	4.0	4.3	5.0	–
Special receptor maximum	1.1	4.0	8.1	8.2	8.8

^a 3-year average of annual 98th percentile of the 24-hour average concentrations.

^b Average over a single calendar year of all 1-hour concentrations.

MPOI = maximum point of impingement.

Source: CIAR 70, Table ECCC 11-3, PDF p. 39.

[480] Benga stated that the Canadian Council of Ministers of the Environment intended the CAAQS to be used to characterize air quality and potential air quality impacts in areas where people live or where sensitive receptors are found. The council did not intend these standards to be used for comparisons against air quality at a project fence line. Benga also stated that guidance from AEP suggests the CAAQS are to be used for management and/or monitoring, not predictive modelling. As a result, Benga chose to compare only special receptor predictions against the CAAQS, and not the RSA's maximum point-of-impingement predictions or predictions at the mine permit boundary. Benga indicated that it predicted NO₂ exceedances of the 2025 CAAQS at special receptors in both the baseline and application cases, and noted that the prediction at the special receptors did not change with the addition of project emissions.

[481] ECCC requested information from Benga relating to the selection of an air monitoring station to represent background ambient air quality concentrations. Benga asserted that the Lethbridge station provided a conservative assessment of NO₂. Benga confirmed that Canadian Pacific Railway line emissions were not explicitly modelled in the air quality assessment. To address concerns expressed by ECCC, Benga updated its dispersion model to incorporate existing trains and additional locomotives that would operate at the loadout. Benga indicated that the updated modelling resulted in increased application-case NO₂ concentrations and continued to predict exceedances of the 2025 CAAQS for NO₂. Benga acknowledged that the addition of the rail-line emissions and changes to loadout locomotives did increase baseline and application-case predictions. But the overall conclusions of the EIA air quality assessment did not change. Benga also stated that the predictions remained conservative given the use of background concentrations from non-rural monitoring stations.

[482] In ECCC's hearing submission, they continued to express concerns relating to the air quality dispersion model's predictions for the baseline and application cases, even after Benga provided updated modelling results. Benga used baseline monitoring data from the city of Lethbridge, which resulted in a baseline assessment overestimate because the Lethbridge data were not representative of pollutant levels in a rural community. ECCC suggested that the overestimate was so great that it prevented the project's impact on the region's air quality from being adequately assessed. ECCC recommended that Benga re-model regional air pollutants, incorporating the baseline monitoring results, to produce new predictions of NO₂ and PM_{2.5} based on year 19 of the project. ECCC also recommended that the revised modelling should be conducted in a way that minimizes the sources of error previously identified (i.e., biases due to imprecise application of source types, such as road and community emissions).

[483] In response, Benga produced a revised 2020 dispersion model based on the recommendations specified in ECCC's hearing submission. The revised 2020 model utilized ambient background NO₂ concentrations from the Steeper air monitoring station (southeast of Hinton, Alberta). Benga indicated that the Steeper station is more representative of rural ambient backgrounds compared with stations closer to Crowsnest communities and surrounding areas. Benga updated the Blairmore community emissions to more accurately reflect the spatial variation in emissions. It also updated the model configuration for the highway and railroad segments.

[484] Benga noted that the revised 2020 model's predictions for both baseline and application cases were less than the AAAQO for NO₂ at all receptors and averaging periods. Benga's comparison of the 2020 model's predictions to the one-hour CAAQS is provided in Table 8-8, which illustrates that NO₂ concentrations were reduced but exceedances at community receptors were not eliminated. Benga noted that these revised annual predictions resulted in a 30 to 50 per cent decrease at community receptors for both baseline and application cases. For annual predictions, Benga stated that the 2020 model eliminated exceedances of the CAAQS at some locations and likely reduced the exceedance frequency at others.

Table 8-8. Summary of predicted NO₂ concentrations compared with CAAQS

	Revised highway and community modelling 2020			Updated rail and project locomotive emissions 2018 (ECCC-R2-6)			CR 1a original emissions 2016 (CIAR 42)			2025 CAAQS (µg/m ³)
	Baseline (µg/m ³)	Application (µg/m ³)	Application exceedance frequency	Baseline (µg/m ³)	Application (µg/m ³)	Application exceedance frequency	Baseline (µg/m ³)	Application (µg/m ³)	Application exceedance frequency	
98th percentile daily peak 1-hour concentration (a)										
Overall maximum (MPOI)	112	275	–	122	278	–	110	278	9.5%	–
Mine permit boundary maximum	48	105	–	67	107	–	59	107	2.2%	–
Special receptor maximum	102	103	3.8%	118	121	9.0%	106	106	5.3%	79
R1 Campground	91	91	0.7%	88	88	1.0%	86	86	0.7%	79
R2 Trapper's cabin 1	10	44	0.0%	34	60	0.0%	34	59	0.0%	79
R3 Residential 1	89	89	0.6%	91	91	1.2%	88	88	0.6%	79
R4 Residential 2	8.5	21	0.0%	33	45	0.0%	33	45	0.0%	79
R5 Residential 3	9.0	28	0.0%	33	51	0.0%	33	51	0.0%	79
R6 Coleman	100	100	3.1%	103	103	4.6%	95	95	2.8%	79
R7 Frank	87	87	0.5%	89	89	1.1%	85	85	0.6%	79
R8 Blairmore North	102	103	3.8%	118	121	9.0%	106	106	5.3%	79
R9 Aboriginal	23	87	0.3%	46	91	0.6%	43	90	0.6%	79
R10 Residential 4	12	83	0.1%	37	88	0.4%	35	88	0.4%	79
R11 Trapper's Cabin 2	11	86	0.1%	35	92	0.3%	34	92	0.3%	79
R12 Residential 5	16	60	0.0%	40	71	0.0%	38	71	0.0%	79
R13 Residential 6	14	67	0.0%	38	74	0.0%	36	74	0.0%	79
R14 Blairmore Centre	94	94	1.4%	94	94	2.4%	92	92	1.7%	79
Annual concentration										
Overall maximum (MPOI)	33	36	–	51	57	–	46	47	–	–
Mine permit boundary maximum	6.7	14	–	21	28	–	20	28	–	–
Special receptor maximum	28	32		47	51		43	43		23
R1 Campground	14	15	0	26	27		25	25		23
R2 Trapper's cabin 1	2.0	2.6	0	16	17	0	16	17	0	23
R3 Residential 1	14	14	0	27	27		25	25		23
R4 Residential 2	1.9	2.1	0	16	17	0	16	17	0	23
R5 Residential 3	1.9	2.2	0	16	17	0	16	17	0	23
R6 Coleman	28	28		38	38		36	36		23
R7 Frank	19	20	o	31	31		29	29		23
R8 Blairmore North	25	32		47	51		43	43		23
R9 Aboriginal	3.4	7.8	0	18	22	o	17	21	o	23
R10 Residential 4	2.3	15	0	17	28		17	28		23
R11 Trapper's Cabin 2	2.0	4.8	0	17	19	0	16	19	0	23
R12 Residential 5	2.6	6.6	0	17	21	0	17	21	0	23
R13 Residential 6	2.4	5.8	0	17	20	0	17	20	0	23
R14 Blairmore Centre	24	25		36	37		35	35		23

MPOI = maximum point of impingement.
 Source: CIAR 571, Table 2.3, PDF p. 53.

[485] Benga asserted that the updated modelling assessment demonstrates that the results of all the air quality model approaches taken over the course of the assessment process are reasonably consistent with one another. It stated the results are also consistent with one year of monitored NO₂ concentrations at the station near Blairmore. In their final argument, ECCC indicated that they had reviewed Benga's hearing response submission dated October 5, 2020, and acknowledged that Benga had provided modelling of NO₂ per ECCC's recommendation.

[486] We recognize that Benga has devoted considerable effort to conducting several iterations of the dispersion model. It made refinements to address concerns raised by review participants related to the modelling approach. Based on the modelling approaches described by Benga, and with the exception of some fugitive dust uncertainties discussed below, we accept that modelling predictions can be reasonably compared against the applicable AAAQO and CAAQS. Based on Benga's modelling predictions, we acknowledge that baseline NO₂ concentrations were already elevated in the communities due to the adjacent highway. We recognize that project NO₂ emissions may approach or exceed AAAQO at or near the mine pit. But we do not expect this to result in significant increases beyond the mine permit boundary or in adjacent communities.

[487] We find that Benga utilized conservative ambient air quality background concentrations for the air quality assessment. But we also acknowledge ECCC's concern that overly conservative background concentration values can potentially hinder a reviewers' ability to assess project effects on air quality. We also recognize that Benga updated the 2020 model to utilize more-representative background concentrations, which resulted in lower predicted concentrations and fewer exceedances of applicable standards. We find that Benga's updated 2020 model rectified ECCC's concern regarding overly conservative background concentration values.

[488] Benga predicted exceedances of applicable AAAQO and guidelines near the boundary of the project mine pit associated with dust and particulates. But it indicated that pre-existing highway and community emissions already contributed to these exceedances. We find that the addition of project emissions of dust and particulates would adversely affect the ambient air quality in the area immediately surrounding the mine permit boundary.

[489] The CAAQS are intended to characterize and manage air quality and potential air quality impacts in areas where people live or where sensitive receptors are likely found. They are not intended for comparisons against air quality at project fence lines. We have examined the CAAQS as an indicator to help us understand any existing or emerging regional air quality issues to which the project could contribute.

[490] The project SO₂ predictions show negligible changes from the baseline to application case, and concentrations in nearby communities remain well below the applicable CAAQS. We find that the project is not a significant source of SO₂ emissions and would not contribute to regional air quality issues.

[491] The project PM_{2.5} predictions showed some increases from baseline to application case. While the predictions remained below the CAAQS, the annual prediction was close to reaching the standard. We therefore note that project emissions could contribute to a regional air quality challenge for PM_{2.5} in nearby communities.

[492] The project NO₂ predictions showed increases from the baseline to application case, notably in areas surrounding the mine permit boundary and, to a lesser extent, receptors near the project rail loadout adjacent to Blairmore. We note that baseline case predictions in the communities already exceeded CAAQS for NO₂ and acknowledge that these exceedances can be attributed to highway and community emissions. We therefore note that project emissions could contribute to a regional air quality challenge for NO₂ in the nearby communities.

Benga proposed reasonable combustion emission controls and technologies, but uncertainties about haul-road fugitive dust mitigation measures remain

Combustion emissions

[493] Benga indicated that the project will consist of a series of pits that will maintain a balance of overburden removal and production of coal. Benga assumed that the overburden would be mined with hydraulic shovels, end dump trucks, and blasting with ammonium nitrate–fuel oil. Benga also said that coal would be removed using diesel-powered bulldozers, backhoes, and end dump trucks. Benga indicated that operating emissions were due to the combustion of fuel sources (drilling, blasting, bulldozing, loading and hauling) and dust from travel on haul roads.

[494] Benga estimated diesel combustion emissions (NO_x, SO₂, CO, and PM_{2.5}) using emissions factors, engine power rating, load factors, and the number of engines. It estimated dust emissions based on total annual coal production and waste volume, and the number of annual working hours for each activity. Table 8-9 summarizes the estimated project diesel fuel combustion emissions.

Table 8-9. Maximum hourly and daily emissions from project diesel fuel combustion

Project activity	Maximum hourly emissions (kg/h)				Maximum daily emissions (kg/day)			
	SO ₂	NO _x	CO	PM _{2.5}	SO ₂	NO _x	CO	PM _{2.5}
Coal mining	0.5	8.6	0.56	0.10	0.8	164	10.2	1.9
Waste removal	0.15	34	1.89	0.39	2.7	640	34	7.3
Haul road	0.25	48	3.32	0.58	4.1	846	53	10.0
Disposal area	0.10	25	1.25	0.28	1.9	483	24	5.4
Reclamation	0.01	0.3	0.19	0.01	0.1	2.4	2.0	0.1
Plant	0.04	10	0.53	0.11	0.7	187	9.5	2.1
Train loadout	0.02	0.89	1.6	0.01	0.2	7.1	13	0.1
Blasting	7.1	394	1394	–	7.1	394	1394	–
Total	7.7	521	1403	1.5	18	2724	1540	27

Source: CAIR 42, CR 1, Table 4.2-3, PDF p. 43.

[495] Benga stated that ammonium nitrate–fuel oil blasting would be a major source of NO₂, SO₂, and CO emissions. Benga asserted that it conservatively modelled blasting emissions to occur on each day of year 19, rather than the 265 days per year that it expected blasting to actually occur, to ensure worst-case meteorological conditions would occur simultaneously with blasting. In determining blasting emissions, Benga assumed that the ammonium nitrate–fuel oil contained 5.8 to 8 per cent fuel and the fuel oil would be ultra-low-sulphur diesel. Table 8-10 summarizes the blasting assumptions.

Table 8-10. Details for ammonium nitrate–fuel oil blasting

	Volume (bank m ³ /year)	Blasts/year	Powder factor (kg/bank m ³)	Explosives (tonnes)	Explosives/blast
Overburden	48 064 000	265	0.65	31 242	118

Source: CIAR 42, CR 1, Table A5-2, PDF p. 199.

[496] Benga proposed the following mitigation measures and commitments to manage mobile equipment and blasting emissions:

- It would equip heavy-duty mine equipment and the fleet of mine vehicles with United States Environmental Protection Agency Tier 4 engines.
- It would investigate alternative ammonium nitrate–fuel oil formulations that reduce NO_x emissions during blasting.
- It would use propane or natural gas for coal plant building heating.
- It would spread blasting over two or more hours of the day, or over the course of the week, to reduce hourly blasting emissions in any one hour.
- It would implement an integrated dispatch system at the mine to provide overall control of individual trucks and allocate sequencing and routing to minimize delays and unnecessary idling and fuel wastage. It would also manage the fleet to minimize fuel consumption by minimizing haul-road length and gradient, and would regularly maintain the fleet to minimize fuel consumption and emissions.
- It would use low-sulphur-diesel for the mining fleet.

[497] Benga indicated that in 2011, ECCC adopted amendments to the *Off-Road Compression-Ignition Engine Emission Regulations* that aligned Canadian emission standards with those set by the United States Environmental Protection Agency Tier 4 standards for non-road engines, including the emission limits, testing methods, and effective dates. Benga also noted that Canadian Tier 4 standards came into force in January 2012 and apply to engines of the 2012 and later model years.

[498] ECCC indicated that Benga did not clearly define mitigation measures to reduce the impact of mobile equipment on air emissions from the project. ECCC requested that Benga consider a maintenance program, plans to upgrade/retrofit vehicles, anti-idling practices, and operator training for minimizing emissions. In response to ECCC's request, Benga provided an overview of a maintenance and training plan related to mobile equipment. Benga noted that the mine fleet would be regularly upgraded and, by year 19, some equipment may be newer and more efficient than that used for the air quality assessment. Benga also noted that retrofits were not part of the planned emissions mitigation measures because it used exhaust emissions from Tier 4 standards in the air quality assessment, and off-road standards could be more stringent by year 19.

[499] Diesel-powered mobile equipment is a substantial source of project combustion emissions. We accept that Benga has committed to acquiring mobile equipment that is compliant with Tier 4 emission standards, which represents the current *Canadian Off-Road Compression-Ignition Engine Emission Regulations* requirements. We note that mobile equipment operator training and maintenance are important aspects in ensuring emissions are minimized.

[500] Blasting with ammonium nitrate–fuel oil is another substantial source of combustion emissions. Benga did not provide explicit alternatives to the use of ammonium nitrate–fuel oil. However, we acknowledge that Benga’s estimates of the blasting frequency used in its air quality assessment were conservative. We find that Benga proposed reasonable mitigation measures for, and conducted a sufficiently conservative assessment of, blasting emissions.

Fugitive dust

[501] Benga stated that dust emissions from wheel entrainment would be a major source of particulate matter emissions from the project. Benga assumed that haul roads would be regularly watered during the summer, resulting in an 80 per cent reduction of dust emissions from wheel entrainment. Benga also assumed that winter dust emissions from haul roads would be reduced by 90 per cent as the roads would be covered by snow and/or frozen. Benga indicated that, based on climatological data, periods of snow cover would extend from October to April in the project area. Table 8-11 summarizes the estimated project fugitive dust emissions, excluding wind-driven dust emissions.

Table 8-11. Maximum hourly and daily fugitive dust emissions from project activities

Project activity	Maximum hourly emissions (kg/hour)			Maximum daily emissions (kg/day)		
	PM _{2.5}	PM ₁₀	TSP	PM _{2.5}	PM ₁₀	TSP
Coal mining	0.3	1.6	4.7	5.0	29	83
Waste removal	1.2	5.1	13.8	21	96	252
Haul road	15	149	597	256	2556	10 251
Disposal area	0.4	1.6	4.7	7.6	32	89
Reclamation	0.2	2.0	5.0	2.6	13	39
Plant	0.2	3.7	9.2	2.7	54	139
Train loadout	0.03	1.0	2.0	0.3	7.6	16
Blasting	1.1	19	37	1.1	19	37
Total	18	183	673	296	2807	10 905

Source: CIAR 42, CR 1, Table 4.2-4, PDF p. 43.

[502] Benga proposed the following mitigation measures and commitments to manage fugitive dust emissions:

- It would systemically apply water to haul roads and the plant access road to minimize dust using a dedicated water truck.
- It would retain snow cover on the road when safe to do so, to minimize dust in the winter.
- It would use gravel or crushed rock as the underlay on the haul roads to minimize dust.
- It would use a grader to maintain the active surface of the mine roads by moving the silt particles to the inactive portion of the road or covering the active portion with coarser material.
- It would progressively reclaim and revegetate mined areas to reduce windblown fugitive dust emissions from exposed land.

- It would preserve trees and bushes around the mine and plant perimeter to help trap dust emissions from mining activities and reduce dust concentrations farther from mining activities.
- It would limit speeds on mine roads to 50 km/h or less.

[503] ECCC expressed concerns related to Benga's assumption of an average haul-road dust mitigation of 80 per cent. Actual control efficiency could vary both above and below this average throughout the year. ECCC noted that in each year, there will be numerous hours during which mitigation could fall below 80 per cent and this can coincide with warm, dry, and windy conditions that lead to more haul-road dust emissions. ECCC said that Benga's use of an 80 per cent control efficiency in the project model requires an assumption that this level of mitigation can be achieved at a minimum throughout the year. ECCC requested that Benga provide information on the use of an 80 per cent average control efficiency to demonstrate that it was adequately conservative, or to estimate a lower control efficiency.

[504] In response to ECCC's request, Benga said that a literature review indicated that the use of an average control efficiency of 80 per cent would be achievable. Benga stated that the need for this level of control efficiency was the greatest during conditions most conducive to high predicted dust concentrations. It claimed these conditions usually occur in light-wind, stable, low-mixing-height conditions that are most common in the evenings and during winter. Benga stated that watering is expected to be effective longer in light winds, but light winds would not influence other chemical suppressants. It also noted that ECCC guidance indicated that 100 per cent control efficiency could be assumed during days of precipitation or when snow was on the ground. But Benga said that it chose to assume 90 per cent control efficiency throughout the winter.

[505] Dust was a major concern raised by members of the public, particularly the distance dust from the mine would travel. Local residents also raised concerns about Benga's proposed dust mitigations. Mr. A. Garbutt questioned whether Benga's suggested 80 per cent efficacy was possible. Local residents questioned whether there would be sufficient maintenance of the infrastructure to prevent coal from blowing around as the infrastructure ages, and if the dust would be blown around before Benga could apply EnviroBind. A member of the Coalition noted that Benga had plans to deal with dust at the loadout, but it was not clear how dust will be controlled at the mine pit.

[506] In Benga's final argument, it acknowledged that road dust is typically one of the largest sources of fugitive emissions from mining operations. To mitigate dust emissions from mine haul roads, Benga committed to systematically apply water to haul and plant access roads, apply environmentally friendly chemical dust suppressants to roads as necessary, and retain snow cover on roads during winter months, when doing so does not compromise safety. In its final argument, ECCC recommended that sampling, monitoring, and adaptive management be undertaken to assess and mitigate fugitive dust associated with haul-road use and ensure the proposed level of mitigation is achieved.

[507] The Livingstone Landowners Group also raised concerns relating to Benga's estimates of a summer haul-road fugitive dust emission control efficiency of 80 per cent and a winter control efficiency of 90 per cent. The group stated that control efficiencies at coal mines are typically in the range of 55 to 70 per cent and Benga's own evidence does not support an estimate of 80 per cent haul-road fugitive

dust control efficiency. The group asserted that Benga had underestimated fugitive dust emissions from the project.

[508] In response, Benga noted that it had provided several examples of projects that have achieved control efficiencies of greater than 80 per cent through road watering or the application of chemical dust suppressants. Benga indicated that it had based its assumption of 90 per cent control efficiency in winter on the fact that roads will be frozen or snow-covered for much if not all the season, and by considering winter road dust emissions associated with the Grande Cache Coal Mine. Benga asserted that it will achieve its control efficiencies through a number of mitigation measures, including but not limited to road watering.

[509] We agree with ECCC and the Livingstone Landowners Group that Benga's assumption that it can achieve an average of 80 per cent haul road fugitive dust emission control efficiency in the summer may be optimistic. Benga did not adequately support this assumption, as it did not demonstrate the likely efficiency of its road dust management plan for Grassy Mountain. We find that there are uncertainties relating to the haul road fugitive dust mitigation measures proposed by Benga, and we are not confident in the resulting dust predictions that Benga has provided.

Benga has proposed reasonable fugitive coal dust mitigation measures for rail-car loading and conveyor transport adjacent to Blairmore

[510] Benga described the project's coal-handling process. It would consist of transporting coal from the mine pit with large mining trucks to the run-of-mine raw coal dump station at the coal-handling and processing plant. The plant would have raw coal, reject coal, and product coal material handling components, and a processing plant. Within the processing plant, the coal would be sent through a series of screening, cleaning, and mechanical dewatering steps. Benga stated that the processing plant will be contained within a housed area and all coal material handling will be via covered conveyors. Benga also stated that reject material from the processing plant will be dumped in an enclosed bin and trucked back into the mine for disposal.

[511] Benga described several mitigation measures and commitments to managing fugitive coal dust emissions:

- Placing the processing plant within an enclosed building, and using covered conveyors to handle coal material.
- Using luffing stackers (which can lower and raise a boom) to minimize the drop height and drop time of the coal when transferring coal from the conveyor to the stockpile.
- Installing full cladding on the sides of the rail loadout enclosure to create a wind shelter, and utilizing a movable discharge chute located as close as practical to the coal within the rail cars.

[512] Using a water-based, non-toxic dust suppression product such as EnviroBind DCT (or equivalent) to minimize wind-blown dust from rail cars during transport. Benga noted that the product's manufacturer has committed to working with Benga's engineers to develop a spray applicator unit for the loadout, and to provide guidance in monitoring and optimizing the treatment amounts on-site.

[513] Benga commissioned an engineering study to determine how well the rail-car topper product could mitigate coal dust during the transportation of clean coal product via rail from Blairmore to Vancouver (a distance of about 1100 kilometres). Benga noted that the study tested, by vibration and wind tunnel, a topper product dose that resulted in a particulate loss of 0.09 per cent.

[514] Benga provided additional details about the rail loadout enclosure and the efficacy of mitigating fugitive dust emissions. It confirmed that the rail loadout will be fully enclosed and under a roof. Benga indicated that within the loadout, a movable discharge chute will be lowered as close as practical to the coal within the rail cars. As each car is loaded, the coal surface will be rolled for compaction and sprayed with a topper product to stabilize coal dust during transport to port. Benga noted that this is an industry-accepted approach that has been proven to be an effective way to transport coal products while limiting any potential fugitive coal dust.

[515] Benga stated that the cladding around the loading operations would provide a second barrier for dust emissions. The intent of the cladding was not to create an air-tight barrier but to provide an additional wind break around the operation. Benga provided photographic examples of a similar loadout configuration and noted the lack of coal fines in and around the loadout. Benga asserted that this provides a qualitative illustration of the efficacy of the rail loadout structure in minimizing fugitive dust and coal spillage. It stated that, based on emission and dispersion modelling results, the design of the rail loadout structure and the logistics of loading and transport are adequate to mitigate the potential effects of fugitive dust emissions from loading activity on the adjacent highway and communities. Benga also asserted that there would not be significant effects related to fugitive coal dust resulting from the project.

[516] In its hearing submission, ECCC expressed concerns relating to potential fugitive dust emissions from rail transport of the coal product. ECCC recommended that Benga conduct baseline monitoring of PM₁₀ deposition along the rail corridor prior to and during project operations to assess the project's contribution to fugitive coal dust emitted from open rail cars. They also recommended that Benga consider the potential for re-application of the rail-car topper product at a later point along the route to port, as well as the potential for covers to be applied to rail cars.

[517] Benga indicated that the rail-car topper product was similar to what other companies use, and that Canadian Pacific Railway has at least one re-applicator on the route to Vancouver. Benga stated that it would be optimal to have a product that remained intact for the entire journey, and it would continue to work with Canadian Pacific Railway, and if necessary, use other solutions such as re-application. Benga stated that it considers monitoring of dust along the rail-haul corridor and, if necessary, re-application of the topper product to be the responsibility of Canadian Pacific Railway. Benga also noted that Canadian Pacific Railway has already installed re-application stations along the rail route, which it employs as necessary, along with other mitigation measures to achieve acceptable dust mitigation.

[518] While the project has the potential to emit fugitive coal dust, Benga has committed to a number mitigation measures. We expect that the enclosed coal-processing plant, luffing stackers at the coal stockpile, enclosed conveyors, fully cladded rail loadout, and moveable loadout discharge chute should be reasonably effective in mitigating the release of fugitive coal dust. Benga has made a considerable effort to mitigate project fugitive coal dust impacts on nearby communities. We find that these

commitments by Benga are appropriate and reasonable measures to mitigate fugitive coal dust impacts on nearby communities.

[519] Fugitive coal dust emissions from open-top rail cars may occur during transport to port. But Benga has conducted an engineering study to test the application of a rail-car topper product. Benga's proposed mitigation, the use of a topper product, is common industry practice. Benga is not responsible for fugitive rail car emissions along the journey to port. Rather, this would be the responsibility of Canadian Pacific Railway, which operates topper product re-application stations along the route. We find the measures that Benga has proposed to mitigate coal dust emissions from rail cars to be reasonable and appropriate.

Benga likely underestimated the potential for and effects of worst-case wind-driven dust emissions

[520] Benga estimated, and incorporated into its air quality assessment, wind-driven emissions from active areas of project operations. Project sources of wind-driven emissions included aggregate pits, overburden removal strip, unpaved haul roads, and stockpiles. Benga derived estimates for wind-driven emissions using emission factors from an ECCC guidance document, which assumed that wind-driven emissions occur at wind speeds of greater than 5.36 m/s. Benga estimated TSP, PM₁₀, and PM_{2.5} emissions by assuming that wind-driven emissions occurred 100 per cent of the time. Benga conducted the air quality dispersion model using the Alberta regulatory meteorological dataset for the years 2002 to 2006. But it assumed that wind speeds were always capable of generating wind-driven emissions.

[521] Benga estimated wind-driven emissions from the actively disturbed area, as it expected the overburden and remediation area to be crusted or covered by vegetation or snow. These conditions would reduce the wind erosion potential. Benga assumed that 10 per cent of the mining and stripping area, and 30 per cent of unpaved hauling roads, were active for wind-driven emission calculations. Benga estimated that the total active area generating wind-driven emissions was 35 ha; its summary of maximum daily wind-driven emissions is provided in Table 8-12.

Table 8-12. Maximum wind-driven daily emissions on the windiest day in five years of meteorological data

	Dump area	Coal mine area	Waste strip area	Reclamation area	Unpaved haul road	Coal pile	Total
Actively disturbed area (ha)	4.3	1.5	4.4	2.0	18	4.7	35
Emissions (kg/24-hour day)							
PM _{2.5}	52	11	53	24	44	26	211
PM ₁₀	129	29	132	61	110	66	527
TSP	258	57	264	122	220	132	1054

Source: CAIR 42, CR 1, Table A4-4, PDF p. 194.

[522] In an information request, we asked Benga to evaluate the potential effects of high wind speeds on dust from the project. Benga asserted that one-hour wind speeds in the range of 89 to 102 km/h (or 25 to 28 m/s) have not been recorded at the stations examined in the air assessment. Nor have such speeds been observed in the area of the mine permit boundary in the 2002–2006 Alberta regulatory meteorological dataset. Benga maintained that the air quality assessment model accounted for wind-

driven dust conservatively at all wind speeds, with wind-driven emissions assumed to occur at wind speeds above 5.36 m/s for 100 per cent of the time. Benga provided the frequency distribution of high wind speeds at the four monitoring stations and the mining and dump areas. It noted only six incidents of wind speeds exceeding 60 km/h over monitoring periods of varying lengths (three months to five years). Benga also confirmed that the air quality assessment model results include predictions for high wind speeds; there were no predicted exceedances of the 24-hour AAAQO for PM_{2.5} at any wind speed.

[523] In a subsequent information request, we asked Benga to summarize the wind speed data (including maximum wind gust speeds) for the Crowsnest and Beaver Mine meteorological stations. We asked Benga to evaluate the potential for wind-driven dust emissions as a result of maximum wind gust speeds. In response, Benga summarized daily maximum gust wind speeds from the Crowsnest and Beaver Mines meteorological stations from the past 10 years, with winds of greater than 30 km/h defined as gusts. Benga indicated that the daily maximum gust frequency (for wind speeds exceeding 80 km/h) is less than 1.5 per cent at the Crowsnest station and less than 3.7 per cent at the Beaver Mines station. Benga also indicated that the median gust frequencies are higher during the summer and lower in the winter.

[524] Benga examined the frequency of potential wind-driven dust due to gusts by examining the maximum observed gust in each day. It estimated gust speeds by doubling hourly mean wind speeds. Benga asserted that the air dispersion model generated substantially more wind-driven dust events compared with the number that would be suggested by actual data from the Crowsnest and Beaver Mines stations. Benga noted that the Alberta regulatory meteorological dataset does not include gusts. But this was accounted for by applying the 5.4 m/s speed threshold for wind-driven dust emissions and assuming unlimited erosion potential. The model assumed that the surfaces were disturbed every hour to create new fine material for erosion.

[525] A number of local residents also raised concern that Benga did not appropriately consider the high wind speeds in the area. Several participants stated that the Crowsnest Pass was known for high winds and at the hearing they shared their personal experiences with the strong winds in the area. Witnesses for the Coalition said that hurricane clips are required for roofs in the area, and they described having furniture blow off their porch. Ms. M. Field said that she had been “blown off” her feet by the winds and that the winds were more dangerous than Benga indicated in their assessment. Another local resident, Mr. McIntyre, stated “the wind here has to be experienced to be believed” and noted that the area experienced regular hurricane-force winds (CIAR 756, PDF p. 82).

[526] The Livingstone Landowners Group expressed concern that Benga did not consider high wind speed events, referred to as chinooks, in its air quality assessment. They suggested that Benga’s wind-driven emission estimation methodology only reliably predicted dust emissions over time (e.g., annually) and almost certainly underpredicted wind-driven dust emissions on the windiest days. The group also expressed concerns with the data obtained by the on-site meteorological stations that Benga had situated within project boundaries, where measurements were not made at a standard height and data were only collected for two to three months in 2014.

[527] Benga clarified that it used wind data from the Crowsnest and Beaver Mines meteorological stations and the Alberta regulatory meteorological dataset to develop the air quality dispersion models. Benga stated that it used information from the two on-site monitoring stations to inform terrain influences on wind and help inform the dispersion modelling. It indicated that this information was representative of a year-round assessment.

[528] The Livingstone Landowners Group's expert, Dr. J. Young, conducted an analysis of meteorological data collected from the Beaver Mines station. He said this data indicated that the project's wind-driven emissions could range from 231 to 723 kilograms per day (kg/day). Dr. Young indicated that 723 kg/day of emissions could mean a 37 per cent (worst-day) increase in dust concentrations above the wind-driven dust emissions calculated by Benga. He suggested that Benga has not looked at the worst case for wind-driven dust emissions.

[529] The group also raised concerns relating to the size of the area that Benga used to estimate wind-driven dust emissions for the project. They noted area discrepancies, including references to 161 ha of mining area as opposed to 121 ha, stockpile areas for run-of-mine coal and clean coal, and inclusion of the reclamation area. The group specifically noted that the mine progression plan for year 19, which is the year modelled in the air quality assessment, indicated an active mine area of approximately 300 ha. They asserted that Benga was unable to explain the discrepancy between the 300 ha in the year 19 mine progression plan and the 121 ha used in the air quality assessment wind-driven dust emission estimates. They calculated that 12 ha (10 per cent of 121 ha) was used for modelling, instead of 30 ha (10 per cent of 300 ha), and submitted that the wind-driven dust emissions from the active mining and stripping area had been underpredicted by 150 per cent.

[530] Benga indicated that the project's wind-driven dust emission estimates assumed that 35 ha of the mine area would be disturbed on a continuous basis. Benga also stated that the estimate of actively disturbed area assumed that approximately 10 per cent of the total modelled mining and stripping area was active for wind-driven dust emissions, even though the actual area assumed to be active for wind-driven emissions depended on the specific use of the area. Benga asserted that it overestimated the project's wind-driven dust emissions. Its estimate was based on assumptions in the modelling that emissions would occur for 24 hours each day of the year (with hourly winds above 5.36 m/s), its assertion that wind-driven dust emissions at night would be lower due to reduced operational activity, and the fact that it did not take into account dust reductions due to precipitation.

[531] The Livingstone Landowners Group suggested that Benga's air quality assessment assumed that 30 per cent of haul roads would be actively disturbed. This assessment failed to consider two-way traffic on the haul roads, as two-way traffic would use more than 30 per cent of haul-road width. Benga acknowledged that when two trucks pass each other, a width greater than 30 per cent of the road is likely disturbed. But Benga also maintained that it is fair to assume that when a lone truck is driving on the haul road, its points of contact with the road will likely be less than 30 per cent of the road's total width. Benga asserted that the actively disturbed haul-road assumption of 30 per cent is reasonable and conservative for the purpose of predicting fugitive dust emissions.

[532] We acknowledge that Benga—to conduct the air quality dispersion modelling—utilized the Alberta regulatory meteorological dataset and data from the Crowsnest and Beaver Mines meteorological stations. The on-site meteorological stations installed by Benga in 2014 and operated for two to three months were used to supplement the air quality assessment, and not necessarily used to estimate wind-driven dust emissions. We also recognize that the wind speed data considered by Benga to estimate wind-driven dust emissions may be representative of averaged and long-term effects. But they may not represent worst-case high-wind-speed events.

[533] We acknowledge that Benga assumed the 35 ha area used in the wind-driven dust estimate would be disturbed on a continuous basis (including nights, when reduced operational activity is expected), and that Benga did not factor in the mitigating effects of precipitation. However, we also recognize the existence of uncertainties and inconsistencies relating to Benga’s estimate of active disturbed mine area used in the estimation of wind-driven dust emissions. In our examination of these concerns in the terrain and soils chapter we conclude that we are not confident in Benga’s timing for re-establishing on-site vegetation, or its proposed measures to minimize erosion.

[534] According to the wind-driven dust emission estimates, unpaved haul-road emissions account for a notable portion of the dust emissions. We accept that Benga’s assumption of 30 per cent haul-road active disturbance is reasonably conservative, with the understanding that Benga would only operate a finite number of vehicles, whereas the haul-road emissions are assumed to be continuous for the entire length of the road. Opinions vary on which methodology is most suitable for estimating wind-driven dust emissions. Therefore, it is important to provide a detailed and sound rationale to support the methodology chosen and the assumptions made. We find that, although Benga has likely adequately estimated the average wind-driven dust emissions from the project, it has likely underestimated the potential for and effects of worst-case wind-driven dust emissions.

The project is unlikely to result in adverse effects related to nitrogen or acid deposition

[535] Benga’s EIA considered nitrogen deposition using an approach in which the nitrate particulate was determined to be deposited by both wet and dry processes and was directly calculated by the air quality assessment dispersion model. Benga adopted nitrogen deposition critical-load values from the World Health Organization, with the lowest value being 5 kilograms per hectare (kg/ha) per year of nitrogen. It also used a precautionary value of 3.5 kg/ha per year of nitrogen.

[536] Benga’s air quality assessment dispersion modelling predicted the maximum nitrogen deposition within the regional study area to be 6.5 kg/ha per year of nitrogen in the baseline case and 9.4 kg/ha per year of nitrogen in the application case. The maximum annual nitrogen deposition at the mine permit boundary was predicted to be 1.9 kg/ha in the baseline case and 3.0 kg/ha in the application case. In comparison to the annual critical nitrogen load threshold of 5.0 kg/ha, the baseline case predicted an area of exceedance of 0.6 square kilometres (km²) and the application case predicted an area of exceedance of 0.7 km², indicating a net increase of 0.1 km².

[537] Benga’s EIA also considered the project’s potential for acid deposition with potential acid input of both dry and wet deposition. Benga identified the management levels of the *Alberta Acid Deposition Management Framework* to be critical load (with a trigger level of 0.50 kiloequivalents of hydrogen ions

per hectare per year [(kEq H⁺/ha/year)], target load (with a trigger level of 0.45 kEq H⁺/ha/year), and monitoring load (with a trigger level of 0.35 kEq H⁺/ha/year).

[538] Benga indicated that the project precursor emissions for potential acid input included NO_x and SO₂. Benga's air quality assessment dispersion modelling predicted the maximum annual potential acid input within the regional study area to be 0.11 kEq H⁺/ha/year in the baseline case and 0.18 kEq H⁺/ha/year in the application case. Benga predicted the maximum potential acid input at the mine's permit boundary was predicted to be 0.02 kEq H⁺/ha/year in the baseline case and 0.04 kEq H⁺/ha/year in the application case. All of the predictions were below the *Alberta Acid Deposition Management Framework* monitoring-load threshold. Benga noted that the baseline case annual maximum predicted values in the RSA occurred near Highway 3 and the community of Blairmore. The values were primarily influenced by regional community and highway emissions.

[539] Benga provided an air quality mitigation and commitments summary table. It includes the pathway of effect for changes to terrestrial and aquatic habitats associated with increased potential acid input and nitrogen deposition. Benga stated that the mitigation measures for NO_x and SO₂ also mitigate potential impacts associated with acid input and nitrogen deposition. Benga predicted that the project would increase nitrogen deposition in the RSA and at the mine permit boundary, though the spatial extent of adverse nitrogen deposition would be limited. It also predicted that the project could increase potential acid input in the RSA and at the permit boundary, but without exceeding the monitoring-load threshold.

[540] Project NO_x emissions are the primary precursor to nitrogen deposition and potential acid input. Project SO₂ emissions also contribute to potential acid input. We find that the project's nitrogen deposition and potential acid input effects are not likely to have an adverse impact on the local ecosystem, as they do not exceed the critical load for potential acid input. Moreover, the increase in the areal extent of effects related to nitrogen deposition is small. We note that NO_x (and SO₂) emission mitigation measures will also mitigate nitrogen deposition and potential acid input.

The project is not likely to result in significant adverse effects on air quality

[541] We assess the residual project effects related to air quality as follows:

- **Magnitude:** moderate. The magnitude of emissions associated with combustion are relatively low. The magnitude of particulates and dust attributed to mining activity is high, with some predicted exceedances at localized receptors. On balance, the net effects represent a moderate impact.
- **Geographic extent:** local. Project air emissions are primarily localized to the mine permit boundary and rail loadout facility.
- **Duration:** medium. Emissions will last for the duration of the project, including construction, operation, and reclamation. But emissions are expected to cease after reclamation is complete.
- **Frequency:** continuous. Emissions will be ongoing throughout the life of the project (including construction, operation, and reclamation).
- **Reversibility:** reversible. Combustion emissions are likely to be reversible in the short-term, whereas dust deposition due to wind is likely reversible in the long-term.

- **Ecological or social context:** negative. Adjacent communities are socially sensitive to deposition of coal dust.

[542] We find that the project's air emissions would have an adverse, but not significant, effect on ambient air quality. We have a moderate-to-high level of confidence in our assessment, given that we found that Benga has likely underestimated the potential for and effects of worst-case wind-driven dust emissions.

Cumulative effects

[543] Benga conducted a cumulative effects assessment of the air quality parameters that it considered to have residual effects. But it concluded that the cumulative effects in the planned development case were quantitatively similar to those in the application case, since there were no other reasonably foreseeable projects or emissions sources. Benga concluded that none of the cumulative effects related to air quality were significant. Benga noted that the magnitude of the nuisance effects related to TSP concentrations would be high—but localized—at or near the project site. It assigned every other parameter a low or moderate magnitude. Benga did not propose any mitigation or follow-up measures specifically to address cumulative effects, but reiterated its project-level efforts.

[544] We acknowledge that Benga included existing emissions from Highway 3 and Crowsnest Pass communities in its application assessment. We agree that few other industrial emissions exist that would combine cumulatively with the project emissions. And we note that the project's emissions would be largely localized. We accept Benga's assertion that there is no large quantitative difference between the application case and the planned development case. We also note that other participants did not raise concerns specific to the cumulative effects assessment for air quality. We find that the cumulative effects related to air quality will not be significant.

9. Greenhouse Gas Emissions

[545] Our terms of reference require us to take into account, as an additional factor per section 19(1)(j) of *CEAA 2012*, all incremental air pollutant and greenhouse gas emissions directly attributable to the project. This includes rail transport to the coast of British Columbia and marine emissions within Canadian territorial waters.

Greenhouse gas emissions from the project are relatively modest

[546] The primary sources of greenhouse gas emissions from the project are diesel combustion from the mine fleet and haul vehicles, combustion emissions from rail and marine transport, fugitive emissions of coal-bed methane, and indirect emissions from acquired electricity.

[547] Benga estimated greenhouse gas emissions from the project. To estimate fugitive methane emissions, it used factors provided by the Intergovernmental Panel on Climate Change. To estimate emissions from diesel combustion, it used ECCC factors combined with the amount of fuel consumed. To estimate emissions from rail traffic, Benga assumed a rail travel distance of 1100 km and an emission factor of 15.2 grams (g) of carbon dioxide equivalent (CO_{2e}) per tonne-km. For marine emissions, Benga assumed a travel distance of 180 km from the Port of Vancouver to international waters, and a capsized class of dry bulk cargo vessel with an emission intensity of 2.7 g CO_{2e} per km-cargo tonne. Benga based greenhouse gas emissions associated with electricity consumption on the electricity-generation intensity for Alberta, which at the time was 930 g of CO_{2e} per kilowatt-hour. Benga used year 19 of mine operations to represent the project's maximum annual greenhouse gas emissions, as that is the year when the mine would be at full production.

[548] Benga stated that decommissioning and reclamation activities would occur largely concurrently with mining activities. Therefore, Benga accounted for these mine phases in the operations emissions. It determined that emission sources from closure activities were not significant, as these activities would primarily use electricity and would involve a small fraction of the equipment required during operations. Benga also stated that it did not expect significant greenhouse gas emissions from the closure components of the project, such as the sediment pond and end-pit lake; the small quantities of organic material in these landforms generate little in the way of greenhouse gases. It did not quantify greenhouse gas emissions associated with land-use change, and noted that an increase in forest carbon sequestration was expected after the project was reclaimed.

[549] Benga did not quantify the greenhouse gas sink that would be lost due to the project. It stated that carbon-sink losses would be addressed by amending soil with woody debris or fertilizing and revegetating stockpiled soil, reclaiming and reforesting the project, and minimizing the lifetime of soil stockpiles. However, it added that recovery of carbon-sink losses would depend on the successful reclamation of the site.

Table 9-1. Total greenhouse gas emissions in year 19 and over the life of the project

Source	Highest annual emissions (kt CO _{2e}) in year 19	Lifetime emissions (kt CO _{2e})
Construction	–	22
Operations		
Mine	172	4139
Rail transport	64	1530
Marine shipping	1.9	44
Fugitive methane	70	1692
Indirect (electricity)	120	2896
Reclamation	Included in operations	Included in operations

Source: CIAR 251, Package 1, Table 1.8-3, PDF p. 42.

[550] Benga stated that the project would make a minimal contribution to Alberta's and Canada's total annual greenhouse gas emissions. Based on the project's predicted emissions in year 19, the company estimated that the project would comprise approximately 0.14 per cent of Alberta's 2013 greenhouse gas emissions and 0.05 per cent of Canada's 2013 greenhouse gas emissions. Benga anticipated that the project's contribution to total emissions would be lower in the other years of the project's life.

[551] Ms. B. Janusz stated that it was nearly impossible to predict the project's contribution to national and provincial emissions totals over the life of the mine, particularly once the clearing of forested areas and the carbon footprint of workers is taken into consideration. The Eco-Elders for Climate Action raised a concern about the release of methane from exposed coal. The Livingstone Landowners Group noted that Benga's air quality assessment underestimated the project's fugitive methane emissions. They referenced peer-reviewed articles that argued current estimates of methane emissions from fossil fuels are underestimated. Benga's expert witness, Mr. R. Rudolph, stated that he was aware of the debate on whether methane emissions had been historically underestimated, but that he had no opinion on it.

[552] The Livingstone Landowners Group questioned Benga's conclusion that greenhouse gas emissions from the project would not be significant. The group asserted that Benga based this conclusion solely on the fact that the project's emissions would be a tiny percentage of overall provincial and national emissions. It questioned whether Benga had compared its greenhouse gas emissions with those of other businesses that employed comparable numbers of people. Benga responded that ECCC had noted that its project was in the middle of the typical range of other metallurgical coal mines. Benga said comparing the project's greenhouse gas emissions with other, unrelated businesses is not a valid approach.

[553] ECCC noted that the lifetime greenhouse gas emissions from the project would be 10.3 million tonnes of CO_{2e}, and estimated the project's emissions intensity to be 0.064 tonnes of CO_{2e} per tonne of metallurgical coal produced. ECCC expected that the project's greenhouse gas emissions intensity would be in the middle range of currently operating metallurgical coal mines. However, ECCC did not explain why the project would be in the middle range, providing only numerical values comparing the project's emissions intensity to other surface metallurgical coal mines. Nor did ECCC provide details on whether there was a relationship between access to infrastructure and the use of lower-emitting electrically powered mining equipment. ECCC stated that further analysis of the geological characteristics of the

mine was needed before final conclusions could be made regarding the project's emissions intensity. But they questioned whether the project was designed to minimize greenhouse gas emissions.

[554] We find that Benga did a reasonable job estimating the project's greenhouse gas emissions. We do not believe there are any major sources of greenhouse gas emissions overlooked in the assessment.

Benga's proposed measures to mitigate greenhouse gas emissions are reasonable

[555] Benga proposed mitigation measures for greenhouse gas emissions that focus mainly on the mine fleet, including speed limits, optimization of haul distances, and routine maintenance and upgrades of fleet equipment to minimize fuel consumption and emissions. It committed to acquiring a mobile mine fleet that meets Tier 4 emission standards for heavy-duty off-road vehicles, per the *Off-Road Compression-Ignition Engine Emissions Regulations*. Benga committed to tracking the fleet's fuel consumption, including fuel orders placed and individual vehicles' fuel use. It committed to requiring its contractors to track fuel consumption on the project site. It also committed to investigating potential opportunities to increase the amount of renewable electricity used on site and to use lower-carbon diesel fuel as it becomes available. When questioned, Benga could not provide any details on the availability of lower-carbon diesel. But it noted that the federal government had introduced new legislation that would reduce the carbon content in fuels. Benga estimated that changes in the future power mix of the largely coal-fired electricity grid could reduce the project's lifetime emissions by 10 per cent. Benga also stated that it is "following" potential local sources of wind and solar generated electricity, but did not make any specific commitments to use renewable energy.

[556] Benga stated that coal-bed methane recovery is not practical for the project, because the levels of methane remaining in the coal are relatively low. It therefore did not propose specific mitigation measures for fugitive methane, though it noted that it would be covering the coal seams and putting back reclamation material during closure and reclamation.

[557] To mitigate greenhouse gas emissions from rail traffic, Benga stated that it would request the Canadian Pacific Railway use its lowest-emitting units to transport coal from the project to the Port of Vancouver. Similarly, to mitigate emissions from marine shipping, Benga stated that it would request that the shipping contractor dedicate its low-emitting units to the overseas transport of coal from the project. When questioned about the feasibility of this measure, Benga acknowledged that it could not make decisions on behalf of its commercial partners, but committed to pursue these measures nonetheless. ECCC also acknowledged the challenge in mitigating emissions by third parties but recommended Benga require the lowest-emitting units when negotiating shipping contracts.

[558] Benga predicted that the residual effects on air quality due to greenhouse gas emissions associated with the project would not be significant, particularly after implementing mitigation measures. Benga predicted the effects would be low in magnitude, local in extent, occur continuously, and last the duration of the project. But they would be reversible after project operations cease. It also concluded that the cumulative effects related to greenhouse gas emissions were not significant, as there were no reasonably foreseeable future projects within the air quality cumulative effects assessment RSA that were expected to act in a cumulative manner. Benga's examination of an expanded study area beyond the RSA found that there could be a small increase in emissions due to rail traffic and marine shipping outside of the RSA.

[559] ECCC recommended Benga develop, implement, and regularly update a greenhouse gas emissions reduction plan to ensure the project's emissions were minimized and continued to be refined based on emerging technologies and practices. It also recommended that Benga employ a best available technology (BAT) / best environmental practices (BAT/BEP) determination process to identify additional mitigation measures, describing it as a means to reduce the project's greenhouse gas emission intensity. ECCC provided a report analyzing BAT/BEP in the coal mining sector, and suggested some potential additional greenhouse gas mitigation measures.

[560] Benga responded directly to a number of ECCC's proposed alternatives, identifying physical site and operational challenges with implementing autonomous hauling, mobile fleet electrification, an overland conveyor for transporting coal from the mine pit to the coal-handling and processing plant, and on-site power generation. It also identified technological challenges in using natural gas to displace diesel fuel, and stated that there was insufficient methane present to conduct coal-mine methane pre-drainage and injection into a natural gas pipeline. Benga did agree to eliminate the use of thermal dryers, as recommended by ECCC. It also agreed to update its plans and programs as new and improved technologies arise, and committed to launch the project with the best technology that is economically feasible.

[561] Benga argued that it had committed to feasible mitigation measures to minimize greenhouse gas emissions and to adhere to continuous improvement. It committed to implement a greenhouse gas management plan to manage and reduce greenhouse gas emissions, particularly CO₂ and methane associated with the project. The plan included proposed mitigation measures and emissions reduction commitments, as well as a means of tracking emissions to enable continuous improvement. Benga argued that it has adopted targeted measures to reduce greenhouse gas emissions associated with the fleet, which is a key emission source. It also stated that the greenhouse gas management plan proposed feasible management actions to reduce emissions by incorporating high-efficiency equipment and increasing the fraction of renewable electricity used on-site.

[562] Provincially, the project must comply with the requirements of Alberta's *Technology Innovation and Emissions Reduction (TIER) Regulation*. The Alberta government has implemented the TIER program as a greenhouse gas regulatory framework to replace the *Carbon Competitiveness Incentive Regulation*. Benga stated that the project would join the TIER program, describing it as the "core of emissions management in Alberta" (CIAR 907, p. 5257). In response to questions at the hearing, Benga stated that it had not yet performed the calculations to determine its compliance obligations under the new regulation, or determined how it would satisfy those obligations. It also said that it did not know if the TIER regulation would increase its compliance burden compared with the previous regulatory program.

[563] We find that Benga proposed reasonable efforts to reduce greenhouse gas emissions, and we acknowledge that the proponent committed to continuous improvement. We recognize, however, that Benga did not have a plan to address the new TIER regulations, nor, as discussed below, to address new federal climate change objectives. We find that the greenhouse gas emissions from the project will be modest and subject to regulatory mechanisms through Alberta's TIER program.

Project greenhouse gas emissions are not aligned with current federal objectives

[564] In 2020, the Government of Canada tabled the *Canadian Net-Zero Emissions Accountability Act*, which requires the setting of national targets for the reduction of greenhouse gas emissions in support of achieving net-zero emissions in Canada by 2050. This commitment built on Canada's previous commitment under the Paris Agreement to reduce greenhouse gas emissions by 30 per cent below 2005 levels by the year 2030.

[565] ECCC stated that the government would consider whether the project would contribute to or hinder Canada's ability to meet its climate change commitments. They noted that their recommendation that the project continue to reduce greenhouse gas emissions is in alignment with the government's climate change objectives. ECCC stated that they expect the emissions intensity of surface metallurgical coal projects to decrease over time. This decrease will be due to the development of efficient technologies and the implementation of federal and provincial policies and regulations. ECCC encouraged Benga to adopt multiple BAT/BEP options to significantly reduce greenhouse gas emissions and help Canada meet its net-zero goal.

[566] The Livingstone Landowners Group argued that even though the new federal legislation had not yet come into force, Canada's existing international obligations under the Paris Agreement require Canada to take ambitious measures to reduce greenhouse gas emissions. The group submitted that our task is to consider whether approval of the project would affect Canada's ability to achieve net-zero greenhouse gas emissions by 2050. The group also pointed out that, because national greenhouse gas emissions in 2013 were 726 million tonnes of CO_{2e}, a large reduction would be required to meet the federal target. The group noted that Benga said the project's highest emissions are expected in 2042, which is only eight years before Canada's net-zero target date of 2050. These emissions can only make it more difficult for Canada to meet its target.

[567] Benga acknowledged the project would have to be well below its predicted emissions to make a positive contribution to helping Canada meet its climate change objectives. But Benga also noted that the project would cease production by 2048, and that, in its view, the project would be among the top-performing metallurgical coal mines in terms of greenhouse gas emissions. While acknowledging that its absolute emissions will likely add an extra burden, Benga argued that these emissions would be small compared with the country's overall emissions. Benga noted that its predicted emissions are a "starting point," and that it expects to reduce emissions over the life of the project as emerging technologies become available.

[568] We note that Benga did not provide any evidence to support its assertion that the project would be among the best greenhouse gas performers among metallurgical coal mines. Nor did ECCC explain the logic behind its assertion that the project would fall into the middle range of this industry performance. In either case, while it is not yet clear how Canada intends to achieve the objectives set out in the *Canadian Net-Zero Emissions Accountability Act*, it is reasonable to assume that Canada will put greater emphasis on encouraging industrial projects to reduce their greenhouse gas emissions.

Greenhouse gas emissions from the project are modest, but pose an incremental challenge to Canada in meeting its climate change objectives

[569] The project will contribute more than 10 million tonnes of greenhouse gas emissions over the course its lifetime. Although we accept that the project’s contribution to overall greenhouse gases is modest compared with total provincial and national emissions, we find that this is an adverse effect. We also note that the project would pose a challenge to the Government of Canada’s objective to achieve net-zero emissions by the year 2050. However, the federal government does not yet have a detailed management or regulatory system in place to achieve this objective. The development of policies and programs to meet Canada’s international greenhouse gas reduction commitments are beyond the scope of our review.

[570] Were it to proceed, the project would be required to meet existing provincial and federal requirements for greenhouse gas emissions, and would have to comply with any changes to regulatory requirements that emerge over the life of the project. Benga has indicated that it is prepared to comply with all such regulatory requirements. We assessed the project’s greenhouse gas emissions as follows:

- **Magnitude:** low. Project emissions are modest compared with provincial and national emissions, and would make a minor contribution to overall emissions.
- **Geographic extent:** international. Molecules of carbon, once emitted into the atmosphere, mix globally and become part of the overall enhanced greenhouse effect.
- **Duration:** long. Emissions will last throughout the duration of the project.
- **Frequency:** continuous. Emissions will continue throughout the life of the project.
- **Reversibility:** irreversible. Greenhouse gases emitted by the project will remain in the atmosphere for decades.
- **Ecological or social context:** neutral. The local environment of the project is sensitive to climate change, but this sensitivity is driven by global, not project, emissions.

[571] We conclude that the project’s greenhouse gas emissions would have an adverse, but not significant, effect by contributing to global greenhouse gas emissions and increasing concentrations of greenhouse gases in the atmosphere. We acknowledge that total national emissions are contributing to a significant adverse environmental effect globally via the enhanced greenhouse effect. However, although the project will contribute to overall federal and provincial cumulative greenhouse gas emissions, it would make a minimal contribution to total greenhouse gas emissions annually. We have high confidence in our assessment.

10. Noise, Light, and Visual Aesthetics

Participants are concerned about increased noise from the project

[572] Benga carried out a noise assessment in accordance with the panel's terms of reference, *AER Directive 038: Noise Control*, sections 5(1) and 19(1) of *CEAA 2012*, and Health Canada's *Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise*. Concerns from the participants included elevated levels of noise due to mining operations and the rail loadout, impulsive noise impacts from blasting, low-frequency noise, noise mitigation plans, and noise management commitments.

Noise levels resulting from mine operations are predicted to be within permissible sound levels

[573] Benga conducted a noise impact assessment in accordance with the requirements of *Directive 038* using the Computer Aided Noise Abatement modelling software package. Three different mining years were selected (years 1, 6, and 18) resulting in three different modelling scenarios to represent noise levels for the surrounding receptors. The modelling results indicated that the overall daytime and nighttime equivalent continuous sound levels would be below permissible sound levels for all identified residential receptors and theoretical receptors at the RSA boundary, 1500 m from the mine permit boundary.

[574] A per-cent-highly-annoyed assessment, which indicates how an average community responds to a noise level, was also conducted in accordance with Health Canada's *Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise*. It took into consideration applicable adjustments for various factors. The result of the assessment was well below Health Canada's criteria. Ms. B. Janusz raised a concern about whether a hum would be heard. Benga said that noise from highway and railway traffic noise would be more prominent for residents in Coleman and Blairmore compared with noise from the project.

[575] During the hearing, the Coalition submitted that structures on the Gilmar's and Donkersgoed's properties east of the south rock disposal area were not included as receptors. The properties are located within the proposed mine permit boundary as shown in Figure 5-2 of the chapter on coal mining, handling and processing. The Coalition submitted a noise map markup showing that the Donkersgoed's structure was within the 35 to 40 adjusted decibels (dBA) noise contour, indicating compliance with *Directive 038*—permissible sound levels. However, the markup showed that the Gilmar's structure was within the 40 to 45 dBA noise contour line, indicating potential non-compliance with the nighttime permissible sound level. In response to questions, Benga noted that the structure on the Gilmar's property was a rustic cabin, while the structure on the Donkersgoed's property was a mobile home. Benga questioned whether these structures were occupied for more than six weeks per year and meet the definition of a seasonally occupied dwelling unit under *Directive 038*. Benga said it could take additional measures to avoid exceeding nighttime-permissible sound levels at the two structures. Such measures could include building a berm along the eastern edge of the rock dump and working only on the eastern edge during the daytime.

[576] While we accept that Ms. Gilmar continues to visit her property and make use of her cabin, we are not able to confirm that her cabin meets the definition of a seasonally occupied dwelling as defined in *Directive 038* because she did not provide any details about the duration of occupancy. We note that identifying receptors is a major element of a noise impact assessment. The AER expects proponents to conduct thorough investigations to identify and confirm potential receptors in the surrounding area.

Under *Directive 038*, these investigations are required when noise assessments are being completed in support of regulatory applications. Benga's failure to identify and confirm the nature of potential receptors immediately adjacent to the project, such as the Gilmar cabin and the Donkersgoed's trailer, in its noise impact assessment is a concern. Benga should have developed and maintained an up-to-date receptor inventory. Except for this issue, we find that the modelling approach used by Benga in its noise assessment to be reasonable and to satisfy *Directive 038* requirements.

[577] We accept that the additional noise control measures proposed by Benga would help mitigate noise effects for those receptors immediately to the east of the project and reduce the potential for non-compliance with AER noise requirements. However, it is not clear how effective the proposed berm along the east edge of the south rock disposal area would be, particularly when the Gilmar's cabin is taken into consideration. Even with the proposed additional mitigation measures, it is likely that these receptors would experience increased levels of noise as a result of the project.

[578] With the exception of the Gilmar cabin, at which nighttime permissible sound levels could be exceeded, the predicted sound levels at other receptors are within permissible levels in *Directive 038*. We conclude that the project would result in a change in noise levels in the vicinity of the project and that these changes may be perceptible to some. But we find that the increase in noise levels would be low in magnitude and localized.

The rail loadout facility is predicted to result in a slight increase in overall noise at adjacent receptors

[579] Benga conducted a separate noise study for the rail alignment and loadout. Benga estimated loading of one train of 152 cars per day. The train speed during loading is 350 metres per hour (m/h), and the loading of the train can take up to eight hours. The rail loadout noise study was conducted by modelling existing highway traffic and railway traffic noise, and then adding the rail loadout noise modelling result to the existing noise level to evaluate the change in noise levels. The overall equivalent continuous sound levels noise levels are expected to increase slightly at the receptors when the rail alignment and loadout are operational. The noise level increase due to the rail loadout operation is below 2 decibels (dB) at most of the receptors. The most affected receptors (R-001 and R-002, which are adjacent to the west RSA boundary) are expected to experience an increase of about 4 dB due to the relatively lower baseline sound levels at these two receptors.

[580] The modelling results are based on equivalent continuous sound levels, which may not be sufficient to address noise events associated with loadout operation, such as car shunting and coal loading. Benga said that there would be no shunting or other similar impulsive noises due to the design of the loadout as a continuous loop. There would also be no connecting or disconnecting of rail cars. The only circumstance where this would occur would be if a malfunction required that the cars be disconnected and reconnected; such events are expected to be extremely rare. Benga also submitted that coal loading would not produce impulsive sounds as defined in the Health Canada noise guidance. The coal-loading mechanism involves lowering the chute into the car, letting the coal flow into the car, and then raising the loading nozzle as loading progresses; coal therefore does not fall into the car. Locomotives are the dominant source of low-frequency noise from the rail loadout operation. Benga modelled the locomotive as a continuous noise source for an entire day of 24 hours, although loadout of one train is expected to take only 8 hours of a day.

[581] We find the mitigation measures Benga proposed to reduce noise associated with rail loadout operations to be reasonable and appropriate. We also find that the modelling approach Benga used to assess low-frequency noise resulting from rail loadout operations to be conservative. Based on the proposed noise mitigation measures and modelling conducted, we find that the rail loadout facility will result in a minor increase in overall noise. But it is unlikely to result in low-frequency noise conditions of concern.

Impulsive sound levels due to blasting are predicted to be within regulatory guidelines

[582] Benga modelled the effects of impulsive noise from blasting to compare them with criteria derived from *Guideline NPC-119: Blasting*, which was issued by the Ministry of Environment in Ontario. Blasting will occur during the day shift only, with approximately four to five blasts per week and as many as three per day. Benga said that the modelling of this blasting plan represents the worst-case scenario. The modelling results indicated that the maximum impulsive sound levels would be below the limits set by *Guideline NPC-119*.

[583] We recognize that blasting-related noise and vibration will be perceptible at varying distances from the project, particularly by receptors closest to the project, such as landowners immediately to the east of the mine. We accept that Benga has proposed to employ modern blasting techniques that minimize blasting-related vibration. As well, Benga intends to monitor blasting vibrations and modify its methods to eliminate unacceptable noise and vibrations at nearby receptors. We find that blasting noise will be short in duration, occur during daylight hours only, and remain within the range deemed acceptable for impulsive noise using the criteria established for the Ministry of Environment in Ontario NPC-119. We note that Alberta does not have any specific criteria for impulsive noise. We therefore conclude that the impacts of blasting-noise are acceptable.

[584] Benga's noise mitigation plan and noise management commitments represent best practice in noise control. Benga said that its noise mitigation measures included:

- rock disposal area sequencing, e.g., using rock disposal as a noise barrier for upcoming mining activities;
- blasting noise and vibration mitigation, e.g., smaller, more localized blasts;
- low-frequency noise mitigation, e.g., the noise source data was expected to be conservative on low frequency noise;
- light-duty vehicle-backup-alarm mitigation, e.g., replacing the backup alarm with a flashing light; and
- mechanical maintenance, e.g., site maintenance teams will keep equipment in a good condition to avoid unnecessary noise.

[585] Benga also made the following commitments related to noise management:

- If, upon start-up of the project, a low frequency noise complaint is received, Benga will conduct a comprehensive sound level survey as per *Directive 038*.
- Benga will develop a communication protocol with the Piikani Nation, the nearest Indigenous community, to deal with any complaints or concerns that may arise from the operation.

- Benga will work with the Municipality of Crowsnest Pass to structure a community committee for regular reporting of project news and performance, solicitation of input on upcoming developments, and to create a forum for discussing community complaints and concerns. Benga will make environmental information, mitigation plans, and related reports available to the Municipality on request, notwithstanding the formation of such a committee.
- Benga will conduct follow-up noise monitoring studies, similar to the noise impact assessment conducted for the purposes Benga's EIA, within the first year of the start of operations and thereafter at five-year intervals, to confirm that actual noise levels are consistent with the modelled results and to re-model anticipated noise based on updated mine plans.

[586] We find that Benga's proposed noise mitigation plan and management commitments would reduce noise impacts associated with the project and provide mechanisms to verify noise assessment predictions and address community concerns. Given that noise modelling indicates that the project is expected to comply with existing regulatory requirements (with the possible exception of the Gilmar cabin, as discussed above), we find that these measures are reasonable and consistent with industry-accepted best practices in noise control.

The project will result in increased noise levels, but the effects are not likely to be significant

[587] Benga stated that noise modelling results indicate that throughout the life of the project noise levels during the night-time and day-time would be below the permissible sound levels for all residential and theoretical 1,500 m receptors. Benga determined that, overall, the increase in noise levels will not be significant. We agree with Benga's characterization and assessment of the significance of project-related noise effects.

[588] We assess the residual project effects related to noise as follows:

- **Magnitude:** moderate. There will be noticeable noise impacts for a large number of receptors.
- **Geographical extent:** local. All of the affected receptors are within or not far beyond the LSA boundary.
- **Duration:** long. The effects will last until project decommissioning.
- **Frequency:** continuous. The noise impact will be fairly consistent throughout the life of the project.
- **Reversibility:** reversible. The effects will cease when the project is decommissioned.
- **Ecological and social context:** neutral. There are few other significant noise sources in the project area at present. There is existing noise in proximity to infrastructure such as the highway, rail line, and community of Blairmore.

[589] We find that, while the project will result in an increase in noise levels at some receptors, those effects will be local in extent and diminish with distance from the project. Furthermore, while blasting will occur throughout the construction and operating phases of the project, the increased noise associated with each blasting will last only a few seconds or minutes and blasting will occur during the day shift only. After mitigation, the noise impact is expected to be within the applicable limits. We therefore find that the effects are not likely to be significant. Confidence in our assessment is moderate. Benga took a

reasonable approach to modelling and compared the results to appropriate standards. However, the increase in noise experienced as a result of the project will depend upon the specific equipment selected and operating practices. There is also some uncertainty about the effectiveness of the berm proposed for the south rock disposal area in minimizing noise effects on landowners located immediately to the east of the mine.

The project will result in an increase in nighttime light levels

[590] Benga included an assessment of light effects resulting from the project in its air quality consultant report, but did not include the assessment in its EIA or cumulative effects assessment. Benga's assessment of potential changes in nighttime light levels was conducted by considering four project locations that would require illumination: the rail loadout area, the coal-handling and processing plant, the connecting access road and conveyer route, and the highest elevation accessed during development of the waste rock disposal areas (which are representative of the worst-case locations during operations).

[591] Benga's assessment found that activities at the rail loadout could be seen by residents in Coleman and Blairmore and along several kilometres of Highway 3, but the assessment does not consider the built-up nature of the communities and the blocking of the light by intervening buildings;

- lighted activities at the plant site would not be seen by residents in the communities in the valley or along Highway 3; and
- activities in the area of mining operations as represented by the waste disposal area are likely to be visible over broader areas, mostly from higher elevations, but not from any of the communities.

[592] Benga proposed the following mitigation measures to address changes in ambient lighting:

- Use low-visibility spectrum lights in light stands and on the coal-handling and processing plant and rail loadout structures, with directional shades that minimize illumination above the lights' horizontal line and direct light to the illuminated feature.
- Implement an on-demand and adaptive light-management strategy at the rail loadout during times a train is not on site for loading during nighttime hours.
- Minimize train loading at night.
- Do not equip the overland conveyor system with any additional lighting structures.
- Do not clear existing vegetation (mature trees) around the perimeter of the project and along the access road to reduce total viewshed.
- Use mobile lighting gear on the waste rock disposal area only when needed and equip them with low-visibility spectrum lights positioned, where possible, at the base of existing high points to reduce their associated viewshed.

[593] Benga also committed to adopting the International Dark-Sky Association's Dark Sky Lighting Principles to minimize outdoor light associated with the project. The principles state that all lights should have a clear purpose, be directed only to the locations where they are needed, be no brighter than necessary, be controlled and used only when useful, and be a warm colour where possible. Benga did not propose any additional monitoring or follow-up measures related to light.

[594] Benga acknowledged that artificial lighting, including even small amounts of light, can affect people, wildlife, and bird habitat. Benga concluded that nighttime light can cause a residual effect due to potential nuisance effects. Benga stated that the effect would be local and of medium duration with periodic (nighttime) frequency. As the effects would be reversible in the long term, Benga rated the magnitude as low and concluded that the effect was not significant.

[595] Referring to the Dark Sky Lighting Principles, the Municipality of Crowsnest Pass stated that it was concerned about the effects of light pollution on businesses and residential communities. This light would also interfere with enjoyment of the night sky. The Municipality stated that it was generally satisfied with the commitments Benga has made to reduce nuisance effects of lighting, but recommended that Benga adopt the Dark Sky Lighting Principles as a project design standard.

[596] V. Koch and B. Koch stated that they would be affected by the project because of the light, noise, and dust pollution caused by the project. These pollutants would also affect the value of their property and their enjoyment of the area. They also raised concerns that the project would cause noise, lights, and traffic day and night, and threaten peace and quiet for tourists lodging and camping in the area. They provided Benga's response letter, which stated that lodging and campsites were located far enough away that light pollution would not be significant.

[597] CPAWS noted that Benga had referred to using adaptive management for light pollution, but did not provide an adaptive management plan, making it difficult to comment on the feasibility and appropriateness of Benga's proposed approach.

[598] At the hearing, Mr. C. Gardner, representing the M.D. of Ranchland, stated:

“One of the largest visual impacts would, however, occur at night with the loss of the night sky. The bulldozing industrialization of the Grassy Mountain mine would require lighting for security, safety, and operations. Nighttime mining operations as well would require a lot of light and increasing the light pollution.”

“It is witnessed now out west of Nanton looking towards Teck Coal. The locals talk of how it reminds them of the light pollution from the city of Calgary a few decades ago. The mine lights could spell the end of the current enjoyment of the night sky, certainly for the southern residents of the MD, neighbouring municipalities, the residents of the Crowsnest Pass, travellers, and recreationalists. Certainly, the northern lights would be missed in the communities of the Crowsnest Pass” (CIAR 750, PDF pp. 36 and 37).

[599] The M.D. of Ranchland also raised concerns about the effect of nighttime lighting on songbirds. Ms. B. Janusz questioned Benga regarding the tone or colour of light to be used, and the effects of light pollution on insects. The Livingstone Landowners Group also raised concerns about the effects of light pollution. In response, Benga reiterated its commitment to the Dark Sky Lighting Principles and installing lights only where necessary for safety. Benga also noted that it would follow technological advances in lighting, and update lighting when it was beneficial.

[600] We find that the project will result in an increase in nighttime light levels in the vicinity of the project and this may create some nuisance effects. However, we find the mitigation measures proposed by Benga are appropriate and reasonable and should minimize unnecessary lighting and the associated effects.

The project will affect the visual landscape

[601] Benga did not directly assess the visual impacts from the project, but included mitigation measures to address visual impacts in its assessments of current use, and air quality. Benga stated that comments on aesthetics from local stakeholders were an important factor in selecting the location of the rail loadout facility. Benga added that it would take various steps to obscure the view of the loadout facility from the community. As part of its public consultation plan, Benga said it will continue to consult the community to develop ideas for landscaping and other measures that would diminish concerns related to the visual impact of loadout infrastructure.

[602] Benga proposed the following steps to obscure the rail loadout facility:

- The train loadout and bin will be fully enclosed with an external cladded shed structure.
- The train loadout bin feed conveyor will be fully enclosed with cladding.
- The base of the facility will be lower than the level of the highway, reducing the relative height of the structure as seen from the highway.
- Proper landscaping can further obscure the view by constructing berms around the perimeter of the railway loop and planting shrubs and trees.
- Provide a structure(s) that is visually acceptable. Modern covered loadout facilities, such as the one to be constructed in Blairmore, are similar in appearance to a grain elevator.

[603] Benga also proposed to retain vegetation adjacent to high activity linear corridors, and not clear mature trees around the perimeter of the project or along the access road to reduce the viewshed.

[604] The Municipality of Crowsnest Pass provided input on the potential visual impacts of the project. The Municipality noted that the project, and the rail loadout facility in particular, would affect the visual environment. The Municipality recommended that Benga use non-reflective coatings on its buildings and structures to minimize glare (and visual impacts). The Municipality also recommended that Benga ensure the rail loadout, bin, and conveyer are fully enclosed, the base of the facility is lower than level of the highway, proper landscaping is installed to obscure the rail loadout and railway loop, and that the loadout structure is visually acceptable. The Municipality also recommended as a condition of approval that Benga develop a socioeconomic advisory committee to monitor and receive updates and make recommendations about issues of concern, including visual impacts, in the community.

[605] Ms. Janusz expressed concern about Benga's use of progressive reclamation to address visual aesthetics. She argued that it would not apply to the rail loadout, which would "remain an eyesore that will discourage tourists from recreating in the Municipality" (CIAR 1327, PDF p. 16).

[606] The Livingstone Landowners Group expressed concern over the project's potential impacts on visual aesthetics. It noted that retention of the natural beauty of the area was important to local landowners. A member of the group stated, "We pay a lot of money in taxes for the privilege of living in a beautiful, scenic location in a rural setting" (CIAR 786, PDF p. 185). Members of the Coalition stated that they valued the region for its beauty and wildness, and expressed concern that the project would diminish their ability to use and enjoy the lands.

[607] The Crowsnest Conservation Society raised concern about a shift away from tourism and recreation and a return to an industrial economy, including "visual industrialization." When asked about how much of the recreational landscape and experience would be affected by being able to see the mine on Grassy Mountain, Ms. H. Davis noted that the effects on outdoor recreation had not been adequately assessed. She also stated that the project would be visible from town and from popular recreational sites such as the Crowsnest Mountain and a local ski hill called Pass Powderkeg.

[608] Mr. Des Moulins spoke extensively of his hiking experience in the project area, raising concerns that the visual and sensory elements of hiking in the area would be destroyed if the project were to be built. He showed pictures of the project area from his hikes to describe its probable visual impact from many hiking trails in the region. He also noted that, although Grassy Mountain currently includes an un-reclaimed mining area, the visual impact does not stand out as much as an active mine would.

[609] The M.D. of Ranchland raised a concern about visual impacts. Mr. Gardner described how the grassland ranching lifestyle of the area was linked to the visual aesthetics of the landforms and vistas of the area, as well as to the vegetation and wildlife: "It is impossible to describe the scale of the unmitigated destruction the coal mine will cause. There will be open cuts, pits, roads, landslides, spoil piles, while—while it will all be dusted black with coal dust where a mountain used to stand" (CIAR 750, PDF p. 32). Mr. Gardner noted that most of the daytime visual impacts would be on backcountry users, forestry disposition holders, and people who reside outside of the Municipality and neighbouring communities. He stated that landowners in close proximity to the mine and associated facilities would experience "extreme" visual impacts as well as significant loss of property value. In addition, he noted that blowing dust from the mine would also negatively affect the visual aesthetics. Mr. Gardner said that even after reclamation there would still be a long-term change in visual appeal compared with the surrounding area.

[610] Benga argued that it had taken substantive measures to address concerns related to visual impacts, and to promote coexistence between the project and the developing recreation and tourism economy. These efforts include a commitment to progressive reclamation, adoption of the Dark Sky Lighting Principles, and the establishment of a socioeconomics community advisory committee. Benga argued that the cited visual impacts would be temporary and that the lands would be improved following reclamation compared with current conditions. Benga noted that the project footprint covered just 15.2 km² within an expansive landscape and that ample space for outdoor recreational activities would remain.

[611] We recognize that the open-pit mine that operated previously on Grassy Mountain was not reclaimed. The resulting historic disturbance is visible today from areas adjacent to Grassy Mountain, including the Livingstone Range. Although natural regrowth has diminished the visual impact of the disturbance to some degree, it is still quite visible, and has become an accepted part of the visual landscape.

[612] The proposed mine pit will follow the ridge along the top of Grassy Mountain. Therefore, the disturbance will be visible from areas adjacent to Grassy Mountain and elevated viewpoints in most directions. This will include the Livingstone Range to the east and as far away as Crowsnest Mountain to the west, although the visual impacts will diminish with distance. It will take many years for reclamation to reduce the visual impact. Even with progressive reclamation, visual impacts will persist well into the closure period after mining ceases. It is also likely that even after reclamation, some slopes and features—such as the external rock dumps—will be distinguishable from natural features.

[613] Benga has not yet developed the final landform designs for the waste rock disposal areas. Nor did Benga provide a visual depiction of the closure landscape from different locations in the surrounding area. Consequently, assessing the residual visual effects that would remain was difficult. While Benga provided one three-dimensional depiction of the closure landscape from a vantage point above the project area, it did not demonstrate what individuals on the ground would see. During the operational life of the project, the rail loadout facility would be highly visible from the highway, golf course, and Blairmore. However, the mitigation measures Benga has proposed, along with the recommendations made by the Municipality of Crowsnest Pass, are reasonable and would reduce the visual impacts. The visual impact of the rail loadout facility would be reversed once mining ends and the facility is decommissioned.

[614] We accept that the visual impacts of the project during mining operations and after closure may negatively affect enjoyment of the natural landscape by local residents and visitors participating in tourism and recreational activities in the area. Tourists could avoid the area if the natural landscape becomes highly disturbed and industrialized. As a result, there is a risk that both the recreational and tourism sectors could experience a reduction of activities; this could affect the socioeconomic conditions of the region. We discuss this issue further in the chapter on social and economic effects. However, considerable uncertainty is associated with these effects and they remain difficult to confirm or quantify.

11. Groundwater Quantity, Flow, and Quality

Limitations in Benga's approach to groundwater assessment reduces confidence in its predictions

[615] Benga's groundwater assessment considered key hydrogeological features in the project area. These features included bedrock aquifers, water supply wells, and groundwater sources connected to surface water bodies such as Blairmore Creek, Gold Creek, and Crowsnest River. Benga defined the groundwater LSA as the proposed mine permit boundary plus a one-section buffer 1.6 km wide, and excluded part of the access road to the south. The LSA is intended to include the extent of project-related impacts beyond which the potential effects are expected to be non-detectable.

[616] The RSA was delineated by natural features that are likely to represent groundwater-flow divides, such as river valleys (e.g., the Crowsnest River) or mountain ridgelines. The RSA was extended to the north to include Daisy Creek, which allowed for an evaluation of potential impacts on groundwater in the southernmost portion of the creek's watershed.

[617] Benga made several assessments from a temporal perspective. It assessed the baseline case, which includes existing environmental conditions, existing projects, and approved activities; the application case, which includes the baseline case plus the project; and the planned development case, which includes the application case combined with past studies, existing and anticipated future environmental conditions, existing projects or activities, and other planned projects or activities.

[618] Benga identified and assessed the potential effects of pit dewatering on groundwater quantity. It assessed the potential impacts of mine waste rock, mine operations, and surface facilities on groundwater quality.

[619] As a part of its groundwater assessment, Benga collected and analyzed historical mining data to confirm the location of historical mine workings in the vicinity of the project with follow-up work in late 2017 and early 2018; conducted a field program that involved installing and sampling groundwater monitoring wells and conducting a single pumping test; completed groundwater modelling; and considered linkages to surface water and other subjects. Benga identified two historical underground mines, the Greenhill Boisjoli Mine and the Greenhill Mine, directly south of the main mine development area. Benga found that a small portion of the Greenhill Boisjoli Mine is directly beneath the southern portion of the project.

[620] Benga assumed that groundwater that is stored, or flowing through, underground mines discharges at spring locations and the Greenhill mine portal. It acknowledged that the underground mines directly downgradient from the pit may act as conduits for groundwater flow, decreasing travel times between the pit and the Crowsnest River valley. In its assessment, Benga found groundwater stored in the Paleozoic units that form the bulk of Bluff Mountain will flow radially, including northward. It will then discharge into Blairmore or Gold Creek. Groundwater contours indicate a divide within the Greenhill Mine, with part of the water flowing primarily to the south and the remainder to the north and east. This is consistent with radial groundwater flow around Bluff Mountain.

[621] Based on groundwater modelling, Benga predicted that groundwater within the Greenhill Boisjoli mine will travel primarily to the north, or toward the open pit, which will act as a drain. Due to the presence of a groundwater divide within the Greenhill Mine, groundwater potentially affected by mining operations is not expected to travel from north to south through hypothetical karstic features or the existing underground mine. Benga asserted that affected groundwater will not flow south toward the Crowsnest River valley, where the municipal water wells utilize the alluvial aquifer. As a result, Benga predicted that the quality of groundwater in municipal water wells will not be affected by mining or waste rock disposal activities.

[622] During the review process, Tsuut'ina expressed a concern about the potential for impacts on shallow alluvial aquifers adjacent to Blairmore Creek and Gold Creek. In its EIA, Benga did not specifically assess or model impacts on these shallow alluvial aquifers in the groundwater assessment. Benga said that it did not complete a detailed aquifer characterization because alluvial deposits are thin and limited at the mountaintop, and are a substantial distance from the mine pit area.

[623] Benga installed 19 monitoring wells to determine the hydrogeological properties (such as hydraulic conductivity) and groundwater composition in the vicinity of the project. As well, Benga sampled natural springs and seeps coming from historical mining operations. Only one pumping test was conducted. This dataset served as the basis of a groundwater model covering 1500 ha of highly fractured, folded, faulted, and pre-disturbed mountainous terrain.

[624] Benga assessed the drawdown of aquifer water levels associated with its pit dewatering activities and the potential changes in surface water–groundwater interactions. To carry out this work, Benga developed a groundwater flow model using Finite Element Subsurface FLOW (FEFLOW), which is professional software for modelling fluid flow and the transport of dissolved constituents. As an input for the groundwater flow simulations, Benga used output from the surface water flow model (GoldSim model) water balance information.

[625] Benga's groundwater model predicts monthly and average annual estimates of resulting base-flow reductions to Blairmore and Gold Creek during mining operations. Benga did not provide information on instantaneous base-flow reductions or worst-case scenario changes in base flow on westslope cutthroat trout habitat in Blairmore Creek or Gold Creek. Benga acknowledged the average baseflow output values from the model can vary between 50 per cent higher and 33 per cent lower than predicted outcomes, depending upon the model's assumptions.

[626] Benga's assessment of groundwater impacts considered the need to divert and use groundwater for processing purposes. The *Water Act* regulates the collection, storage, and handling of groundwater and surface water through either licensing (diversion and use of water) or approvals (collection of water but not usage). The *Approved Water Management Plan for the South Saskatchewan River Basin* and the *Bow, Oldman and South Saskatchewan River Basin Water Allocation Order (Crown Reservation)* consider the hydraulic relationship between groundwater and surface water. Groundwater that flows to and from these river subbasins is reserved water and can only be licensed through the transfer provisions of the *Water Act*.

[627] Benga recognized the hydraulic connection between groundwater and surface water. It applied through the licence-transfer process to acquire sufficient groundwater and surface water allocations to operate the mine. Water volumes required for the project are discussed in detail in the chapter on surface water quantity and flow.

[628] Benga's assessment of project effects on groundwater quantity and quality relies on the development and use of groundwater models. Confidence in Benga's assessment requires confidence in the predictive capacity of the models. The models must adequately represent groundwater conditions and behaviour in the project area prior to and as a result of development of the project, which occurs in a complex geological and hydrogeological setting. It is located in steep mountain terrain in an area that has undergone intense folding and faulting during its geological history. The project area has also been subject to historical surface and underground mining, and underground tunnels underlie a portion of the proposed mine pit. The more complex the geological and hydrogeological setting, the more challenging it can be to develop a model that adequately represents site conditions.

[629] During our review, we identified a number of limitations of the groundwater modelling approach used by Benga. These include the limited use of site-specific hydrogeological information, simplifying assumptions in the groundwater modelling, and the lack of an integrated groundwater–surface water model. These limitations create uncertainty in the model's predictions and assessment results. Moreover, they make it difficult for us to have confidence that Benga can effectively mitigate the project's effects. These issues are discussed in the following sections.

The groundwater assessment is based on limited site-specific hydrogeological information

[630] DFO noted the lack of drilling, testing, and assessment of hydraulic conductivity in the more permeable rock units. DFO questioned why the presumably more permeable sandstones of the lower Gladstone Formation or the conglomerates/sandstones of the Cadomin Formation were not targeted by any wells. DFO suggested that using the hydraulic conductivity of 2.6×10^{-6} m/s measured in these wells as a basis for the hydraulic conductivity of the bulk Blairmore Group unit is likely to underpredict the water-bearing capacity of this hydrostratigraphic unit.

[631] DFO also questioned the limited hydrogeological data at depth. They noted that the pit floor will be approximately 430 m below the current topography of the site, and that of the 19 monitoring wells identified in Benga's two monitoring-well summary tables, none extended below 127.4 m and 176.7 m below the surface, respectively.

[632] We understand that Benga has access to information from more than 140 exploratory drill holes within the project area, and that packer tests may have been performed on some of these wells. We recognize that many of the exploratory holes likely pre-date Benga's acquisition of the Grassy Mountain property, and there is likely limited hydrogeological information available from these wells. We also recognize that at the time the EIA was submitted, there may have been limited hydrogeological information available.

[633] However, Benga should have given greater weight to the complexity of the site and participant concerns about project effects on groundwater and surface water. In the course of its more recent exploration drilling, Benga could have collected additional site-specific hydrogeological information to

confirm the hydrological properties at the site. DFO made certain observations that are particularly concerning. These include the limited site-specific information Benga made available for some rock units, the lack of information for aquifers at depth, and its reliance on the results of a single pumping test. Additional hydrogeological data would have provided us with greater confidence in the model's predictions, and given us greater assurance that the properties used in the groundwater modelling reflect site conditions.

Benga's modelling approach for the assessment of effects on groundwater may not adequately account for the complexity of the site

[634] Benga used one of several industry-standard software packages (FEFLOW) to develop its groundwater flow model. Benga acknowledged that the model utilizes the following simplifying assumptions:

- The entire rock/sediment package is a homogeneous, anisotropic medium.
- The system is assumed to behave as a confined aquifer, although it can effectively represent unconfined conditions where these occur.
- The groundwater system flow, which is expected to occur dominantly via fracture flow, is approximated by an equivalent porous media model.
- Hydraulic conductivity (K) is largely anisotropic, with the highest hydraulic conductivity parallel to bedding planes and coal seams and to thrust-fault strikes with the lowest hydraulic conductivity perpendicular to bedding. In general terms, hydraulic conductivity decreases with depth in all orientations, according to a model proposed by Wei et al. (1995).
- Apart from preferential flow parallel to fault strikes, no major fault acts as a significant conduit and there are no major regional deep flow influences.
- Recharge follows the same spatial trend with elevation as precipitation. Precipitation, evaporation, and evapotranspiration mechanisms are not explicitly modelled but assumed to be integrated as "net recharge."
- Water level and creek flow data collected between late 2013 and early 2016 are representative of the pre-mining steady-state conditions and long-term trends.

[635] Benga stated that the modelling assumptions used are reasonable and make use of available data, and that the model replicates reasonably well the site observations and the regional behavior of the groundwater system at the scale of the mine site. As a result, Benga was confident that the modelling was sufficient to evaluate project effects on groundwater flow, quantity, and quality. Benga acknowledged that confidence in model results was highest in the vicinity of the mine area, where more data exist.

[636] Benga acknowledged that limited information is available on unconsolidated sediments and the Blairmore Group rocks overlying the host Mist Mountain Group. These units could affect the overall interaction between the mine and the creeks. Actual conditions may vary locally due to variations in hydraulic conductivity or other material properties where data are not available.

[637] Benga said that large-scale geological structures have been mapped but that it is not possible to confirm, with the available data, where large-scale fractures and faults are connected and where they act as a conduit or as a barrier to flows. Benga indicated that these limitations should be considered when interpreting or using model results.

[638] The Coalition's expert, Dr. J. Fennell, identified a number of concerns related to Benga's groundwater and surface water modelling approach and results:

- Insufficient knowledge of the geological and hydrogeological regime and its influences with a heavy reliance on models attempting to mimic complex systems
- The use of "average" conditions that do not honour the considerable range of variability in historical records resulting in "not significant" impact ratings
- Models that are a gross simplification of natural geological, hydrogeological, hydrological, and geochemical conditions, making it difficult to mimic nature with a high degree of accuracy
- Models requiring a suitable amount of base information to reduce assumptions lead to better results; less data equals less accuracy
- Model outputs that are highly influenced by complexities in actual conditions and subject to propagating errors where conditions are not well-known or constrained
- Models producing non-unique results, with similar results being achieved using different combinations of input parameters
- Models that can be helpful in determining the direction where things may go but are challenged when trying to simulate absolute magnitude
- Models that are only as good as the individuals building them and not meant to replace human intelligence; different results will be obtained by different modellers, and some modellers are better than others

[639] Dr. Fennell highlighted the complexity of the strata and probable presence of active and open faults and fractures that will adversely affect the model conditions. He noted that east-west faulting was not incorporated into Benga's groundwater modelling, even though evidence shows they exist in the adjacent Livingstone Range.

[640] NRCan commented on Benga's three-dimensional modelling approach to identifying groundwater pathways, including the historical mine tunnels. NRCan noted Benga's unsuccessful attempts to locate and identify the historical mines. Benga said that uncertainties within the model, including unknown historical mine locations, would be addressed using its proposed adaptive monitoring and management plan. Results from monitoring will be compared with modelling predictions in the context of mining operations. Benga confirmed the need for additional monitoring and regular reassessment of its adaptive management efforts.

[641] Benga stated that available maps of the Greenhill Boisjoli Mine and the Greenhill Mine show that the two are not directly connected. The entrance portal of the Greenhill Boisjoli Mine has been covered by fill, but matches the location of spring 1, which is on the southern slope of Grassy Mountain, and on

the northern slope of a roughly east-west trending tributary valley. Benga discovered Greenhill Mine workings beneath the southern slope, about 90 m horizontally from the Greenhill Boisjoli portal. Two entrance portals of the Greenhill Mine, i.e. the Greenhill Portal (Main) and Greenhill Portal (Secondary), are still present, about 4.5 km south of spring 1, at an elevation of 1324 m above sea level. SRK Consulting updated the three-dimensional geometry of the two mines by projecting the georeferenced maps onto the 3D representation of the coal seams in Benga's 2016 geological model.

[642] According to SRK, the proposed mine plan puts the Benga mine pit in possible contact with the northernmost extent of the underground Boisjoli Mine. Little is known about the interior of this mine. While there are no reports of backfilling, it is likely that caving reduced the overall hydraulic conductivity of the mine workings. The portal has collapsed, or has been buried by waste rock from previous surface mining. The location of the former portal corresponds to the position of spring 1.

[643] Benga simulated flow travel times, with assumed hydraulic conductivity values for the Boisjoli mine workings up to four orders of magnitude higher than those of the surrounding rock. It found travel times of less than one year through the mine before reporting to the tributary in front of the mine, with some flow travelling to the Grassy Mountain pit over four years. Most of the flow reporting to the Greenhill Mine reaches the portals rapidly (in less than a year), while a portion reports to the tributary north of the mine and between the Greenhill Boisjoli (North) and Greenhill (South) Mines. There is no indication of direct flow, via bedrock, from the north mine to the south mine.

[644] At the hearing, Benga's mining expert, Mr. Youl, stated that Benga had used ground-penetrating radar over part of the initial pit area with considerable success. He noted that Benga was able to identify areas that were partially mined as part of the historical mining operations. Benga proposed to increase the density of ground-penetrating radar data collection as it moves into detailed short-term planning for the mine pit. Benga said that the final check on the location of underground workings would come from the closely spaced blast holes that would be drilled. Based on the historical maps of underground workings, which Mr. Youl described as very detailed, and the additional investigations that had been completed, Mr. Youl indicated that Benga did not expect to encounter additional tunnels that it had not yet identified.

[645] NRCan acknowledged that Benga made use of available data in its modelling, which was appropriate. NRCan said it was important to recognize the uncertainties associated with the modelling and its predictions, as acknowledged by Benga. In NRCan's view, these uncertainties can be effectively addressed through a groundwater monitoring plan and future refinement of the groundwater model. They can also be addressed through effective groundwater management and mitigation strategies, including adaptive management. In response, Benga committed to sharing information obtained through the groundwater monitoring plan.

[646] During the review process, Tsuut'ina expressed concern about Benga's explanation of groundwater flow and thrust faults in the model predictions. Tsuut'ina noted that Consultant Report 3 in the EIA indicates that—due to the complex geology—the groundwater flow system in the area is not simple. As Tsuut'ina further noted, Benga indicated that major thrust faults are expected to be a control mechanism for lateral groundwater flow, while local fractures appear to enhance flow within geological units, rather than across bedding planes. However, Tsuut'ina observed that, ultimately, the report states

that “the actual behavior of each fault is uncertain, as some may act as barriers, while others may act as conduits likely depending in part on the rock type at a particular location” (CIAR 42, CR 3, PDF p. 38).

[647] Tsuut’ina also noted that, in addition to the complex geology and potentially complex groundwater flow, the presence of historical underground mine workings confounds any reasonable comprehension of the behaviour of the site. Tsuut’ina submitted that the conceptual groundwater seepage monitoring plan provided in the Fifth Addendum was not based on field characterization, and that it could be rendered inadequate should fractures and/or existing mine tunnels prove to be paths for contaminated groundwater. This would also be reflected in the model predictions and outcomes. According to Tsuut’ina, contaminated groundwater could bypass the downgradient monitoring proposed by Benga.

[648] DFO noted that the groundwater modelling simulates the top layer of the model with a uniform thickness of 40 m and ignores the role of overburden deposits, which were not modelled explicitly. DFO acknowledged that the hydrogeologic role of the surficial deposits is minimal in the upland areas where field observations confirm their absence, but noted that these deposits exist regionally with an average thickness of 7 m, and within the northern part of the LSA. In addition, DFO questioned to what extent ignoring the surficial deposits may have limited the model’s ability to capture surface water–groundwater interactions, and the impacts on these interactions due to mining.

[649] We accept that the geology of the project area is complex and that the use of simplifying assumptions is an inherent and necessary practice for groundwater modelling purposes. However, the use of simplifying assumptions raises important questions about how well the model represents site conditions and what confidence we can have in the model predictions.

[650] It is important to consider how well the model predicts maximum drawdown effects and the resulting cone of influence, particularly in an east-west orientation adjacent to the mine pit. The model does not account for possible east-west tear faults and fractures and associated groundwater flow paths with potentially higher east-west hydraulic conductivity. It is therefore difficult to determine how well the model predicts drawdown effects. If the maximum extent of drawdown effects is underestimated, then predicted effects on groundwater base flow to Blairmore Creek and Gold Creek may also be underestimated. The model assumes that such faults and fractures either do not exist or do not represent pathways with higher hydraulic conductivity. But the evidence to support this assumption is limited and it is not clear how fully this issue was considered.

[651] In a related area, it is unclear how well the hydraulic conductivity values in the model represent site conditions. The model is based on limited site-specific information. For example, it is uncertain whether Benga collected sufficient information on the geological and hydrogeological properties of the aquifers above, between and below the coal seams to determine hydraulic conductivity values. As pointed out by Tsuut’ina, the presence of historical underground workings further confounds modelling efforts. Benga indicated that it expected to encounter underground workings during mining. However, in the EIA, Benga stated that it had difficulty identifying the location of the workings in the vicinity of the proposed mine pit. As a result, the model does not account for the workings. It is therefore uncertain what effect the historical underground workings have on existing groundwater flow paths, or how project effects would interact with existing groundwater flow.

[652] We find that Benga’s use of simplifying assumptions, and the lack of site-specific hydrogeological information, may not adequately account for the complexity of the site. This is particularly the case given the potential for preferential flow pathways due to fracturing, faulting, and the presence of historical mine workings. This reduces our confidence in the model’s predictions. We understand that Benga proposes to address these uncertainties through its proposed groundwater monitoring program and adaptive management; however, the technical feasibility and potential effectiveness of some of the proposed measures are uncertain. These issues are discussed in the following sections.

Groundwater–surface water interactions are not well understood

[653] In its hydrogeological assessment, Benga confirmed groundwater in the RSA interacts extensively with surface water bodies. Most of the groundwater in the RSA is expected to discharge to the Crowsnest River, except for the deep regional groundwater system that flows from west to east, parallel to the river. On a local scale, Benga found that groundwater discharges to Blairmore and Gold Creeks and their associated tributaries and springs. Existing historical mine workings and features create additional groundwater and surface water interactions, such as groundwater discharge through mine portals, and discharge to or recharge from legacy mine ponds and toe springs from mine dumps.

[654] During the EIA review process, DFO noted that interactions between groundwater and surface water were critical for fish and aquatic wildlife habitat. Yet DFO observed that Benga relied on stand-alone surface water and groundwater analyses with outputs from the separate models used to assess interactions between the two systems. DFO suggested that the assessments contained within the EIA would benefit from application of an integrated (coupled) groundwater–surface water model, given the number of groundwater-supported headwater streams adjacent to the site. However, DFO acknowledged that Benga’s approach was generally in keeping with standard approaches used in these types of projects. It also noted that the EIS guidelines and the panel’s terms of reference do not explicitly require this enhanced level of analysis (i.e., a coupled groundwater–surface water model).

[655] The Oldman Watershed Council also commented on groundwater–surface water interactions. In 2013, the council completed the *Crowsnest River Watershed Aquifer Mapping and Groundwater Management Planning Study*. The council said the results highlighted the complexity of groundwater in the Crowsnest watershed, with its mountainous geology and extensive folding and faulting. A key finding was that much more data and study are needed to understand the complex groundwater system and how it interacts with surface water. The council cautioned that the report’s findings were preliminary and should not be used to make site-specific decisions.

[656] The Timberwolf Wilderness Society noted the critical importance of groundwater–surface water interactions. They questioned Benga’s knowledge and understanding of this issue, particularly with respect to groundwater upwelling and westslope cutthroat trout, in both Blairmore and Gold Creeks, in summer and particularly in winter. The society highlighted the significance of groundwater to westslope cutthroat trout habitat. Benga’s expert, Mr. C. Bettles, confirmed that groundwater flows, groundwater upwelling, and those contributions to base flow are critically important habitat features both in summer and winter.

[657] Notwithstanding Mr. Bettles' confirmation about the critical importance of groundwater upwelling to the trout, Benga's hydrogeologist confirmed that Benga did not complete investigations of the specific locations of groundwater discharge along the creeks. Benga did review areas of groundwater discharge within the main part of the project site, but not at the creeks. The Timberwolf Wilderness Society agreed with the Coalition's expert, Dr. J. Fennell, that Benga underestimated the impacts of the project on the groundwater-surface water relationship and that a significant and permanent reduction of groundwater flow into both Gold and Blairmore Creeks will result.

[658] We accept that groundwater base flow is an important component of surface flows in Blairmore and Gold Creeks and that groundwater upwelling may play a critical role in maintaining westslope cutthroat trout habitat at certain times of the year. Groundwater base flow and upwelling may provide important flow, temperature, and oxygen-regulating functions at specific locations and during certain periods of the year. We discuss the potential project impacts on flows in Blairmore and Gold Creeks, and their corresponding potential impacts on fish, in the chapters on surface water quantity and flow, surface water quality, and fish and aquatic habitat.

[659] To calibrate its model to estimate groundwater contributions to base flow and find a best match between simulated and observed groundwater flow data, Benga varied the groundwater hydraulic parameters. Benga observed that while this approach can estimate regional hydraulic conductivity, storativity, and recharge values, and is considered reasonable for larger-scale approximations, the models may suffer from large uncertainties at the local scale due to heterogeneities not recognized by or incorporated into the larger model.

[660] As a result of the project, the tributary creeks adjacent to the mining areas are likely to experience greater reductions in the per cent of base flow compared with those downstream and downgradient. Where they join the Crowsnest River, the average annual baseflow reductions for Blairmore Creek (BC-01) and Gold Creek (GC-01) are expected to be 9 and 6 per cent, respectively. These baseflow reductions result from the interception of groundwater in the pit and surface water management system. Therefore, the water does not report to the creek as base flow.

[661] Uncertainty remains regarding these base-flow reductions, largely with respect to the range and long-term average base flow in Blairmore and Gold Creeks. This is due to a relatively short period of monitoring data as well as uncertainties over the methods used to separate the base-flow component from the total base-flow component. The sensitivity analysis conducted by SRK highlighted uncertainties in the groundwater model, with variations extending as far as 33 per cent lower and 50 per cent higher, depending upon the assumptions used in the model. However, less uncertainty is associated with the determination of base flow during periods of low flow, which are critical for assessing water quantity and quality and effects on creeks. During low-flow periods, virtually all flow in the creeks is base flow and easily measured.

[662] We note that Benga did not attempt to identify specific locations of groundwater upwelling, nor did it quantify the amount of groundwater baseflow contributing to different reaches of Blairmore Creek or Gold Creek. At the hearing, methods were discussed on how to include this information, but we accept that technical challenges and resource limitations are important considerations.

[663] Groundwater base flow is of great importance in providing and maintaining surface water flows and habitat for westslope cutthroat trout. Consequently, changes in groundwater baseflow predictions may have significant implications for predicted effects on surface water flows and westslope cutthroat trout. To gain confidence in the predictions of effects, a comprehensive understanding of groundwater–surface water interactions is required. Given the sensitivity of the project’s location in a headwaters area and the potential for adverse effects on westslope cutthroat trout, the use of an integrated groundwater–surface water model may have been more appropriate and provided greater confidence in assessment predictions.

Bedrock aquifers within the mine pit will be removed and those adjacent to the pit will be dewatered

[664] In the course of mining, Benga proposes to remove bedrock aquifers within the mine pit, and to dewater bedrock aquifers adjacent to the mine pit by pumping groundwater. Although the removal of bedrock aquifers within the mine pit will be permanent and irreversible, Benga expected that the lowering of water levels in adjacent aquifers due to dewatering will be temporary; new water levels will become established after mining operations and dewatering activities cease. Benga submitted that residual project impacts from aquifer removal and dewatering would be minimal, given that bedrock aquifer destruction will be limited to the mine pit.

[665] Benga said that most groundwater captured in the mine pit will be returned to Blairmore and Gold Creek as part of its mitigation strategy, resulting in limited impacts on groundwater quantity. Benga asserted that most of the groundwater in the pit will not be affected by selenium or other contaminants. The water can be pumped directly to sedimentation ponds for removal of total suspended solids prior to release to Blairmore and Gold Creeks.

[666] Benga’s FEFLOW model predicts the drawdown cone, as defined by a drawdown contour of 5 m, to be approximately 10.0 km² in area, including 3.8 km² outside of the mine pit. Maximum in-pit groundwater drawdown is predicted to be 430 m at the base of the pit at 1590 m above sea level. The extent of the mining-induced groundwater capture zone, or groundwater that will drain to the pit (including the pit areas), is predicted to be about 10.9 km² for end-of-mine period. The capture zone external to the pit is estimated at 4.6 km². Benga concluded that the overall impact on bedrock aquifers is not significant and limited to areas around the mine pit.

[667] For the end-of-mine scenario (year 23 of mining, prior to reclamation), Benga’s model predicts the drawdowns would be highest in the vicinity of the pit and between 30 m and 430 m. The water level at the base of the pit is predicted to be between 1600 and 1800 m above sea level on average. Measurable drawdowns and the mine pit capture zone are largely within 400 m of the pit boundary and contained within the mine permit boundary. Benga’s model shows that measurable drawdown from the pit dewatering does not extend to Blairmore Creek, Gold Creek, or Daisy Creek, but does extend below some of their headwater tributaries. Most of the changes are expected to occur directly beneath the pit in association with pit dewatering and drawdown. Existing groundwater divides are not affected, except within the pit boundaries. Drawdown at the mine permit boundary is not predicted to be measurable and is expected to be within the natural range of variation. The area of measurable drawdown is predicted to be contained within the local study area.

[668] The Coalition criticized Benga's assertion that the drawdown impacts on the groundwater and surface water regimes will not be significant. The Coalition submitted that the removal of much of Grassy Mountain will result in a permanent decrease and alteration of the local water table. The mine will remove up to 430 vertical metres of the mountain, with a hole in the earth reaching 110 m below Blairmore Creek, and up to 40 m below Gold Creek. This will produce a permanent depression in the water table that will cause groundwater to be drawn inward toward the depression, intercepting flow that would have otherwise reported to certain reaches of Blairmore and Gold Creeks. Numerous upland springs, wetland areas, and seepages supporting habitat on the mountain, as well as along the remaining upland areas around the mine pit, will inadvertently dry up and be lost forever. The Coalition questioned how this result could be characterized as "not significant."

[669] The Coalition also questioned Benga's prediction that aquifer dewatering effects will be limited to within 400 m of pit location. It argued that the impacts will extend far beyond pit boundaries. Of particular concern is the potential for groundwater drawdown in an east-west orientation. The Coalition's expert, Dr. Fennell, asserted that the presence of east-west tear faults and fracturing on Grassy Mountain will significantly increase the hydraulic conductivity and drawdown in an east-west direction. He estimated that drawdown effects in the east-west orientation will go well beyond both Blairmore and Gold Creeks to 2400 m in a 50-year time span.

[670] Dr. Fennell provided evidence of east-west tear faults in the adjacent Livingstone Range and argued Benga did not examine, look for, or even consider similar tear faults on Grassy Mountain. The Coalition concluded Benga's model lacks the rigour such a model warrants because of limited groundwater data collection and use in the model. The Coalition suggested Benga focused its attention on coal-seam data collection, and that Benga conducted limited drilling and exploration of surrounding bedrock above, below, and adjacent to the coal seams (pay zones).

[671] Benga argued that Dr. Fennell's calculations and estimate of impact distance of drawdown in groundwater of between 1500 and 2400 m are inaccurate. Benga's groundwater expert, Ms. N. Grainger, explained that the larger impact area suggested in Dr. Fennell's report does not account for the tilted angle of the bedrock and project site, which results in the drawdown extending over a much smaller area than it would in a flatter setting.

[672] Dr. Fennell asserted that the EIA's assumption of 28 per cent of mean annual precipitation as the recharge input into SRK's groundwater numerical model is high, given documented mountain front/block recharge estimates. For this assertion, Mr. Fennell cited a paper titled "Mountain-block hydrology and mountain-front discharge" (Wilson and Guan 2004). Ms. Grainger suggested that the paper is not applicable to the Grassy Mountain Project site as the authors reviewed sites with considerably lower precipitation and substantially different geology. Furthermore, the paper identified a range of per cent recharge, which is in fact within the range used in SRK's groundwater numerical model.

[673] The limited site-specific groundwater data and some of the simplifying assumptions used in the groundwater flow model reduce our confidence in its predictions of drawdown effects. In particular, the presence and potential contribution of east-west tear faults and fracturing was not specifically accounted for in the modelling and is not well understood. This creates uncertainty for the assessment of potential

effects of drawdown, and has implications for potential impacts on surface water bodies such as Blairmore and Gold Creeks.

[674] We understand Benga's view that the east-west tear faults observed in the adjacent Livingstone Range may not be present at Grassy Mountain; however, the evidence on this point is not persuasive. Presumably, the rocks comprising Grassy Mountain were subject to the same stresses during mountain building that the rocks comprising the Livingstone Range experienced, and similar features could be present. However, Benga presented little evidence to demonstrate that it thoroughly considered this possibility or that it understands the location, frequency, and extent of east-west faults and fractures and their potential to contribute to increased east-west hydraulic conductivity. If hydraulic conductivity is higher in an east-west orientation than what is accounted for in the model due to the presence of faulting and fracturing, then the extent of drawdown may be higher than predicted in this direction, resulting in greater impacts on the amount of groundwater discharged to Blairmore and Gold Creeks. Although groundwater modelling is a potentially effective method for predicting impacts, Benga's model does not appear to have considered reasonable worst-case drawdown scenarios related to dewatering. This reduces our confidence in its predictions.

[675] It is reasonable to assume that groundwater levels will reach a new equilibrium level at some point after mining and dewatering operations cease. But given the changes to the topography that would occur as a result of the project, we find that the elevation at which groundwater levels become re-established, and how long it will take, remain uncertain.

Drawdown and quality impacts on domestic and municipal water supply wells are predicted to be negligible

[676] Benga completed both a desktop and field-verified survey of groundwater users. It concluded that domestic, agricultural, and municipal water supply wells are located several kilometres southwest of the mine pit. Benga predicted that drawdown impacts will have negligible to no residual effects on these wells, mainly due to their significant distance from the mine pit area.

[677] In a search of the Alberta Environment and Parks (AEP) Water Well Information Database, Benga found 177 water wells and 10 springs within the RSA. Most of the wells are for domestic use, with 15 identified as industrial, and another 14 as municipal. The remaining wells serve domestic/stock and miscellaneous purposes. Most of the wells are in the vicinity of the towns of Frank, Blairmore, and Coleman. Of the 177 active water wells within the regional study area, 47 water well records and one spring are located within the LSA, with 35 records indicating domestic use and 11 indicating unknown use. Eight records are located within the mine permit boundaries; six are listed as industrial (Scurry Rainbow Oil and Devon) and two as domestic.

[678] Benga conducted a field survey in the fall of 2014 to confirm groundwater and surface water users. During the survey, six water wells and two springs used for domestic purposes were verified. Some of the wells reportedly used for domestic purpose in NW and SE-16-08-04 W5 were not surveyed because access to them was not granted by the owners. In general, water sampled from the landowner wells and springs is of the calcium bicarbonate type with various concentrations of sodium and magnesium. Total dissolved solids range from 264 milligrams per litre (mg/L) to 651 mg/L, with about half having concentrations higher than the Canadian drinking water guidelines of 500 mg/L.

[679] For selenium, Benga said no observed concentrations exceeded the Canadian drinking water guidelines in landowner wells or springs. Furthermore, Benga said that the proposed site-specific objectives for selenium for the project are more stringent and lower than the Canadian drinking water guidelines (0.05 mg/L). As a consequence, meeting the site-specific objectives will automatically meet the Canadian drinking water guidelines and will be protective of drinking water receptors, including domestic and municipal wells. No selenium concentrations exceeded the Canadian drinking water guidelines for landowner wells or springs. Members of the Coalition who live in Valley Ridge Estates expressed concern about the potential impact on their well water, as well as on the value of their properties.

[680] We agree with Benga's conclusions that the project is likely to have little to no effect on domestic municipal and agricultural groundwater wells. These wells are located primarily in the Crowsnest River valley, a considerable distance south of the proposed mine. Similarly, the project is unlikely to affect groundwater wells in Valley Ridge Estates, which are 3 to 4 km southeast of the mine's boundary. The groundwater flow path modelling conducted by Benga indicates that a groundwater divide exists between Bluff Mountain and the project, and that groundwater flow in the vicinity of Bluff Mountain, adjacent to Valley Ridge Estates, is radial. This suggests that groundwater contaminants from the project are unlikely to flow south and east of Bluff Mountain and reach domestic water wells in this area. We acknowledge several private landowners own lands along Gold Creek to the east of the mine pit. Further discussion regarding the water supply for these landowners follows.

Surface springs used by residents on the east side of Grassy Mountain may be affected

[681] The Coalition noted that two of its members, F. Gilmar and the Donkersgoeds, own land on the west side of Gold Creek, within the proposed mine permit boundary. Other members, such as V. Emard, live on the east side of Gold Creek adjacent to the mine permit boundary. The Coalition said its members were concerned about the potential for impacts on their local water supply. Specifically, concerns were raised about the potential for coal mining to contaminate or reduce groundwater flow to springs they rely on for water when using their properties, particularly the spring on Ms. Gilmar's property (SW 30-8-3-W5M) and the Donkersgoed spring (SW 19-8-3-W5M) on the west side of Gold Creek.

[682] Ms. Gilmar commented on the quality of the water in Gold Creek and her domestic spring, from which she has drawn drinking water for 58 years. According to Ms. Gilmar, the Gold Creek water is "...beautiful water. It's the last of the last. You do not find water like that anywhere." (CIAR 1339, PDF pp. 18–19). Mr. Emard also stated that he relied on a collection of springs adjacent to Gold Creek and attested to the quality of the water. We accept that landowners to the east of the proposed pit along Gold Creek rely on the creek or surface springs to provide some or all of their water while using their properties.

[683] Gold Creek likely represents a groundwater divide (recharge boundary condition), meaning that springs to the east of Gold Creek are unlikely to be affected by groundwater drawdown from mine operations. However, it is possible that springs on the west side of the creek could be affected by mining drawdown. The potential for contamination, while lower, also cannot be ruled out for springs to the west of Gold Creek for several reasons. These include the complexity of the site's geology, the limited information about the location, the source and nature of the springs, and the limitations of Benga's

groundwater modelling. Benga did not specifically model shallow unconsolidated deposits, or assess the project's impacts on these springs. Overall, several uncertainties remain over the potential for contaminant transport from the mine site toward Gold Creek, and the proximity of these springs to the mine pit. Consequently, were the project approved, monitoring of these springs would need to be a consideration for the design of the groundwater monitoring program.

Mine pit construction and dewatering are predicted to affect groundwater base flow to Blairmore Creek and Gold Creek

[684] Benga predicted that the project's pit construction and dewatering will affect groundwater base flow to surface water courses, specifically Blairmore and Gold Creeks. Benga suggested that mitigation strategies will negate the predicted impacts. Namely, it will provide continuous recharge to the creeks from stored water reserves in the sedimentation ponds and from treated water from the saturated backfill zones. Moreover, Benga predicted that its proposed surface water management system (drainage ditches, surge and sedimentation ponds) would capture a large proportion of water from the pit, with a peak of 72 litres per second (L/s) in 2025. The water management system would be dismantled in 2046, dramatically increasing the amount of groundwater base flow reporting to Blairmore Creeks and, to a lesser extent, Gold Creek.

[685] Benga's modelling results indicate a 10 per cent reduction in Gold Creek base flows at GC-02 over the first year of operation, and a more gradual reduction thereafter, with a maximum reduction of 63 L/s, or 19 per cent of total base flow at end of mine life in 2041. Base flows in Gold Creek would increase following closure to a steady-state value that is 17.5 per cent lower than that of pre-mining conditions. These reductions result from the interception of groundwater in the pit and surface water management system flows that do not report to the creek as base flow. Benga said it is important to recognize that these flows do not account for any mitigating measures that will be implemented by the surface water management system (such as flow augmentation) and therefore are not net reductions.

[686] The Coalition's expert, Dr. Fennell, stated that base-flow estimation is challenging at the best of times, and involves several techniques that infer rates from existing streamflow data (i.e., indirect method). He said Benga's comparisons of modelled and observed results over- or underrepresent peaks and lows, indicating that the model is not accurately representing the timing and rate of flow.

[687] The Coalition was concerned that Benga may have overestimated recharge in the FEFLOW model produced by SRK, reducing the predicted spatial extent and magnitude of groundwater drawdown effects and underestimating associated reductions in base flow in Gold Creek. In response to questions from the Coalition, Benga confirmed that SRK used an average number of 28 per cent of the mean annual precipitation for recharge in its model. The model assumed that 28 per cent of the mean annual precipitation in the Gold Creek watershed will end up as groundwater recharge. Benga's groundwater expert, Ms. Grainger, clarified that this was not uniform across the model area; in some areas of the model the recharge rate used was lower, and in other cases it was as high as 50 per cent or more.

[688] Ms. Grainger confirmed that Benga did not map where or how much baseflow recharge was occurring along specific reaches of Blairmore and Gold Creeks; it was only estimated by reach. The Livingstone Landowners Group argued this is one of the single most important issues for the whole site. The group contended that Benga should have paid greater attention to the rate of base flow to the

creeks. The potential effects of changes to baseflow to Blairmore Creek and Gold Creek are discussed in the chapter on surface water quantity and flow.

[689] We note from Benga's evidence that the final mine pit depth will be 110 m below Blairmore Creek and 40 m below Gold Creek. This could result in significant alterations to the groundwater divide that currently exists within the mine pit area as the mine deepens to 430 m. Instead of continued groundwater flow gradients from Grassy Mountain toward Blairmore and Gold Creeks, the gradients could shift toward the mine pit, resulting in a permanent groundwater sink. Because it is unknown at what elevation groundwater levels will re-establish after mining operations cease or how long this will take, the magnitude and duration of predicted effects on base flow for Gold and Blairmore Creeks are also uncertain.

[690] As previously discussed, there is some uncertainty about whether east-west fractures and tear faulting exist on Grassy Mountain and the extent to which they influence groundwater flow. If present, the faulting and fracturing could provide pathways with increased permeability and hydraulic conductivity that could affect the lateral extent and magnitude of predicted drawdown. If the effects of drawdown are greater than those predicted in an east-west direction, this could further decrease the amount of groundwater base flow reaching Gold Creek and Blairmore Creek.

[691] We understand that Benga did not attempt to confirm the specific locations and volumes of groundwater baseflow or upwelling at different points along Blairmore and Gold Creeks. While this may have provided greater certainty and confidence in the assessment results, we recognize that this could be technically challenging and require considerable effort. However, in the absence of such information, and given that the method used to estimate groundwater recharge to base flow is subject to considerable uncertainty, we have a low degree of confidence in the predicted changes to base flow, particularly during low-flow conditions and for Gold Creek.

[692] We find that the project is likely to reduce groundwater base flow to both Blairmore Creek and Gold Creek. Due to limitations associated with the groundwater modelling, there is considerable uncertainty about the magnitude and duration of reductions to groundwater baseflow. It is therefore not clear that the modelling completed by Benga is sufficiently conservative and represents a reasonable worst-case scenario for the assessment of effects. The potential effects of reduction in groundwater base flow on surface water flows and fish and fish habitat are discussed in the chapter on surface water quantity and flow and the chapter on fish and aquatic habitat.

Waste rock is a potential source of acid mine drainage and may release selenium, metals, and other contaminants to groundwater

[693] Mining operations and waste rock disposal may affect groundwater quality as a result of the composition of the coal and waste rock and the use of explosives for mining. The chapter on surface water quality provides a detailed discussion of the potential for waste rock from the project to generate acid and result in leaching of selenium and other trace metals. The baseline study assessed the current conditions of groundwater in the study area, including the areas of the historical waste mine dumps and seeps coming from underground tunnels and shafts of the historic mines.

[694] The conditions at the site from the baseline sampling program indicate that 38 per cent of groundwater samples have concentrations of selenium that exceed the alert concentration of 1 ug/L as listed in the *Environmental Quality Guidelines for Alberta Surface Waters (or Freshwater Aquatic Life Guidelines)* that are protective of aquatic life in general, including fish, invertebrates, and aquatic plants (ESRD 2014), but below the *Guidelines for Canadian Drinking Water Quality* (Health Canada 2014). Cadmium concentrations in the sampled locations were below the *Freshwater Aquatic Life Guidelines* except in two toe springs coming from the legacy waste dump.

[695] No potential acidic conditions were observed in the baseline assessment. However, groundwater samples collected by Benga during the baseline assessment contained dissolved oxygen, indicating oxic conditions in the groundwater system. Additionally, the baseline assessment showed the presence of trace elements in groundwater such as aluminum, zinc, and mercury. This indicates that those elements can be mobilized under current conditions, prior to the mining operations.

[696] Benga's assessment indicated that—due to oxidation of pyrite—rock units from the Cadomin Formation and the Mutz, Adanac, and Moose members have the potential to generate acidic conditions when brought to the surface and exposed to air. Benga stated that the associated release of sulphides, selenium, and, to a lesser degree, cadmium, can affect groundwater quality.

[697] Benga indicated there was limited data for certain parameters in groundwater including beryllium, bismuth, lithium, molybdenum, ammonia, phosphorous, tin, strontium, titanium, thallium, vanadium, and zirconium. It did not include these parameters in the groundwater testing conducted for the baseline assessment. For these parameters no source term was included for groundwater and the concentration was assumed to be 0 mg/L in the impact modelling on surface water quality.

[698] Benga's expert, Mr. S. Jensen, stated that the use of background water quality for groundwater in the modelling of impacts on surface water quality was limited to instances in which groundwater was extracted and then conveyed to surface water. The loading of these elements was assumed to be not measurable for the final outcome. Benga stated that the risk of release or concentrating of naturally occurring radioactive materials or technically enhanced naturally occurring radioactive materials was assessed as not being an important risk for the project given site-specific conditions at Grassy Mountain.

[699] The Coalition stated that leaving the trace elements out of the analysis of potential impacts on groundwater, instead of accounting for their presence in groundwater, is not a conservative approach. The Coalition argued that not assessing the potential for trace elements other than selenium to leach into groundwater from the waste rock does not provide a reasonable worst-case scenario. The Coalition also stated that Benga has not assessed the risk that its operation might have on the concentration, and potential release, of naturally occurring or technically enhanced levels of radioactive materials into groundwater. The potential for such a release has been observed when the same formations were mined in British Columbia.

[700] The Coalition noted that Benga's testing of the various bedrock formations indicated that mobilization of harmful trace elements is possible under oxic conditions. But Benga did not investigate mobilization potential under suboxic or anoxic conditions. The Coalition also pointed out that Benga did

not assess the mobilization potential from formations beneath the mine footprint, in unlined rock dumps, or in water management ponds.

[701] In addition to potential contaminants of concern from waste rock, the explosive used for mining, ammonium nitrate–fuel oil, creates a potential for nitrate and nitrite blasting residues to be present within the pit and the waste rock disposal areas. No nitrate exceedances above the Canadian drinking water guidelines and *Freshwater Aquatic Life Guidelines* were measured in the groundwater baseline samples. Benga stated that nitrate denitrification will be implemented in the saturated zones through a mechanism similar to that used for selenium attenuation.

[702] Benga stated that various measures exist to minimize or prevent adverse impacts on the quality of shallow groundwater. They include industry-standard operating practices, preparedness for upset conditions, and the appropriate management of upset conditions. Benga proposed to limit the development of acidic conditions and the potential for selenium and trace-metal leaching from waste rock using a combination of blending of potentially acid-generating and non–potentially acid-generating waste rock and underwater storage. Blending of waste rock is the primary means of mitigating acid generation in the external waste rock disposal areas, while a combination of waste rock blending and underwater storage is proposed for waste rock used to backfill the mine pit, in what Benga refers to as saturated backfill zones.

[703] A discussion of Benga’s approach to waste rock blending is provided in the chapter on coal mining, handling, and processing. Benga’s plans to create saturated backfill zones to mitigate leaching of selenium, as well as other proposed mitigation measures, are discussed in detail in the chapter on surface water quality.

[704] Benga stated the great majority of solutes travelling from the base of the waste rock via groundwater would not likely reach the tributaries or creeks for at least 50 years (travelling via the Mist Mountain Formation). This prediction is based on the location of proposed ex-pit waste rock disposal areas relative to Blairmore and Gold Creeks and their tributaries. However, little characterization has been undertaken of surficial unconsolidated deposits and the Blairmore Group rocks, which overlie the Mist Mountain Formation. It may be that groundwater could reach the tributaries and creeks more rapidly via these shallower pathways.

[705] Benga produced a map of residence times in groundwater (time to travel from a source to a surface water receptor) for the long-term closure state. Benga confirmed that its team expects that the modelled residence times will be similar under the baseline and long-term closure conditions, even though they have modelled only long-term closure. However, residence times will be different during operations phase. Surface water quality modelling assumes that 5 per cent of all contact water will seep into groundwater and immediately enter the creeks. The residence time in groundwater is assumed to be zero and therefore does not affect modelling results for surface water targets. Benga acknowledged that, in the long run, surface water capture ditches and sediment ponds will likely capture some of the shallow seepage from the ex-pit waste rock area toward Blairmore and Gold Creeks. However, it stated that other measures will be required to capture higher groundwater proportions.

[706] Benga described the design features to minimize seepage into groundwater from the waste rock dumps in the Eleventh Addendum:

- The waste rock dumps are located outside of Gold Creek and Blairmore Creek valley bottoms. To the best extent possible, Benga located the waste rock dumps at higher elevations where subsequent capture of any percolating water is possible. This design feature is not a common mining standard as it requires expensive hauling of waste rock up a hill.
- Before depositing material, as much organic, weak, or fine-grained materials within the foundation of the waste dumps as possible will be removed. The waste dump foundation will consist of granular, till-like soils or bedrock.
- Where bedrock is exposed, Benga will assess whether open fractures can be sealed with cement or chemical grout, by adopting contact grouting procedures commonly utilized for water retaining dams.
- All spoils are designed to be constructed in lifts 15 m or higher that will form a zone of segregated coarse rock at the base of each lift, particularly the base layer, which will form the foundation of each spoil and provide adequate drainage through the bottom.

[707] Benga submitted that the implementation of the proposed key measures for the construction of the waste dumps will minimize infiltration of water from the waste dumps into the foundation. It will also facilitate gravity drainage from the waste dumps and direct the drainage water through ditches and trenches to surface water ponds. However, if these seepage minimization and capture measures are insufficient, and groundwater quality monitoring indicates that the surface water quality at receptors such as those at Gold Creek or Blairmore Creek may be affected, Benga will implement groundwater seepage capture wells.

[708] The Livingstone Landowners Group pointed out that Benga predicted areas of the low residence times (0 to 10 years) will extend between the mine site and Gold Creek. The group emphasized that Benga did not look at a worst-case scenario for contaminant movement toward Gold Creek. The Coalition raised concerns regarding Benga's plan to mitigate potential seepage by sealing fractures in the rock to block potential pathways under the waste rock dumps and the saturated backfill zone. The Coalition suggested that faults in the mine workings might be obscured by residual fines and rock fragments and not easily identified.

[709] During the hearing, Benga indicated it had a high level of confidence in techniques such as ground-penetrating radar, aerial drones, and seismic refraction profiles to find the faults and fractures. Benga stated that it had some success with ground-penetrating radar across the site while looking at different layers of sediments below the topsoil and organic layers down to bedrock. Benga stated that it had used ground-penetrating radar across the raw water pond to acquire information on the design of the dam wall's foundation and to highlight cavities and previous underground workings.

[710] Benga described its intention to conduct fieldwork to develop a thorough understanding of the fracturing and potential groundwater pathways once it clears vegetation and topsoil from the surface of the dumps or the dump areas. However, while ground-penetrating radar surveys appear to be promising, the company had not used the technique for groundwater pathway investigations previously. Benga stated

that this would require specialized post-processing. Benga stated that it is not familiar with examples of grouting a floor of a mining pit or under a waste rock dump, but expressed its willingness to explore techniques that have not been used in the past.

[711] NRCan questioned which metrics can be used to evaluate factors such as the safety of the proposed grouting operation when deciding to implement grouting of the fractures. CPAWS stated that identifying, and potentially sealing, fractured zones can be challenging and will require detailed surface geophysical surveys. It might require downhole geophysical surveys and drilling angled boreholes to intercept subvertical fractures. The application of grout curtains commonly requires multiple grout curtains, because the fractures may not be interconnected; a single unsealed fracture may be responsible for large amounts of groundwater flow and, as a result, can have a significant effect on surface water chemistry if it discharges into a stream.

[712] We recognize that waste rock at the project is a potential source of acid generation, and may release selenium and other metals into groundwater. We also note that baseline groundwater sampling confirmed the presence of oxygen in groundwater, which would provide conditions conducive to acid generation. Contaminants that enter the groundwater system, if not attenuated naturally or captured and treated, may be discharged to Blairmore Creek or Gold Creek.

[713] Benga's ability to minimize acid generation and associated leaching of trace metals in waste rock relies on a combination of effective blending of potentially acid-generating and non-potentially acid-generating waste rock and storage under water. As discussed in the chapter on coal mining, handling, and processing, it is not clear whether there is sufficient non-potentially acid-generating waste rock for blending.

[714] The modelling used to predict effects on groundwater and surface water quality assume high capture and treatment rates and limited seepage from the waste rock dumps and saturated backfill zones. As discussed in the chapter on surface water quality, we find that the capture rates for the waste rock dumps and the treatment rates for the saturated backfill zones are highly optimistic and not well supported by the evidence provided by Benga.

[715] Given the complexity of the site's geology and limited site-specific information on its hydrogeological properties, there is considerable uncertainty about the amount of seepage that may occur below the waste rock dumps or associated with the saturated backfill zones. Little evidence supports the low seepage rates used in the modelling. If capture or treatment rates are significantly lower or seepage rates significantly higher than those used in Benga's models, the magnitude of potential effects on groundwater and ultimately surface water would be greater than predicted.

[716] The estimates of the residence times in the saturated back fill zone and in the groundwater system before reaching sensitive surface water receptors are key variables. We find that the difference between a period of days and a period of months or even years of transport time cannot be predicted by Benga's groundwater model with sufficient accuracy due to the modelling limitations discussed earlier. While Benga's modelling results show that the residence time in groundwater for a large part of the mining footprint exceeds 50 years, the same modelling also predicts that a portion of the lease between south and central waste rock disposal areas and Gold Creek could have residence times of zero to ten years.

[717] We find that leaching of selenium and other trace metals to groundwater is likely to occur, and that Benga's assessment may have underpredicted the magnitude of the project's effects on groundwater. This finding is based on the uncertainties about the rate and amount of seepage that will occur below the waste rock disposal areas and associated with the subsurface backfill zones and the effectiveness of the proposed mitigation measures (capture and treatment). Any increase in the magnitude of effects on groundwater would have potential implications for surface water quality.

Operation of the saturated backfill zones may mobilize and increase the toxicity of trace elements such as arsenic

[718] The Coalition agreed that Benga's plan to use saturated backfill zones to manage selenium and nitrates can work under the right conditions. However, the Coalition expressed concern about what other reactions might occur within or below the saturated backfill zones once they are established and anoxic conditions are achieved. Anoxic conditions in the saturated backfill zone may favour precipitation of elemental selenium; but they may result in the mobilization, and an increase in the toxicity of, other trace elements such as arsenic. The Coalition noted that under the conditions expected to exist in the saturated backfill zone, arsenic falls within the stability field consistent with its more mobile and toxic form, trivalent arsenic. This suggests the potential for the mobilization of toxic arsenic under anoxic conditions.

[719] The Coalition is concerned that development of an anoxic plume of groundwater under the saturated backfill zones or other mine-related structures will increase the risk of mobilizing potentially harmful trace elements from the waste rock and underlying soil and/or bedrock. In some cases, this may be Fernie Group strata, for which no information regarding trace element chemistry was provided by Benga. Once mobilized, some of the trace elements will have the ability to be transported considerable distances.

[720] The Coalition said its concern was based on the presence of elevated trace elements in the soil and water of the project area, as indicated by Benga's baseline assessment. The Coalition noted that the presence of some contaminants at levels above Canadian guidelines for the protection of drinking water and provincial guidelines for the protection of freshwater aquatic life has been confirmed in some of the monitoring well samples assessed by Benga. Selenium, aluminum, cadmium, chromium, copper, mercury, nickel, and zinc have also been found in some of the springs, creeks, and ponds sampled by Benga. The Coalition concluded that these results indicate the presence of these contaminants in the waters of the project area.

[721] Benga stated that the process that takes place in the saturated backfill zone—anaerobic biological reduction—is well known and documented. Although Benga has focused much of its efforts on selenium treatment in the saturated backfill zones, it stated it is not ignoring the potential for other constituents, such as manganese and arsenic, to be mobilized from the waste rock in the saturated backfill zone. Benga indicated it would take steps to quantify exactly which ones will be mobilized using test work at various scales, and would devise appropriate treatment.

[722] Concerning all substances other than selenium, Benga indicated at the hearing that there will be sufficient time to consider whether a metals treatment facility is needed to address discharges into Blairmore Creek. Benga committed to installing such a facility if needed. Benga confirmed that sampling for arsenic concentrations in groundwater would be a normal part of a water monitoring program. In its

final argument, Benga acknowledged that leaching of metals may occur for an extended period after closure. Accordingly, Benga estimated a long-term care and custody cost of \$22 million. Benga further stated that this estimate would be revised in response to reclamation work and monitoring performed as the project progresses.

[723] As discussed in the chapter on surface water quality, we find that Benga focused its assessment of the saturated backfill zones primarily on the fate of selenium and, to a lesser extent, nitrates. Although Benga indicated it is aware of the potential for other metals to be mobilized in the saturated backfill zone and within the external waste rock dumps, the EIA provides little information or discussion of this issue. While Benga said it did not consider the mobility of other metals to be an important risk for the project, it presented limited site-specific analysis of hydrogeochemical conditions to support this position. The baseline groundwater assessment indicates the presence of both dissolved oxygen and some trace elements in excess of regulatory guidelines in the groundwater system. This indicates that such mobilization is possible either naturally or through the historical mining activity in the project area.

[724] Based on the evidence, we find that trace metals other than selenium may be mobilized from waste rock within the saturated backfill zones and external waste rock dumps. These trace metals could be released to groundwater. Arsenic is a particular concern due to its potential to be released from the saturated backfill zone in its more mobile and toxic form. The groundwater system may provide some natural attenuation, reducing the likelihood of these trace metals reaching surface water receptors such as Blairmore and Gold Creeks. But Benga does not appear to have assessed in a systematic and thorough manner how extensively this will occur for these various metals. As a result, we find that the assessment of project effects on groundwater did not consider a reasonable worst-case scenario and may underestimate project effects.

[725] We recognize that Benga considers the mobilization of other trace metals unlikely at a scale that will require additional mitigation, and it proposes to rely on further study, groundwater monitoring, and adaptive management. Benga proposed additional mitigation measures that could be deployed if necessary. They include the installation of groundwater recovery wells downgradient of the external waste rock dumps and/or construction and operation of a water treatment plant for metals in the effluent from saturated backfill zones. However, both of these mitigation measures are subject to uncertainties regarding their technical and economic feasibility and effectiveness. The potential use of groundwater recovery wells is discussed later in this chapter, while the metals treatment plant is discussed in the chapter on surface water quality.

Leakage from the saturated backfill zones is likely

[726] Benga stated that the efficacy of saturated backfill zones in removing selenium and nitrates is reliant on the residency time of the process-affected water within the backfill. The longer the residence time, the more effective the removal. Benga stated there is currently no information to indicate what the required minimal residence time would be. Benga referenced Bianchin et al. (2013), who concluded from one case study that selenium attenuation may have occurred at residence times ranging from 0.3 to 3 years. The uncertainty of this estimate reflected the range of groundwater flows in the backfill.

[727] Seepage is anticipated from the saturated backfill zones. To minimize such seepage losses, Benga proposed to use a combination of engineering options. Benga stated that the pit will be extended to below the known level of existing underground mine openings. Where it is safe and practical to do so, rock exposed in the pit floor will be mapped for open fractures associated with faults and joints. Depending on the state of the post-mining state of the pit floors, some of the following geophysical methods will be applied to identify and map the structure at depth beneath the pit floor:

- Seismic refraction profiles can be acquired across the pit floor to measure changes in rock velocity with depth.
- Lines of ground-penetrating radar data can be acquired on a coarse grid across the pit floor to identify major fractures and any voids.
- Using drone technology and air photos, the observable joint sets in the pit walls will be mapped and plotted on a rose diagram to show the orientation of faults and joint sets. In addition, where it is safe and practical to do so, groundwork (dip and strike) could be done as warranted to confirm orientations of these structures.
- Significant identified fractures will be assessed to determine if they can be sealed with cement or chemical grout by adopting contact grouting procedures commonly utilized for water retaining dams. This assessment will consider factors including the safety of the proposed operation, the total number of features detected in the saturated backfill zone, and the technical feasibility of the sealing procedure.

[728] The Livingstone Landowners Group's expert, Dr. McKenna, identified a number of potential concerns related to saturated backfill zones. Dr. McKenna said that it appeared that Benga simply assumed water would flow all the way through the various saturated backfill zones to the dewatering well instead of developing a groundwater model or conducting any studies to support this assumption. He suggested that water travelling through the saturated backfill zone could potentially short-circuit to the nearest exit and not travel all the way through. Potential exit points include existing mine tunnels from historical mining operations. The group concluded that within the saturated backfill zone system, contact water could seek preferential pathways, causing the saturated backfill zone to leak, into legacy underground workings and groundwater.

[729] Benga was asked about the possibility of encountering open tunnels resulting from historical mining operations and their potential impact on groundwater flow through the backfill zones. Benga indicated that it would plug any open tunnels encountered during mining prior to backfilling and flooding of the mine pit, potentially with compacted material and grout. While Benga said that techniques were available to do this, it provided limited details on specifically how this would be done.

[730] The Livingstone Landowners Group also expressed concern about the significant hydraulic pressure that the plugs may need to be able to withstand given the potential height of the water column. Benga estimated the height of the water columns at about 50 to 100 m. The group suggested the design was dangerous because all-out failure of a plug would equal a hole in the side of the backfill zone. Benga stated that it would be far more likely to seep along the wall of the plug and that such seepage will be relatively small.

[731] CPAWS' expert, Mr. M. Bowles, expressed a concern that Benga's submission does not adequately address the complexity of characterizing fracture zones and selectively sealing fissures in the underlying bedrock. He stressed that identifying such zones can be extremely challenging and requires detailed geophysical surveys, possibly downhole geophysical surveys, and drilling numerous angled boreholes, because the fractures could be subvertical. To seal off the seepage, the grout curtains could be installed but Mr. Bowles stated that even the best-designed grout curtains are rarely 100 per cent efficient. In many cases, multiple grout curtains must be installed. An additional challenge is that the fractures may not be interconnected, and sealing the specific fractures responsible for contaminant transport may prove complicated. Large volumes of groundwater can flow through a single unsealed fracture. Mr. Bowles indicated that in his experience it is possible to see impacts on surface water chemistry from a single highly conductive fracture.

[732] We understand that contact water could seep into groundwater prior to the treatment of selenium, nitrates, and other potential contaminants. This could occur if the residence time in the saturated backfill zone is insufficient or pockets of untreated contact water are created by the flow regime in the saturated backfill zone. This seepage may decrease groundwater quality and contribute to further exceedances of criteria observed in the baseline assessment. Without a clear understanding of groundwater flow direction and rate, Benga will have a challenging time detecting and remediating contaminated groundwater.

[733] It was not clear from Benga's evidence what success it had in locating the historical underground workings that may be encountered during mining. Their presence and locations remain uncertain. We accept Benga's commitment that it will plug any open mine tunnels it encounters, and that techniques are likely available to do so. But without some details about the specific methods that would be used, it is not possible to confirm the technical feasibility or likely effectiveness of the measures, including their potential to withstand the hydraulic pressures to which they may be subjected. We recognize that after backfilling and flooding of the mine pit, it would not be possible to access or repair any of these plugs, should failure occur.

[734] We acknowledge that Benga confirmed its willingness to attempt to identify and seal fractures that may occur under the saturated backfill zones with cement or chemical grout, should significant preferential flow pathways be identified during the construction phase. However, we are not confident that the proposed techniques would be effective, or technically and economically feasible. Three reasons stand out. The geological setting in the project area is complex, with faulted and fractured bedrock. The areal extent of the proposed saturated backfill zones is quite large. And Benga has acknowledged that it lacks experience with large-scale cementing/grouting operations in similar settings. Identifying which fractures represent preferential pathways and sealing them is likely to be extremely challenging. We therefore conclude that it is likely that seepage would occur from the saturated backfill zones.

Seepage to groundwater is expected from the end-pit lake

[735] Because its modelling indicates that groundwater will flow toward the end-pit lake, Benga stated that water will not migrate away from the pit. This will provide longer residence times and an opportunity for mixing. In Benga's submission, discussion of groundwater flow direction after filling of the end-pit lake is limited. But Benga did acknowledge that leakage from the lake into groundwater will begin immediately upon filling the pit. The predicted water quality in the end-pit lake is discussed in the chapter on surface water quality.

[736] Seepage from the end-pit lake via the groundwater pathway represents a source of selenium input to Gold Creek. This seepage combines with seepage from the waste rock to account for a portion of seepage bypassing the southeast surge pond and discharging into Gold Creek. Benga concluded that Gold Creek will not receive contact water beyond the minimal amount expected through seepage.

[737] The Coalition argued that hydraulic gradient reversal (and, subsequently, groundwater flow direction reversal) will occur after the end-pit lake is filled. This may result in the end-pit lake contributing contaminants to groundwater, as the water in the end-pit lake is expected to exceed *Freshwater Aquatic Life Guidelines*. The Coalition argued that the end-pit lake will have deep sections (up to about 80 m), and has a reasonable chance of creating anoxic conditions at its base. The development of such conditions, in the presence of a residual organic substrate such as carbonaceous rocks of coal fines, could again mobilize trace elements from bottom sediments and/or rock layers, and could mobilize harmful trace elements known to be present in the area that then seep into groundwater.

[738] As discussed in the surface water quality chapter, Benga provided little information about the fundamental design features of the end-pit lake. While a detailed design is not an expectation or requirement at this stage of the regulatory process, sufficient information is required for us to understand the nature of the project's effects, the potential effectiveness of any proposed mitigation measures, and the nature of potential residual effects after mitigation.

[739] We find that Benga did not provide sufficient information to give us confidence that it understands the potential effects on groundwater quality of seepage from the end-pit lake. Specifically, we are concerned that, due to the complexity of the geological setting and the potential for fracturing and faulting, potential impacts on groundwater quality resulting from seepage from the end-pit lake may be underestimated. Further, considerable uncertainty remains about groundwater flow direction in the vicinity of the end-pit lake after mining operations cease and groundwater levels achieve a new equilibrium in the closure landscape. Uncertainties about the effects on groundwater associated with the end-pit lake also have implications for surface water quality and westslope cutthroat trout.

Benga's proposed groundwater monitoring and adaptive management plan may not provide sufficient protection for the site

[740] Benga provided an overview of its proposed groundwater management plan for the project in the EIA. Benga stated that the main purposes of the groundwater monitoring program for the project are to evaluate changes in water levels associated with pit dewatering and detect any impacts on shallow groundwater quality. Benga's groundwater plan proposed to assess both groundwater quality and quantity by measuring hydraulic heads (water levels) and monitoring groundwater chemistry. Benga said the plan will be tailored to mine activities, with hydraulic head monitoring implemented around and downgradient of the mine pit and chemistry monitoring implemented near facilities that handle a variety of chemicals and fuels and around waste rock and sedimentation ponds.

[741] Benga proposed to collect baseline data from the wells to assess variations in hydraulic heads and baseline chemistry. Monitoring wells would be installed during the construction of the project so that baseline data are collected prior to the commencement of mining. Benga proposed monitoring water levels monthly during the initial period when levels are stabilizing to establish baseline conditions prior to mining. Once drawdowns become more predictable, monitoring frequency may be decreased. The water

sampling frequency is expected to be either biannual or annual. Analytical parameters are expected to include major ion chemistry, metals, and hydrocarbons, depending on location. Indicator parameters will be selected, and baseline data will be used to establish upper and lower control limits that represent the range of natural variations.

[742] Benga said that indicator parameters will be selected and baseline data (hydraulic head and chemistry) used to establish upper and lower control limits that represent the range of natural variation. The upper and lower control limits will be used during operational monitoring to compare measured values with the expected range of baseline conditions. Trends in parameters above the upper limit or below the lower limit will trigger Benga's groundwater response plan. The groundwater response plan establishes the steps to be followed once a parameter is detected outside of the control limits. Criteria that would trigger a groundwater response plan include hydraulic heads below threshold values near the mine pit (i.e., a drawdown value greater than predicted); an increase in concentrations of inorganic, dissolved and/or total metals parameters (concentration above upper control limits or an increasing trend that suggests incomplete treatment of water prior to release to the environment); and the detection of parameters above the detection limit for chemicals not naturally present at the site that could indicate incorrect handling practices or spills.

[743] Benga stated that the uncertainties within the groundwater model and the modelled predictions would be addressed through the use of an adaptive monitoring and management plan. Results from the model were used to select preliminary monitoring locations and areas requiring monitoring to confirm modelling predictions and ensure all receptors are effectively monitored prior to any potential impact associated with mining activities. Benga said that results from the monitoring will be compared with the modelling predictions throughout mining operations, with the need for additional monitoring or implementation of adaptive management re-assessed regularly.

[744] Benga identified a number of possible mitigation and adaptive management measures that it could implement if changes to groundwater are detected. Benga's approach to adaptive management for changes to groundwater quantity recognizes the potential for a decrease in groundwater discharge to surface water. Benga said it will address this through flow augmentation, using water stored in surge and sedimentation ponds, drainage ditches, and the saturated backfill zone water (after treatment). Benga's proposed mitigation measures for the effects on surface flows are discussed in the chapter on surface water quantity and flow.

[745] Should the project have an effect that impedes the use of a privately owned well, mitigation could include either drilling a new well or connecting the affected user to the municipal water network. Changes in groundwater quality near the mine pit and the surge ponds would be addressed as part of the management of treatment cells. Changes in groundwater chemistry near the facility would be investigated for spills or upset conditions that result in a discharge of chemicals to the surface and seepage into the shallow groundwater. Possible response measures include spill investigation, source removal, remediation, risk assessment, and/or risk management.

[746] Benga said that the addition of one or multiple lines of interception wells, low-permeability cut-off walls, or additional water treatment systems would be contingent on the failure of the base design to meet the water quality targets. Benga acknowledged that a second line of seepage capture wells may

be needed to ensure capture rates are achieved, but that design of such an interception system was not carried out.

[747] Benga said that monitoring wells will be located as close as practical to the potential source. The main focus of the groundwater monitoring program will be on the shallow-to-intermediate groundwater systems that have the potential to discharge near or into the surface water receptors, including Blairmore and Gold Creeks. As substantial measures will be implemented to capture potential contaminants at the source, the groundwater monitoring program's primary objective will be to confirm the efficiency of the capture program; the secondary objective will be to ensure that the receptors are not negatively affected by project activities.

[748] Benga said that the available maps of the Greenhill Boisjoli and Greenhill (South) Mine workings show that the two mines are not directly connected, with only the Greenhill Boisjoli Mine located underneath the proposed mine footprint. Because of the lack of a connection, Benga considered the old mine workings an unlikely pathway for groundwater transport and proposed that groundwater monitoring at these features be limited. Groundwater monitoring will occur at existing portals or seeps associated with historical mines, which will confirm the lack of impact associated with the new mining activities. In response to an information request, Benga provided additional information on its proposed groundwater monitoring plan in the Eleventh Addendum.

[749] Benga clarified that the final locations of the monitoring wells will target preferential flow pathways, including more permeable fractures and bedrock zones, to maximize the effectiveness of the monitoring program in the early detection of adverse effects. Multiple nested well pairs using traditional nested wells or the use of single-borehole, multi-level technologies will be considered to make it easier to monitor multiple depth intervals, target the possible pathways from shallow to deep water-bearing zones, and ensure a comprehensive detection of groundwater quantity (water levels and gradient) and quality (chemistry).

[750] In addition to monitoring wells, water samples will be collected from toe springs associated with the drainage of the rock disposal areas, from the various surge ponds and sedimentation ponds, and from the end-pit lake. The southeast surge pond, designed to contain process-affected water, is about 50 to 100 m from Gold Creek. The planned groundwater monitoring network around the southeast surge pond will include a provision for multiple monitoring wells downgradient from the pond dam. At the hearing, Benga confirmed that the proposed monitoring well locations in the Eleventh Addendum represent an early and preliminary indication of potential locations. Benga indicated they will need to be reviewed.

[751] Benga stated that external waste rock disposal areas and similar facilities will be stripped of topsoil as a part of mine development, and that additional mapping of the fault structures will take place at this time. Benga stated that it is impractical to monitor all faults and fractures. Instead, the intent is to monitor preferential flow pathways at a "representative number of locations" downgradient of rock disposal areas. Benga stated that the final locations of the monitoring wells would be determined after detailed investigation of the external waste rock disposal areas.

[752] The east sedimentation pond is near lands owned by Ms. Gilmar and Mr. Emard. In response to questions from the Coalition, Benga characterized the area downstream from the east sedimentation pond as low risk, but said that two monitoring wells are placed there “proactively.” Benga described its proposed water monitoring system as layered, adjacent to most of the mine structures, in the downgradient receiving environment, and in the creeks.

[753] Benga stated that the techniques used to establish the locations of the monitoring wells will include a combination of surface mapping of fractures and borehole examination of fracture features, employing flow meters and packer tests. Benga stated that it may augment this work with ground-penetrating radar, although such tools are more often used to locate underground workings and formation interfaces. Benga stated that the cost of installing monitoring wells is not prohibitive, but it would prefer to discuss the detailed design with the AER after additional work is done. Multiple wells could be installed at appropriate locations if multiple preferential paths are identified.

[754] The Municipality of Crowsnest Pass expressed general satisfaction with Benga’s mitigation measures. Although supportive of the mine development, the municipality requested that all environmental monitoring and future mitigation measures and planning be discussed and made available to the municipality, upon request.

[755] The Oldman Watershed Council suggested the groundwater monitoring program requires improvement. This is due to the project’s high risk to groundwater, the reliance on this resource by nearby residents, and the extreme difficulty of reversing impacts. Frequent and comprehensive monitoring will increase the confidence of local and downstream residents, and will permit a rapid response by the company and the province should problems be detected. Transparent reporting of data would further increase confidence.

[756] We recognize that Benga provided a preliminary groundwater monitoring plan in its EIA and that many details have yet to be developed or confirmed. We accept that it is common practice for proponents to submit a high-level groundwater monitoring plan as part of an EIA and regulatory applications. A detailed groundwater monitoring plan is also commonly provided for review by the AER as a condition of approval. This is intended to avoid unnecessary effort by applicants, should a project not be approved. This requirement also recognizes that additional investigations may be completed and some elements of the project design may change during the course of the regulatory review, necessitating changes to the proposed monitoring program. We find the level of information provided by Benga in its EIA and response to information requests, and the information it provided at the hearing, to be sufficient to allow us to assess the likely effectiveness of the monitoring program.

[757] As discussed earlier, the geology of the site is complex and considerable uncertainty exists about the potential for preferential groundwater flow paths due to the presence of fracturing and faulting. Additionally, the area of the mine pit, saturated backfill zones, and external waste rock disposal areas is large. Given the geological complexity of the site and the large areal extent of features to be monitored, we are concerned that the relative spacing of the wells (between 250 m and 1 km) presented in the proposed groundwater monitoring plan would not be sufficient to provide effective monitoring of the site. We understand that the proposed number and locations of wells are preliminary and that Benga indicated

a willingness to add additional wells if necessary; however, we are not confident that simply adding additional wells will ensure effective monitoring.

[758] We find that the design of the groundwater monitoring network is largely dependent on future investigations of fracturing and faults to identify potential preferential pathways and increase understanding of site-specific hydrogeological conditions. As discussed earlier, there is significant uncertainty about whether the investigation techniques proposed by Benga will allow it to successfully identify preferential flow paths associated with fracturing and faulting. If such preferential flow paths exist and Benga is not able to identify and monitor them, the potential impacts on groundwater may not be detected. If contaminants migrate undetected to surface water receptors and discharge into Blairmore and/or Gold Creeks, there may be little opportunity for successful mitigation that would not affect the base flow to the creeks.

[759] Benga's approach to preventing groundwater contamination (and subsequently surface water contamination) due to seepage of contact water from the waste rock disposal areas into the groundwater system relies heavily on the monitoring program's ability to identify when the seepage capture efficiency is below the required 95 and 98 per cent. We are not confident that the monitoring program would be able to identify all seepage from the waste rock disposal areas and whether a capture rate of 95 or 98 per cent was being achieved.

[760] We acknowledge that the proposed groundwater monitoring program design accommodates additional monitoring wells next to engineered structures that are deemed the highest risk, such as the southeast surge pond. However, the preliminary program design does not appear to systematically account for the modelled residence time (and therefore travel time) from monitored structures to the surface water receptors. For example, given the proximity of the southeast surge pond to Gold Creek, the contact water could seep into groundwater and discharge into the creek prior to detection by the monitoring wells, either due to the spacing between the monitoring wells or the frequency of the monitoring. It was not clear from Benga's evidence whether the southeast surge pond would be lined. From Benga's response to a question at the hearing, we understand that current plans do not involve a liner, but that a liner could be installed subject to further investigation.

[761] The high-risk areas of the project may require higher frequency of monitoring due to the greater risk or critically low travel time to surface water receptors. To ensure effective monitoring of the potential mobilization of elements potentially toxic to the aquatic life, the sampling protocols would need to be refined to acknowledge the modelled residence times. The fact that the groundwater monitoring program focuses solely on shallow groundwater is also a limitation of the proposed program, given the topography and complexity of the site and the depth of the proposed mine pit and associated saturated backfill zones. While monitoring and identifying potential impacts to surface water receptors is critical, without monitoring of deeper zones, deeper groundwater contamination may go undetected. Given the identified limitations of the proposed groundwater monitoring program, we are not confident that the program would detect all seepage and sources of groundwater contamination from the project.

[762] During the course of the review and at the hearing, Benga provided a preliminary groundwater response plan as a component of its groundwater monitoring and management plan in the EIA and further details about its approach to adaptive management. However, we find that these plans lack some of the

elements of effective adaptive management discussed in the chapter on the panel approach to determining the significance of effects. For example, the plan lacks clear and testable environmental assessment predictions and thresholds for implementation of further adaptive management actions. Furthermore, Benga provided little evidence to demonstrate that its proposed additional adaptive management measures were technically and economically feasible given the geological complexity of the site. We realize that a final groundwater monitoring and adaptive management plan is not required at this point in the regulatory process. However, given the uncertainties and known concerns about potential effects on groundwater that flows in Blairmore and Gold Creeks and on westslope cutthroat trout, additional information would have provided us with more confidence that the use of adaptive management would be effective.

The project is not likely to result in significant adverse effects on groundwater quantity and flows

[763] Benga assessed the potential project effects of mine dewatering on groundwater quantity as low in magnitude, local in extent, and irreversible. It concluded that most drawdown effects within the bedrock aquifers would occur within the mine permit boundary and be not detectable (less than 5 m) at the LSA boundary. The effects will remain after cessation of mining activities but diminish with time as a new groundwater equilibrium develops away from the pit. The probability of effects was high and Benga's confidence in its conclusions was moderate. Benga concluded that the residual effects were not significant. Benga acknowledged that after mitigation, effects within a portion of the mine permit boundary may exceed the range of natural variability and/or guideline or threshold levels. However, Benga states that these impacts will not measurably change the potential use of groundwater from bedrock aquifers across most of the LSA.

[764] We accept that some groundwater would be lost as make-up water for the coal-processing plant as the product coal would absorb some water during the washing process. However, we find that these volumes are small. Groundwater losses from other uses, such as dust control and evaporation from storage ponds, are also small. The removal of aquifers within the mine pit and dewatering of adjacent aquifers during mining would result in changes to groundwater levels and groundwater flow patterns in the vicinity of the mine pit and groundwater base flow contributions to Blairmore and Gold Creeks. Due to limited site-specific hydrogeological information, the use of simplifying assumptions in the groundwater model, and the complexity of site geology, we find there are large uncertainties about the magnitude, lateral extent, and duration of predicted project effects.

[765] Our assessment of residual project effects on groundwater quantity and flow after implementation of proposed mitigation measures is as follows:

- **Magnitude:** moderate. Dewatering to allow mining to a depth of 430 m below current topography will result in changes to groundwater levels and flow that are different than background groundwater conditions, even after mitigation measures are implemented.
- **Geographic extent:** local. Although groundwater drawdown in aquifers could extend beyond the permit boundary and to Blairmore and Gold Creeks, it is unlikely to extend beyond the LSA.
- **Frequency:** continuous. Effects will occur throughout the mining operation period.
- **Duration:** persistent. Even after mining ends, groundwater impacts will continue during the closure period.

- **Reversibility:** reversible in the long term. Groundwater effects will remain after the mining operation is over and diminish slowly over time as groundwater levels and flows seek a new equilibrium.
- **Ecological and social context:** neutral. Groundwater quantity and flows have been affected by historical mining operations (tunnels) but are not subject to other pressures, and current conditions appear stable.
- **Likelihood:** high. Aquifer dewatering and groundwater drawdown are planned as part of mining operations.
- **Confidence rating:** low. The cause-and-effect relationships are not completely understood due to limited site-specific hydrogeological information and modelling assumptions.

[766] Overall, we conclude that project-related effects on groundwater quantity and flow will be adverse, but not significant. This finding is based on the local extent of predicted effects and the finding that there are no domestic or municipal water wells within the LSA that would be affected by the project. We recognize that changes to groundwater levels and flow are likely to affect base flow to Blairmore Creek and Gold Creek and this has implications for westslope cutthroat trout. Our significance determinations for those effects are provided in the chapter on surface water quantity and flow and the chapter on fish and aquatic habitat.

The project is not likely to result in significant adverse effects on groundwater quality

[767] Benga assessed potential project effects related to mine waste rock and mine operations on groundwater quality in bedrock aquifers to be low in magnitude, local in extent, long in duration, and reversible in the long term. Effects would remain after the cessation of activities and require mitigation but diminish with time. Effects would be limited to the mine permit area and LSA. The probability of effects was medium with mitigation measures in place and the confidence rating was moderate. Benga concluded that the residual effects after mitigation would not be significant, as effects after mitigation are expected to be below guidelines or threshold levels.

[768] Benga assessed the potential project effects on groundwater quality in bedrock aquifers resulting from surface facilities as moderate in magnitude, local in extent, occasional in frequency (spills), long in duration (because the site may not be fully remediated until reclamation activities are undertaken after operations cease), and reversible. Benga provided a confidence rating of moderate as it indicated efficient measures will be in place to allow for early detection of upset conditions and response in a timely manner. The probability of occurrence was rated as medium as upset conditions are typically infrequent. Benga concluded that residual project effects related to facilities were not significant as no adverse effects are predicted with mitigating measures in place.

[769] Benga assessed the potential for project effects related to groundwater quality on domestic and municipal water supply wells as non-existent given the distance to the closest water supply wells (more than 3 km) and confidence in its proposed mitigation measures to effectively mitigate potential impacts on groundwater quality.

[770] We accept that with proper design, monitoring, and effective spill response at project facilities, the risks posed by facility operations to groundwater are low. We also agree that it is unlikely that project impacts on groundwater quality will adversely affect domestic or municipal groundwater wells due to their distance from the project and current understanding of groundwater flow directions. However, project activities may adversely affect the flow or quality of springs used by landowners within or adjacent to the proposed mine permit boundary and west of Gold Creek.

[771] The potential project effects on groundwater quality of most concern are seepage from external waste rock disposal areas, saturated backfill zones, and the end-pit lake. Due to the limited use of site-specific hydrogeological information, the use of simplifying assumptions in the groundwater model, and the complexity of site geology, we find the magnitude and extent of predicted project effects on groundwater quality are uncertain. We do not have confidence that Benga's proposed measures to mitigate the effects on groundwater quality, such as seepage capture from the waste rock disposal areas and treatment by the saturated backfill zones, will be as effective as claimed by Benga. We are concerned that predicted project effects on groundwater may be underestimated.

[772] We find that the magnitude of the impact predicted by Benga did not take into account some of the site-specific data pertinent to the mobilization of trace elements and their fates in groundwater. Nor did Benga provide sufficient evidence to support assertions that groundwater flow is slow enough to allow for attenuation of selenium and other elements prior to reaching surface water receptors. We find that Benga made little effort to characterize groundwater composition variability across the LSA. It also did little to study potential contaminants of concern other than selenium and nitrate (such as arsenic) from various project-related sources and their potential transport mechanisms.

[773] Our assessment of residual project effects on groundwater quality after implementation of proposed mitigation measures is as follows:

- **Magnitude:** moderate. The size of the mining structures from which seepage may occur, the potential for release of contaminants beyond that accounted for in the assessment, and the potential that mitigation measures to control seepage may be less effective than expected are cause for concern.
- **Geographic extent:** local. The effects on groundwater quality are expected to be confined to the LSA.
- **Frequency:** continuous. The effects will occur throughout mining operations and into the closure period.
- **Duration:** persistent. The effects are expected to last beyond mine operations and into the closure period.
- **Reversibility:** irreversible or only reversible in over decades or centuries.
- **Ecological and social context:** neutral. Groundwater quality has been affected by historical mining operations and waste rock dumps but is not subject to other pressures and current conditions appear stable.

- **Likelihood:** moderate. While some release of contaminants to groundwater is expected, the potential magnitude and extent of effects on groundwater are uncertain due to limitations of the assessment approach.
- **Confidence rating:** low. The effects on groundwater quality may be underestimated due to limited use of site-specific hydrogeological information and modelling assumptions.

[774] We conclude that project-related effects on groundwater quality will be adverse, but not likely significant. This finding is based on the local extent of predicted effects and the absence of domestic or municipal water wells within the LSA that are expected to be affected by the project. We recognize that changes to groundwater quality have implications for water quality in Blairmore and Gold Creeks and for westslope cutthroat trout. Our significance determinations for those effects are provided in the chapter on surface water quality and the chapter on fish and aquatic habitat.

The project, in combination with other existing, planned, and reasonably foreseeable projects, is not likely to result in significant adverse cumulative effects on groundwater quantity and quality

[775] Benga acknowledged that residual effects on groundwater quantity and quality would result from the project, but did not conduct a cumulative effects assessment for groundwater. Benga stated that such an assessment was not necessary because there were no reasonably foreseeable projects within the RSA that would interact in a cumulative manner with the project with respect to groundwater. Benga noted that existing sources of water releases were measured or estimated and included in the groundwater modelling to describe the past and existing conditions related to groundwater.

[776] As no other planned or reasonably foreseeable projects within the RSA are expected to act in a cumulative manner with the project, we agree that a separate cumulative effects assessment was not necessary for groundwater. We recognize that groundwater within the project area and LSA has been affected by historical mining operations but accept that this has been accounted for in the baseline and application cases. As discussed in the chapter on the effects of the environment on the project, it is unclear whether or how Benga considered the potential effects of climate change on the project. When combined with project effects, climate change may contribute to cumulative effects on groundwater quantity and quality.

12. Surface Water Quantity and Flow

Water recycling and licence transfers will likely satisfy project water demand

[777] In its original application, Benga indicated a need for 0.11 m³ of make-up water per raw metric tonne of coal. The application also indicated that the coal-processing plant was designed to produce a nominal 4.5 million clean metric tonnes of coal per year. Benga updated this water demand its Second Addendum, reducing its requirement to 0.057 m³ of licensed make-up water per raw metric tonne and indicating that it achieved the reduction in freshwater use by incorporating water recycling measures in the plant. The reduction would be achieved specifically by recycling water from the coarse reject bin and centrifuges. Table 12-1 provides a breakdown of the volumes in Benga's updated water balance.

Table 12-1. Updated water balance volumes

	Original (m ³ /year)	Revised (m ³ /year)
Make-up water	900 000 ^a	478 000 ^b
Recycled from centrifuges		174 000
Recycled from reject bin		30 000
Total coal processing plant water demand	900 000	682 000

^a CIAR 42, Section C, PDF p. 95 based on 0.11 m³ per raw metric tonne of coal.

^b CIAR 69, PDF p. 250 based on 0.057 m³ per raw metric tonne of coal.

[778] Benga reduced the expected water demand for its coal-processing plant from 900 000 m³ per year to 682 000 m³ per year without any apparent reduction in coal-processing/production volumes; nominal coal production remained at 4.5 million clean metric tonnes per year, and maximum production at year 12 remained at 8.3 million raw metric tonnes. Benga stated that the reduction was made possible by recycling water from a combination of the two improvements, i.e., the reject bin/conveyor belt and the centrifuges. However, as shown in Table 12-1, these improvements alone do not fully account for the reduction in water demand. Benga did not provide a detailed explanation of how the reduction was achieved. However, when other operational water requirements are added, Benga's total licensed water requirement increased from 478 000 to 556 631 m³. The other requirements include washdown make-up water, evaporation from the raw water pond, and contingency provisions. Benga applied for 558 772 m³ under its *Water Act* licence applications.

[779] Benga stated that its dewatering system could be relied upon to supply recycled water. At the hearing, Benga said that the technologies it intended to employ (i.e., screens, vibrating centrifuges, belt press filters, and sieve bends) are commonly found in processing plants at mines around the world. Benga also described the adjustments, modifications, and redundancies that it would employ to ensure the dewatering system operated reliably. Should the water recycling system malfunction, Benga laid out plans to reduce the plant production rate or even stop production. Asked if the project might require future water allocations, Benga stated that it believed the amount of water that it applied for is sufficient for the project.

[780] Potential future water needs are an important consideration, since it is difficult to find existing licences that could be transferred and the remaining water in the Oldman River Basin is reserved under the *Oldman River Basin Water Allocation Order*. Moreover, water resources in the local watershed are

stressed, and high irrigation demand as well as apportionment of water to the province of Saskatchewan exists below the Oldman Dam. We accept that Benga's operational needs could be met with the amount of water requested, and that no further allocations may be needed. We view the process adjustments, along with Benga's assurances to reduce coal-production rates if necessary, as key measures to ensure that Benga remains within its annual water use target of 556 631 m³.

Requirements of proposed licence transfers demand a strong water release plan to mitigate effects

[781] Benga submitted three applications under the *Water Act* to divert water for operations:

- New licence – an allocation for industrial purposes (185 022 m³) of reserved water available under the *Oldman River Basin Water Allocation Order, Alberta Regulation 319/2003* and amended to 109/2010
- Transfer – a transfer of allocation (123 350 m³) from an existing licence (0039493-00-00), currently held by Canadian Natural Resources Limited, on the Crowsnest River, and previously held by Devon Canada Corporation
- Transfer – a temporary transfer of allocation (250 400 m³) from an existing Licence (00046522-00-00), held by the Municipality of Crowsnest Pass on York Creek; this is a partial transfer as the requested allocation is a fraction of the licence's full allocation of 308 280 m³ and is a temporary transfer because Benga applied to hold the allocation for a period of 25 years, after which the allocation would revert to the Municipality of Crowsnest Pass

[782] The requested licence transfers are within the South Saskatchewan River Basin (SSRB), where the *Approved Water Management Plan for SSRB* authorizes transfers, subject to sections 81-83 of the *Water Act*, and provides the matters and factors that must be considered in transfer applications.

[783] The *Administrative Guidelines for Transfer of Water Allocations* lists factors about a transfer that may affect other affected parties:

- Are the sources of water the same or different?
- What is the impact on the watercourse or aquifer between the existing and proposed point of diversion? Will there be more or less flow? Will there be a change in water quality?
- Could the drainage area change above the point of discharge and affect the available water supply (if it is an upstream transfer)? If there is a major tributary contributing to the mainstem then there will likely be a reduction in the eligible volume to be transferred.
- Historical water use.
- Licence priority may affect licensees that, due to a change in location, were not previously affected by that licence in times of water shortages. This may also affect the location at which priority may be administered.

[784] Benga acknowledged these unique factors are considered when transferring water licences and attempted to address these factors as discussed below.

[785] The York Creek Licence (0004562-00-00) authorized the Municipality of Crowsnest Pass to divert water from York Creek at NW-34-007-04-W5M. The licence allows diversion of 308 000 m³ of water annually for municipal purposes. Benga applied to temporarily transfer 250 000 m³ from this licence to Benga's proposed point of diversion, the raw water pond at SW-024-008-04-W5M. The proposed transfer would move the allocation from York Creek, a tributary on the southern side of the Crowsnest River, to Blairmore and Gold Creeks, both tributaries on the northern side of the river. York Creek neither receives flow from nor contributes flow to Gold Creek or Blairmore Creek. Therefore, there is no hydraulic connection between the original point of diversion of the York Creek licence and the new proposed points of diversion on Blairmore and Gold Creeks. According to Benga, the York Creek licence has not been used since the 1980s. In other words, Benga would be using water that had not actually been removed from the watershed for decades. Benga considers the fact that the existing licence for potential water use is in good standing outweighs concerns about the projected increase in actual water use.

[786] The Crowsnest River Licence (0039493-00-00) authorized diversion of 123 000 m³ of water per year for industrial purposes from the Crowsnest River at NE-02-008-05-W5M. The proposed transfer would move the allocation from an upper reach of the Crowsnest River to Blairmore and Gold Creeks, both tributaries on the lower reach of the river. At the original point of diversion, the Crowsnest River neither receives flow from nor contributes flow to either Gold Creek or Blairmore Creek. Therefore, no hydraulic connection exists between the original point of diversion of the Crowsnest River licence and the new proposed points of diversion on Blairmore and Gold Creeks. As was the case with the York Creek Licence, Devon Canada Corporation did not historically utilize the entire allocation from the Crowsnest River Licence.

[787] The *Approved Water Management Plan for the SSRB* enables and supports transfers to accommodate the redistribution of water already allocated in the SSRB. However, it emphasizes in its matters and factors that transfers should result in no significant adverse effects on existing users (licensees, household users, and traditional agricultural users) and should have no significant adverse impacts on the aquatic environment. In essence, a transfer should create no greater or more adverse an impact than if the transfer were not issued. The established and foreseeable pattern of water use under an existing licence informs and may also limit the amount of water that can be transferred to a new licence, regardless of the licence's good standing. Section 82(5) of the *Water Act* also states that a review of a transfer application may consider the allocation of water that the licensee has historically diverted under the licence.

[788] Under Alberta's *Water Act*, a licence transfer must not impair the exercise of the rights of any household user, unless consented to by the household user. At the hearing, Ms. Gilmar described her household use of water from a shallow well near Gold Creek that likely interacts with Gold Creek and is located downstream of the project. Ms. Gilmar has used this source for drinking water for the past 58 years. Benga stated that it would rely on the senior priorities of the York Creek and Crowsnest River licences (priority 1 and 3 respectively in the Crowsnest River basin) in response to concerns about additional impacts from license transfers. For example, Benga stated:

“The priority system was created and allows for a ‘first in time, first in right.’ As such, the senior, highest priority licences will be allowed to withdraw water before junior licences in times of water shortages. The system was created to allow this and all licensees are aware of this. The junior licences were always at risk when the Devon and York Creek licences were at their original locations because both licences were in good standing and capable of fully utilizing their allocations at any time, thus juniors downstream should have been prepared operationally in any year to expect the same flow at their diversion points as will occur with the transfers in place, or are better off due to the storage at Grassy that is available in low stream flow periods” (CIAR 69, PDF p. 301).

[789] Benga appeared to rely on the transfer licences’ senior priorities to suggest that impacts of the transfers did not need to be mitigated, because downstream users in the basin “should have been prepared” for these senior licences to use their full volume at any time. We note that Benga’s argument may be applicable for users directly downstream from the original licences. But the same is not true for users and the aquatic environment of Blairmore and Gold Creeks, which the original licences were not intended to affect and where the original sources of water do not contribute any flow.

[790] Also, the Benga argument failed to recognize that the matters and factors of the *Approved Water Management Plan for the SSRB* and Section 82(3) of the *Water Act* require that a transfer may not impair the exercise of rights of any household user, traditional agricultural user, or other licensee other than the household user, traditional agricultural user, or licensee who has agreed in writing that the transfer of the allocation may take place. Coalition members Ms. Gilmar, Mr. and Mrs. Donkersgoed, and Mr. Emard are household users downstream of the project who expressed concerns for their water supply during the review process.

[791] Benga stated that downstream movement of the allocations allows water to remain in the Crowsnest River basin longer than otherwise would have occurred if the original licensees diverted water at their respective points of diversion. This argument, while accurate, ignores users and the aquatic environment in Blairmore and Gold Creeks. Benga has also failed to address the flow needs of users downstream of Gold Creek on the Crowsnest River by not providing an appropriate plan for releasing water to augment flows (which we discuss below).

[792] We find that the lack of hydraulic connection between the original licensed points of diversion and the proposed mine site, coupled with the historically low or non-use of the water licences, means that these licence transfers would result in new and adverse impacts on Blairmore and Gold Creeks, particularly on the aquatic environment and household users. These impacts are not mitigated by the senior priorities of the licences, and they warrant a strong and reliable flow augmentation plan based at least on meeting the instream flow needs of Blairmore Creek and Gold Creek. We discuss Benga’s efforts to develop a flow augmentation plan later in this chapter.

[793] Section 83(1) of the *Water Act* and the *Approved Water Management Plan for the SSRB* authorize the statutory decision maker to withhold up to 10 per cent of an allocation of water that is being transferred, and recommends withholding this amount unless there is a compelling reason to withhold less. This withheld volume is called a “water conservation holdback,” and preventing its allocation to a diversion licence allows that water to remain in the river for the benefit of the aquatic environment or to

implement a water conservation objective. One of the main conclusions of the *Approved Water Management plan for SSRB* was that rivers in the Bow, Oldman, and South Saskatchewan River subbasins are highly allocated, and that population and economic growth continue to put pressure on the water resources, the aquatic environment, and the security of existing allocations. The *Approved Water Management Plan for SSRB* provides for water conservation holdbacks to help increase the flows of these rivers by incremental amounts or at least to help offset increases in water use by transferees. As a result, the current practice of all statutory decision makers in the SSRB is to withhold 10 per cent of any transferred licences.

[794] Benga requested a licence transfer for the full requested volumes to the project's point of diversion for both transfer requests, without the 10 per cent conservation holdbacks. The two requested licence transfers amount to 374 000 m³, 10 per cent of which is 37 400 m³. If the 10 per cent conservation holdback was withheld from the transferred volumes, Benga's total licence allocation would decrease from 558 772 m³ to 521 397 m³.

[795] AEP's *Guide to Compelling Reasons to not take the 10% holdback for Transfers within the SSRB* provides statutory decision makers with guidance on these compelling reasons, and documents past decisions where the 10 per cent holdback was not taken. The guidance suggests that the decision not to withhold a 10 per cent holdback must be justified as serving a greater benefit for the protection of the aquatic environment or implementation of a water conservation objective than it would if the holdback were taken.

[796] One such compelling reason, which could apply to this project, would be the establishment of minimum flow conditions in a licence that restrict water diversions when minimum flows are not met. Benga could have implemented this approach by developing a flow-augmentation plan that provided for minimum water releases from the project during low-flow periods. We accept it is possible that establishing such a minimum flow condition could provide a greater benefit to users and the aquatic environment compared with requiring the 10 per cent holdback. However, as we discuss below, Benga did not provide a satisfactorily comprehensive flow-augmentation plan, despite multiple requests to do so during the review process. As a result, Benga did not adequately support its request to not withhold 10 per cent of the licence transfer volume.

Hydrology modelling introduces many uncertainties, particularly for dry periods

[797] Benga evaluated the impacts of the project on surface water quantity with a hydrologic model using GoldSim, which is a graphical, object-oriented interface for carrying out spreadsheet calculations. Benga used it to define the relevant physical hydrological processes. Monthly surface runoff volumes were calculated based on the annual precipitation, the average monthly runoff distribution, and runoff coefficients. Benga computed monthly precipitation by distributing the annual precipitation over the historical average monthly runoff percentage. GoldSim also computed daily average precipitation values by dividing the monthly precipitation equally over the number of days in each month. This allowed Benga to base its daily precipitation values on a simple computation using year-to-year average annual precipitation.

[798] Benga used the runoff coefficients to estimate monthly runoff from a surface area, taking into consideration how the land is being used and indirectly accounting for losses such as evapotranspiration and infiltration. The coefficients are assigned based on the land use and surface characteristics at the site. The monthly runoff volume is calculated by multiplying the catchment area affected by the project, the runoff coefficient, the annual precipitation, and the monthly runoff percentage. According to Benga, the site catchment area is divided into subcatchments upstream of each prediction node used in the model.

[799] DFO stated that GoldSim is not a hydrological model, but a model framework that lacks sufficient detail to properly present physical processes. According to DFO, such models produce considerable uncertainty. They would prevent Benga from adequately assessing impacts on fish and fish habitat. DFO raised four key concerns with respect to the GoldSim model:

- Mean annual precipitation is the only hydrologic input that changes during any annual simulation to calculate surface annual and monthly runoff. This approach does not have the resolution to capture seasonal variation.
- Benga computed surface water runoff based on runoff coefficients and selected most runoff coefficients based on professional judgement alone.
- Benga computed monthly surface water runoff from annual precipitation, a monthly runoff distribution, and the runoff coefficients. Using annual precipitation as the only variable does not adequately represent month-to-month streamflow variability. This brings into question the suitability of the model to represent drought and low-flow conditions.
- The model does not consider the concept of change in storage. The representation of storage is critical when simulating low-flow conditions, as the resilience of the aquatic system can release stored water as base flow.

[800] DFO concluded that this modelling approach would produce coarse estimates of annual and monthly runoff. While likely suitable for the design of the water management system and for testing operational scenarios, it would have a high level of uncertainty on a monthly basis, particularly during periods of low flow. Before the hearing, Benga indicated that it would explain how its understanding of the capabilities of the GoldSim model differed from DFO. However, during the hearing, it provided no additional evidence on this topic to respond to DFO's critical assessment of GoldSim. Nor did Benga cross-examine DFO on this issue. Benga also did not address this issue in its closing arguments.

[801] The Timberwolf Wilderness Society agreed with DFO, stating that Benga did not adequately characterize baseline hydrological conditions nor sufficiently predicted altered conditions. The society also disagreed with Benga's use of annual and monthly average flows to estimate effects on fish and fish habitat, stating that the use of averages was inadequate to capture the impact on instantaneous minimum or maximum flows.

[802] We consider DFO's concerns about the ability of Benga's hydrology model to provide suitably detailed estimates of the impacts of the project on flows in Blairmore and Gold Creeks, particularly during periods of low flow, to be unrefuted technical evidence. In essence, the lack of detail in Benga's

hydrology modelling increases our uncertainty in estimating the project's impacts on the habitat of westslope cutthroat trout in Blairmore Creek and Gold Creek.

Base-flow reductions arising from groundwater drawdown add uncertainties in understanding overall stream flows

[803] Benga's groundwater model estimated reductions in stream base flows, or the portion of flow that is sustained in the stream between precipitation-related runoff events. Benga estimated that at the end of mine life, the annual average base-flow reduction will be about 19 per cent in some reaches of Gold Creek and as high as 30 per cent in Blairmore Creek. For the long-term closure timeframe, the annual average reduction in base flow will be about 16 per cent for Blairmore Creek and 18 per cent for Gold Creek, while on a monthly basis the reductions to base flow will be as high as 16.9 per cent in February for Blairmore Creek and 20 per cent in May for Gold Creek.

[804] Benga did not provide a monthly breakdown of base-flow reductions for the end-of-mine timeframe. But we expect that, as with the long-term closure timeframe, the highest monthly reductions would exceed the annual average reductions. The groundwater model predicted a reduction of base flow in both Blairmore and Gold Creeks as a result of the mining operation, without including water management such as water returns from the saturated backfill zones.

[805] In comparison with the groundwater modelling, Benga's surface water modelling predicted a smaller decrease in overall stream flows for Gold Creek, with monthly reductions of between 3 to 7 per cent up to a maximum of 10.4 per cent. Benga attributed the Gold Creek decrease in flows mainly to operations of the mine and the diversion of contact water (which has come in contact with waste rock piles) from Gold Creek to Blairmore Creek. Benga stated that no contact water will be discharged to Gold Creek; rather, all contact water will be directed to Blairmore Creek.

[806] Benga predicted that the overall stream flow in Blairmore Creek will increase, because the water management system will divert contact water from Gold Creek subcatchments (as well as Blairmore Creek subcatchments) into saturated backfill zones for treatment. Eventually, all the treated water will be released into Blairmore Creek. Benga estimated that the typical average monthly stream flow gains along Blairmore Creek will be between 5 and 15 per cent, up to a maximum of 35.4 per cent. The projected Blairmore Creek flow increases depend on the treated water being of sufficient quality for release.

[807] The differences in how the groundwater model and the surface water model predict the impact on base flow are due to how the models are implemented. The groundwater model independently considers annual precipitation as a source of groundwater recharge over the land surface and estimates groundwater discharge to streams. The GoldSim water and load balance model combines the effects from the hydrologic model discussed above, the baseflow reduction from the groundwater model, and the project's water management infrastructure. It is not clear how the baseflow reduction from the groundwater model was merged into the water and load balance model. Benga affirmed that the flow change that should be considered is from the water and load balance model and not from the groundwater model.

[808] The Coalition expressed several concerns with the groundwater model, stating that the reduction in base flow in both Blairmore and Gold Creeks could be higher than that presented by Benga. Key concerns for the Coalition included

- Benga applied a high recharge (water that infiltrates or percolates into the ground) to the model, which results in an underestimate of the baseflow reductions, particularly along Gold Creek;
- Benga did not consider baseflow reductions of significant magnitude as it relied on “average” conditions, ignoring the extremes and future changes to hydroclimate of the region due to the projected increase in global temperature;
- the groundwater model’s lack of consideration of faults and associated fractures led to inaccurate baseflow change projections in Blairmore and Gold Creeks;
- the groundwater model was sensitive to recharge and hydraulic conductivity; and
- calibration of the model consistently underrepresented the observed base flow, leading to questions regarding the accuracy of drawdown projections and the associated reductions in base flow.

[809] We discuss these concerns in detail in the groundwater quantity, flow, and quality chapter.

[810] Benga’s hydrology model estimated stream flow changes that included surface flow, interflow, and base flow, whereas its groundwater model provided a separate assessment of specific changes to the groundwater flow regime. Benga did not explain how it integrated the groundwater and surface water model predictions into a single estimate of the predicted changes in Gold Creek flows during low-flow periods when creek flows are dominated by base flow. The Coalition recommended that comprehensive groundwater–surface water interactions be investigated, using an infrared camera survey or geophysical reconnaissance to assess the spatial and temporal variability of baseflow contributions along Blairmore and Gold Creeks.

[811] Based on the sensitivity analysis, recharge is the model component that causes the greatest change to base flow. Benga responded to the Coalition’s concerns about recharge by stating that the range of recharge is consistent with what was used in the model, and emphasized that the model was calibrated to the base flow. With respect to model calibration, the Coalition pointed out that the model overpredicts the base flow, particularly in Blairmore Creek. Benga agreed with the Coalition, saying that the model both under- and overpredicted, meaning that, on an annual basis, it would average out.

[812] While we agree with Benga that averaging the modelled base flows over the year would produce a superior calibration, this may not mean that the calibration accurately represents base flows. These calibration concerns, together with Benga’s decision to apply high recharge values along some areas near Gold Creek, create uncertainty in estimating the impact on base flows produced by the groundwater model. Benga did not provide a detailed explanation as to how the base flows from the groundwater model are integrated into the load and water balance model. Given the complexity of the site, a better-integrated model of surface water–groundwater interactions would have been more suitable for assessing the impacts on base flow.

[813] We share the concerns expressed by participants about the groundwater model. When we consider these concerns together with Benga’s use of a simplistic hydrologic model that uses average annual precipitation as the only changing parameter, we find that there is uncertainty about the model’s ability to assess the impact of the project on base flow, fish, and fish habitat.

Benga's evaluation of critical flows and flow augmentation needs for Gold Creek and Blairmore Creek is inadequate

[814] As mentioned earlier, we asked Benga to produce a comprehensive flow augmentation plan to support its requested licence transfers and the Oldman Dam reservation licence. This is an important consideration given that these licences would introduce new water diversions to streams that support threatened fish species in Blairmore Creek and Gold Creek, in addition to downstream household users on Gold Creek.

[815] Benga considered several instream flow-assessment methods. These included desktop methods based on the statistics of undisturbed flows: the Alberta Desktop Method, the DFO *Framework for Assessing the Ecosystem Flow Requirements to Support Fisheries in Canada*, and the Alberta *Surface Water Allocation Directive*. Each of these approaches use a combination of a maximum allowable percentage change in flow and an ecosystem base flow below which no further human-induced reductions in flow would be allowed.

[816] The Alberta Desktop Method recommends a maximum reduction in flow of 15 per cent and an ecosystem base flow at weekly 80 per cent exceedance flows (that is, the flow that would be exceeded 80 per cent of the time under undisturbed conditions, for each week of the year). DFO's *Framework* recommends a maximum flow reduction of 10 per cent, and an ecosystem baseflow at 30 per cent of a stream's mean annual discharge. For streams with mean annual discharges of less than 2 m³/s, Alberta's *Surface Water Allocation Directive* requires a maximum flow reduction of 10 per cent, with no reduction when flows are below the weekly 80 per cent exceedance flow.

[817] Benga provided the weekly 80 per cent exceedance flows and the mean annual discharges for Blairmore and Gold Creeks. The mean annual discharges were 0.235 m³/s and 0.669 m³/s, respectively. The DFO framework ecosystem base flow would therefore be 0.07 m³/s and 0.20 m³/s in Blairmore Creek and Gold Creek, respectively.

[818] The alternative to these desktop approaches is to conduct a site-specific study to identify critical flow limits. Benga presented the results of its instream flow assessment in the First Addendum, and later adopted this assessment to support its evaluation of critical flows.

[819] The Coalition's expert, Mr. A. Locke, recommended a general approach consisting of a maximum percentage reduction in flow and an ecosystem baseflow component for both Blairmore and Gold Creeks. The ecosystem base flow could be derived from the instream flow assessment Benga provided, and from other relevant information. Mr. Locke recommended that the selected ecosystem base flow be carried out through discussions among Benga, provincial and federal regulators, and other interested parties. In its closing argument, Benga stated that it generally agreed with Mr. Locke's recommendation.

[820] On several occasions during the review and pre-hearing process, we requested that Benga provide a concise flow-augmentation strategy; that is, discuss how it would satisfy the return flow needs of the project and provide instream flow needs for both Blairmore and Gold Creek. Benga responded that the intent of its instream flow assessment was to assess the potential impact of changes in flow, not to provide an instream flow-needs quantity.

[821] Benga did not provide from its instream flow assessment any instream objective flows for either Gold Creek or Blairmore Creek. Benga instead provided the minimum monthly flows that the Alberta Desktop Method would recommend remain instream, based on historical conditions from 1976 to 2016. To meet these instream objectives, Benga provided an outline of a water return strategy that would use AEP's Delta Water Availability Tool. Benga suggested that its approach be accepted in principle. It proposed to develop the specific required calculations before project start-up, using the AEP tool once it is available. The AEP tool was, and remained at the time of the hearing, in a draft stage.

[822] We asked Benga to provide weekly ecosystem baseflows for Blairmore and Gold Creeks and develop a detailed flow-augmentation calculation based on the Alberta Desktop Method or another similar instream flow methodology. We included an example of a flow-augmentation methodology that would satisfy this request. Benga responded that, for Gold Creek, because the predicted project effects are less than the Alberta Desktop Method's 15 per cent limit and almost entirely less than the 10 per cent DFO limit, no flow augmentation is required. For Blairmore Creek, Benga responded that the project is designed to discharge all saturated backfill zone-treated water into Blairmore Creek and that there will be no need to augment flows to Blairmore Creek, even under upset conditions, to meet instream flow needs.

[823] If Benga would not be able to release water to Blairmore Creek from the saturated backfill zone, Benga stated that it considered the threshold for no significant effect to be when changes to habitat area are less than 10 per cent and not when changes in flow were less than 10 per cent. However, 10 per cent is the recommended threshold for a change in flow under the DFO *Framework*. DFO stated in its closing argument that a 10 per cent change in instantaneous flow is not equivalent to a 10 per cent change in physical habitat area. DFO stated that it would consider any loss in critical habitat area as a result of changes in flow to be a residual effect.

[824] For Blairmore Creek, Benga used the instream flow assessment to identify the equivalent of an ecosystem base flow. It proposed threshold flows of 0.20 m³/s for the May-to-July spawning period and 0.07 m³/s for the remainder of the year. Benga derived the 0.20 m³/s threshold for May to July by assessing the flow at which project effects would reduce westslope cutthroat trout habitat by 10 per cent.

[825] During a situation in which flows from the saturated backfill zones to Blairmore Creek were suspended, Benga committed to release up to 0.07 m³/s from sources other than saturated backfill zones, such as sedimentation ponds. For May to June, when flows drop below 0.20 m³/s, Benga proposed to assess contributing flows in the Blairmore Creek watershed and pump the appropriate amount of water from the pit to sedimentation ponds. Benga did not describe how this assessment of flows in Blairmore Creek would be done. Benga stated that no flow augmentation is proposed for Gold Creek and that any project impacts on the creek would be counterbalanced through its habitat offsetting plan, which had been submitted in draft form to DFO for approval. Benga did not provide threshold flows or minimum flow release commitments for Gold Creek.

[826] At the hearing, we asked Benga to provide "for each reach and life stage during operations, what is the flow below which the predicted change in flow due to your project will reduce habitat by more than 10 per cent" for Gold Creek (CIAR 881, PDF p. 37). In its response, Benga changed the wording of this request to "provide calculated flow reductions for all study reaches and Westslope Cutthroat trout life stages on Gold Creek which cause fish habitat (Area Weighted Suitability or 'AWS') to decline by

10 per cent averaged over the pertinent fish bioperiods” (CIAR 929, Undertaking 22, PDF p. 1). Benga provided the change in flow required to reduce habitat area by 10 per cent under average flow conditions in each reach and life stage. This was not the information we requested.

[827] We consider a detailed flow augmentation plan, which would demonstrate that the project would be able to offset its impacts on creek flows during critical periods, a critical component of the project because the project would introduce new water diversions and flow alterations on streams that support threatened fish species and are used by downstream households.

[828] We agree with the Coalition that an augmentation plan based on a site-specific instream flow assessment would ideally be developed through discussions among Benga, provincial and federal regulators, and other interested parties. Such discussions did not occur during the review process, and therefore Benga should have demonstrated that it had sufficient water storage throughout the project life to meet the recommendations of a government approved policy approach, such as the Alberta Desktop Method, the DFO *Framework*, or Alberta’s *Surface Water Allocation Directive*. Benga did not provide such a demonstration. Instead, it requested that its alternative approaches be accepted in principle and argued that a detailed plan could be provided prior to project start-up. We find that Benga did not adequately demonstrate that it would be able to augment flows in Blairmore Creek and Gold Creek when required.

Water quality concerns could affect the ability to release water

[829] Flow augmentation requires a clean water source that can reliably meet water quality standards set by Alberta’s *EPEA* during periods of low flow. For the project, the primary sources for flow augmentation are saturated backfill zone outflows and sedimentation ponds. Sedimentation ponds will receive pumped seepage water from the mine pit, in addition to collecting surface runoff from the mine site. Outflow water from saturated backfill zones will be a substantial source of the water released into Blairmore Creek. As we discuss in the surface water quality chapter, questions exist about the reliability of the saturated backfill zones to treat water that has come into contact with waste rock to meet *EPEA* or site-specific water quality release criteria.

[830] Benga assessed a scenario where the saturated backfill zones would not be able to release water to Blairmore Creek for a period of up to 55 days, during which this water could be diverted to the raw water pond and then receive additional treatment. Benga described the likelihood of a saturated backfill zones outflow suspension as unlikely. Benga did not describe what it would do if the saturated backfill zones outflow suspension were to last more than 55 days. Nor did Benga substantiate why a suspension should be considered unlikely, beyond its confidence in the effectiveness of saturated backfill zones treatment. Benga calculated the 55-day period from the available free storage in the raw water pond (664 000 m³) for the anticipated inflow design flood. At an average saturated backfill zone extraction rate of 12 000 m³/day, it would take 55 days to fill this free storage.

[831] The Alberta *Dam and Canal Safety Directive* requires this extra storage space to be available in case of an extreme event. The directive requires a re-assessment of emergency plans, safety plans, and consequences classification when there is a “significant change in risk to the factors at risk posed by the dam or canal.” Raising the water level of a dam structure into the space reserved to contain the inflow design flood would constitute a significant change in operational procedures. It would therefore

necessitate a re-assessment of the dam's emergency and safety plans. Benga did not provide an assessment of the risk of an extreme rainfall event occurring while this emergency reserve storage capacity was being used to store saturated backfill zone water that could not be released to Blairmore Creek.

[832] In the chapter on surface water quality, we discuss in detail our concerns with Benga's assumptions about the likely effectiveness of saturated backfill zones. We found that the project is likely to cause significant adverse effects on surface water quality. An important element of that finding is that Benga has not adequately supported its assertions about the effectiveness of the saturated backfill zones. If Benga's assumptions about the saturated backfill zone treatment and contact-water capture efficiency are not met, we find that Benga has not provided sufficient reason for us to be confident that a suspension of saturated backfill zone flows to Blairmore Creek would not extend for longer than 55 days, and potentially indefinitely. We therefore find there to be a high level of uncertainty about Benga's analysis of predicted surface flows in Blairmore Creek.

[833] Benga's preferred sources of augmentation water, when saturated backfill zone water is not available, are three sedimentation ponds with a combined capacity of 163 000 m³, which is enough to provide water at a rate of up to 0.07 m³/s to Blairmore Creek for 27 days. Additional water, which Benga described as being not exposed to selenium, would be sourced from groundwater seepage from the mine pit via sedimentation ponds. This seepage could supply 2000 to 5000 m³/day over the mine life, according to the groundwater model. However, as we discuss in the surface water quality chapter, we have water quality concerns about pit-wall runoff and groundwater seepage into the pits, including the potential for these waters to contain elevated selenium.

[834] As discussed in the chapter on surface water quality, Benga proposed to divert sedimentation pond water with elevated concentrations of selenium or other parameters of concern to the saturated backfill zones for treatment. Because all water treated through the saturated backfill zones is discharged to Blairmore Creek, this represents a potential risk for a Gold Creek flow-augmentation plan.

[835] Benga stated that the southeast surge pond, which would receive water that has come in contact with waste rock, would have a spillway directed to Gold Creek and be designed to fully contain an environmental design flood with no flow through the spillway. A specific environmental design flood level was not identified, although a 1-in-200-year event was described as "not untypical for environmental design floods." Selenium-containing water could therefore be released to Gold Creek during extreme rainfall events.

[836] We find that, given the presence of a *SARA*-listed species in Gold Creek, a higher level of precaution for the environmental design flood is warranted for the southeast surge pond compared with a typical case. Were the project approved, we would recommend a return period of greater than 200 years for the southeast storm pond's environmental design flood.

Project is likely to have adverse impacts on surface flows in Blairmore and Gold Creeks, with uncertain flow augmentation and water controls

[837] During periods of critically low flows, Benga could combine a large amount of water stored in sedimentation pond with groundwater pit seepage to augment creek flows. We conclude that there may be

enough water storage within the mine footprint to support a comprehensive flow-augmentation plan if uncertainties about the reliability of water quality could be fully addressed. However, Benga was not able to clearly address our water quality concerns and did not provide a comprehensive flow-augmentation plan.

[838] We assess the residual effects of the project on surface water quantity as follows:

- **Magnitude:** low to moderate. If the saturated backfill zones function as Benga hopes, and an effective water return strategy were developed, the magnitude of the impacts on flows would be low. The magnitude of impacts on flows in the Crowsnest River is low to non-existent.
- **Geographic extent:** local. The project effects are expected to be local and limited to Gold Creek and Blairmore Creek. The project's impacts on the hydrology of the Crowsnest River and other downstream water bodies are likely to be negligible.
- **Duration and frequency:** long and continuous. Project effects on the hydrologic conditions of Gold Creek and Blairmore Creek are expected to be long and continuous, with effects lasting throughout the project life. At closure, the hydrological conditions are expected to return to the equivalent of an undisturbed condition.
- **Reversibility:** reversible. Project effects on local hydrology would be reversible in the long term, because once mining operations cease and reclamation takes place, local flows should return to near baseline levels.
- **Ecological and social context:** neutral to negative. The current hydrologic condition of the proposed mine site is heavily disturbed due to previous mining operations. But the surrounding Blairmore and Gold Creek watersheds are otherwise in a near-natural or undisturbed hydrologic condition. At the broader river basin scale, the project is within the heavily allocated Oldman River and South Saskatchewan River Basins.

[839] We find that the project is likely to increase risks to and to have adverse impacts on the quantity of surface water flows in Gold and Blairmore Creeks. We expect these impacts will likely be low to moderate in magnitude and limited to these creeks. However, given the uncertainties with water quality management, the presence of a threatened aquatic species, and the lack of a comprehensive flow-augmentation plan, we are unable to confidently conclude that the project's effect on the aquatic environment of Gold Creek and Blairmore Creek will be acceptable.

[840] Overall, we expect that the project's impacts on surface water flows will be adverse, but not significant. Our confidence in this assessment is moderate-to-high, given the uncertainties in Benga's analysis. We note that, based on Alberta and DFO policy guidance and fully addressing the reliability of the water quality of flow augmentation sources, a comprehensive flow-augmentation plan for streams whose flows would be affected by a project such as this should have been a component of Benga's hydrological analysis. Although we are denying the project application under the *Coal Conservation Act* for different reasons, we would have required Benga to produce such a plan had we approved the project. Given that no other existing or reasonably foreseeable projects affect flows in Blairmore and Gold Creeks, the planned development case for this application is identical to the application case, and our findings for cumulative effects on water quantity are the same as our findings for project effects.

13. Surface Water Quality

The project's nature and location require careful and precautionary evaluation to avoid significant adverse environmental effects

[841] The project is located in a sensitive mountain environment that contains rare plant communities, habitat for several species at risk, and critical habitat for the threatened westslope cutthroat trout. The project has the potential to adversely affect the water quality of Gold and Blairmore Creeks, which are within the headwaters of the Crowsnest, Oldman, and South Saskatchewan Rivers. These waters are important to many Albertans and Indigenous groups.

[842] The Oldman watershed contributes to the water supply for hundreds of thousands of people downstream. In addition to residential users, multimillion-dollar agricultural and agri-food processing regions operating downstream of the project require high-quality water for crop irrigation and livestock. Water availability and quality for these businesses contributes to the livelihood of many local residents, and the economy of Alberta. Furthermore, the Crowsnest River is a highly regarded fly-fishing tourism destination in Alberta, and the fishery is an important economic driver in the region. Other recreational tourism industries exist downstream of the proposed project, which also rely on good water quality and availability.

[843] The project is in an area governed by the *SSRP* under Alberta's *Land-Use Framework*. Protection of water quality is a primary focus within the plan, which specifically recognizes the unique geography of the eastern slopes. As part of the *SSRP*, the *South Saskatchewan Region – Surface Water Quality Management Framework* provides the tools to manage water quality in the Oldman River (and other water courses). This *Framework* complements existing policy, legislation, regulations, and management tools by setting surface water quality triggers and limits on the mainstem rivers, with the goal of managing cumulative effects.

[844] These waters have a connection to Indigenous people and their traditional territory. The Crowsnest River is tied to specific ceremonial practices. The Piikani Nation described the Oldman River watershed as important for both cultural and traditional uses. The Stoney Nakoda Nations submitted that they have been sustained by the waters flowing through their traditional lands since time immemorial, and are concerned about diminishing water quality. The Stoney Nakoda noted that, in signing Treaty 7, they understood that they would be free to continue to make use of as much of the waters as they had in the past and that those waters would be left for their use. Tsuut'ina Nation viewed water as a source to sustain life and they also consider water a medicine. The Ktunaxa Nation described the headwaters of the Crowsnest River to be sensitive and sacred, and tied to their oral history, as they consider it the home of the creation-being Raven. The Shuswap Indian Band explained that mountainous areas hold the highest quality of water and plant resources for spiritual practices and ceremonies, and it is important to their spiritual well-being that these resources are protected. During the review process, many Indigenous groups expressed concerns that the project could have negative effects on the waters of the watershed, although most groups later withdrew their concerns or submitted letters of non-objection to the project.

The project location is next to important habitat for westslope cutthroat trout

[845] In 2013, Canada listed the westslope cutthroat trout as threatened under Schedule 1 of *SARA*. Westslope cutthroat trout are the only subspecies of cutthroat trout native to Alberta. The current federal recovery strategy for the species adopted the *Alberta Westslope Cutthroat Trout Recovery Plan 2012-2017* and identified its critical habitat. That critical habitat includes the mainstem of Gold Creek and all its tributaries, including fishless headwaters. Within the LSA, this includes 16.7 km of the Gold Creek mainstem and tributaries of Gold Creek. AEP identified a very high need to protect Gold Creek habitat, as well as habitat in the Blairmore Creek watershed, which could provide opportunities to help recover genetically pure and near-pure strains of the species. The *Alberta Fish Sustainability Index* ranks the Blairmore Creek population as being at very high risk.

[846] Many participants in the review process were concerned about the potential for the project to release selenium and harm westslope cutthroat trout. Benga proposed to develop a site-specific water quality objective (SSWQO) for selenium in waters downstream of the project. This objective was higher than the provincial selenium guideline for the protection of aquatic life. But Benga submitted that its site-specific objective would still be protective of westslope cutthroat trout health.

Lessons from the Elk Valley illustrate the challenges and costs of dealing with the water quality issues that this project will face

[847] The Grassy Mountain coal deposit is part of the Mist Mountain formation, which is also the source of coal for Teck's metallurgical coal-mining operations nearby in British Columbia. Teck has encountered issues, specifically the release of selenium and nitrate from mining waste, that could also arise at Grassy Mountain. Benga considered Teck's coal projects in the Elk Valley throughout its EIA as relevant comparisons for its analysis of potential issues and effects that may arise, and for its proposed mitigation measures and monitoring programs. Many other participants also recognized and accepted the similarities of Benga's proposed project to Teck's mines in the Elk Valley.

[848] Benga submitted that selenium concentrations in the Elk River system are well above water quality guidelines, and can seasonally exceed risk-based benchmarks at monitoring locations and/or compliance points. Benga also acknowledged the collapse of a population of westslope cutthroat trout in the Upper Fording portion of the Elk River watershed. The Oldman Watershed Council stated that selenium contamination in the Elk Valley from Teck's coal operations has occurred in the Koochanusa Reservoir, which is much larger than the Oldman Reservoir, and downstream in the Kootenay River. The council also stated that Teck has had limited success at reducing selenium concentrations. In response to questioning from the Livingstone Landowners Group at the hearing, Benga agreed that selenium management will cost Teck on the order of hundreds of millions of dollars. Selenium contamination is not the only contaminant of potential concern causing aquatic effects in the Elk Valley. Mine-related calcite deposition affects some portions of the Elk River system downstream of mine discharges, and calcite deposits are difficult to remediate. Thirty per cent of the 288 km of mine-exposed rivers and tributaries surveyed in 2018 are affected by calcite levels that exceed background levels. Other contaminants of potential concern related to mining operations, including sulphate, nitrate, nitrite, uranium, and cobalt, have exceeded water quality guidelines. Even with active water treatment, nitrate concentrations in Line Creek exceed permit limits. The Elk Valley serves as a cautionary example regarding what could occur when sources of selenium and calcite formation are not controlled. It affirms

the importance of preventing problems before they arise, rather than relying on adaptive management after contamination problems have taken hold.

Benga provided a detailed site water management plan

[849] Benga proposed to capture, treat, and release all surface runoff water as well as water pumped from the pit (primarily groundwater). The water management system would collect surface runoff water from the active mine face, roads, train loadout areas, and pit water (groundwater) and divert this runoff to sedimentation ponds. These ponds would treat total suspended solids (the primary contaminant of concern Benga expected to see occur at elevated levels in this water) through pond design, settling, and the use of chemical flocculants. Once Benga had confirmed that this water meets regulatory limits, it would release the water to either Blairmore or Gold Creek, depending on the location of the sedimentation pond. Benga noted that it could also pump surface runoff water from mining areas and haul roads to the raw water pond, instead of discharging it through the sedimentation ponds, if the water quality of this runoff does not meet regulatory limits for release to the environment. Benga indicated that it does not expect this water to contain elevated levels of selenium.

[850] Benga did expect runoff water from the waste rock disposal areas (also called contact water) to have elevated concentrations of selenium, which would require further treatment before Benga could release it to the receiving environment. Ditches on the site would capture runoff and seepage from the waste rock disposal areas, and direct this contact water to the surge ponds. Should groundwater monitoring wells around the waste rock disposal areas detect elevated selenium or other contaminants of concern due to seepage of water into the groundwater system, Benga would install seepage capture wells to recover this water and direct it into the surge ponds.

[851] Contact water from the surge ponds would be pumped to the saturated backfill zones either directly (northwest surge ponds and raw water pond) or indirectly (southeast surge pond to raw water pond, and then to the saturated backfill zones), where it would undergo selenium removal. Benga would either release the saturated backfill zone effluent to Blairmore Creek, or subject it to additional treatment (a gravel-bed reactor, metals treatment plant, selenium treatment plant, or advanced oxidation) before releasing this water to Blairmore Creek. It would not release any treated water from the waste rock disposal areas or saturated backfill zones to Gold Creek. Benga would use water from the raw water pond as the primary source of process water to wash the coal in the processing plant, as well as for dust control on roads within the mine site and on the main access road. It would pump excess water from the raw water pond to the saturated backfill zones for treatment. Benga indicated in its final argument that it may consider alternative sources of water for dust control. Figure 13-1 presents a schematic outline of Benga's site water management plan.

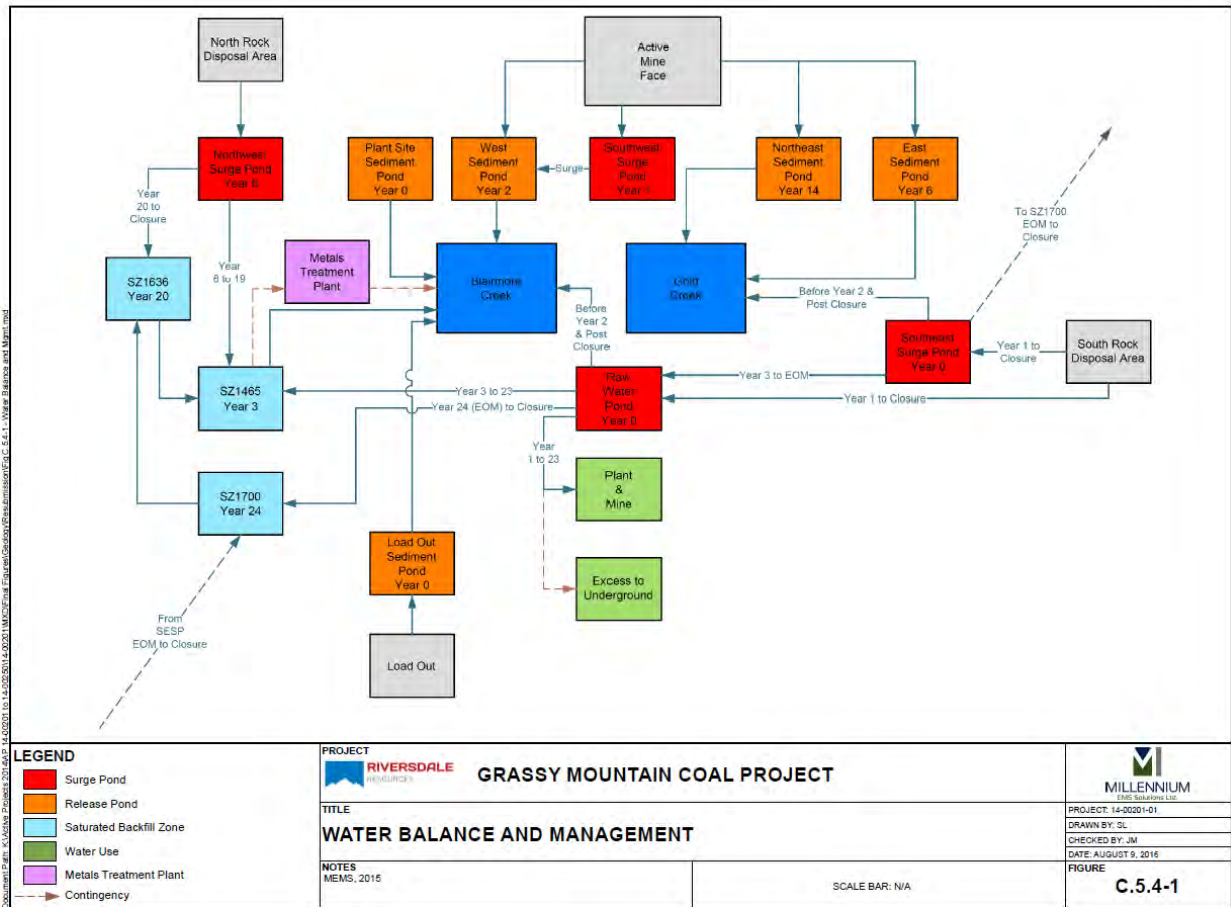


Figure 13-1. Benga’s site water management plan. Source: CIAR 42, Section C, Figure C.5.4-1, PDF p. 254.

[852] Benga expected to reclaim sedimentation ponds at the end of mine life, allowing most runoff from the reclaimed mine site to flow naturally into Blairmore and Gold Creeks. However, Benga expected that selenium levels in contact water from the waste rock disposal areas would be elevated for long after reclamation. Benga proposed to keep the surge ponds in service for an indeterminate period after mine closure, and to pump this water to the saturated backfill zones until selenium levels in the effluent meet acceptable limits.

[853] Benga would allow the final north pit to fill with water at the end of mine life to form an end-pit lake. Benga originally considered allowing water from the end-pit lake to discharge to Gold Creek through horizontal drainage holes drilled on the eastern side of the lake. During the hearing, Benga clarified that its updated plan was to allow water from the end-pit lake to flow naturally into the saturated backfill zone, and ultimately Blairmore Creek. Benga further clarified that it would not allow direct discharge of the end-pit lake water into Gold Creek.

[854] Figure 13-2 illustrates the proposed system of sedimentation ponds, surge ponds, raw water pond, saturated backfill zones, and the end-pit lake.

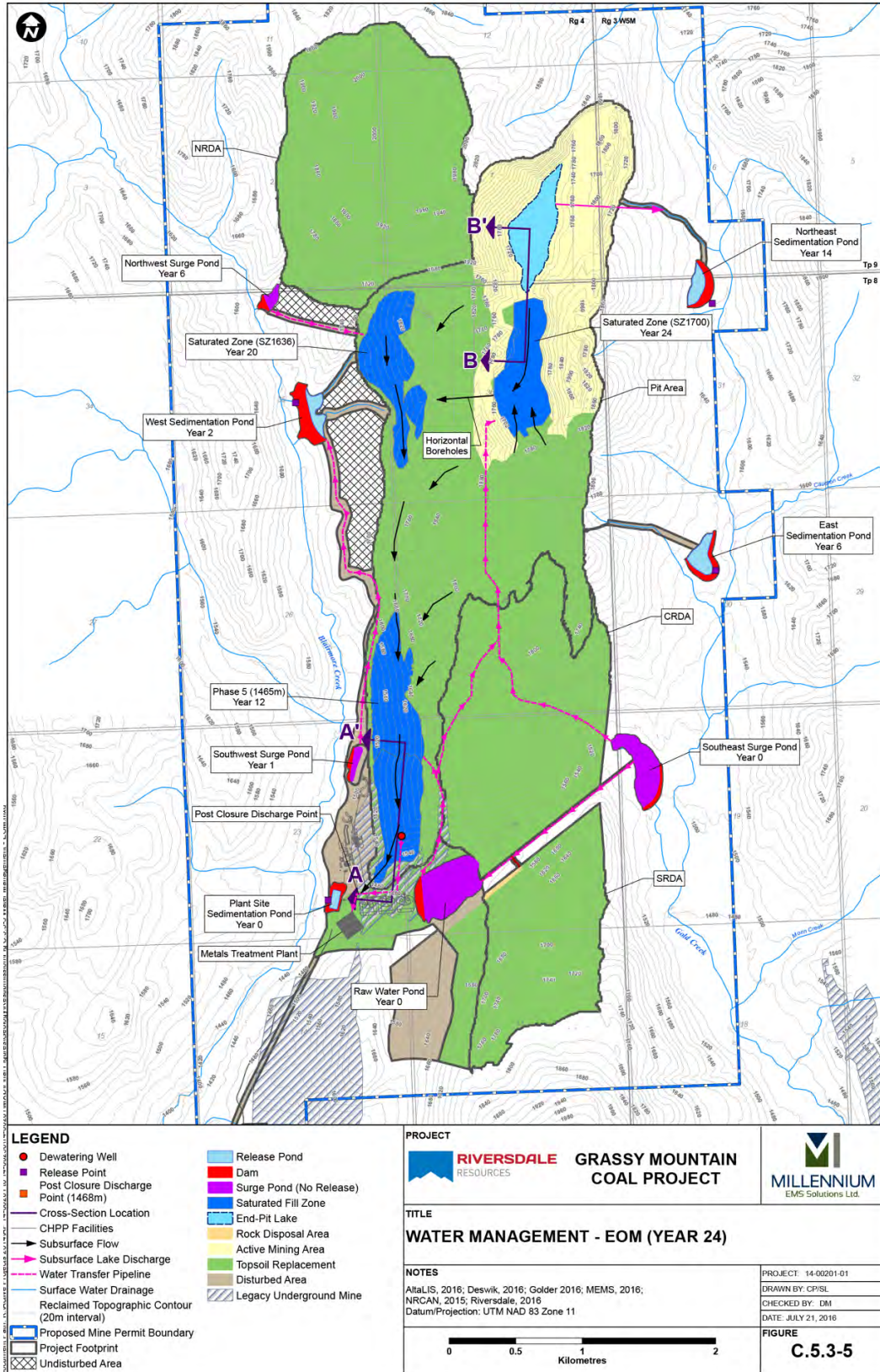


Figure 13-2. Water management system elements. Source: CIAR 42, Section C, Figure C.5.3-5. PDF p. 251.

Sources of selenium and other leaching metals may be underestimated, and the complete mitigation of acid generation is uncertain

[855] Waste rock, coal reject, and legacy mine waste produced or exposed during mine operations pose two inter-related challenges: acid production and metal leaching. The primary risk is that toxic metals will be released from mined rock and affect sensitive water bodies such as Blairmore and Gold Creeks for decades.

[856] The oxidation of pyrite or other sulphide minerals commonly associated with coal deposits generates acidity and releases metals. However, not every exposed mineral oxidizes and generates acidity, and some can neutralize acidity. Assessment of these issues requires that the sulphide and associated trace-metal content of waste rock be adequately characterized, and that the potential for acid production and metal leaching be quantified. Using this information, appropriate measures can be developed to prevent or mitigate acid generation and the release of trace metals into the environment. At Grassy Mountain, selenium is a contaminant of particular concern.

[857] Benga evaluated the potential for generating acid rock drainage as determined by the ratio of modified neutralization potential and acidification potential for mined rock, as well as the sulphide-sulphur content. Benga used this approach to classify waste rock as potentially acid generating, non-potentially acid generating, or uncertain. As well, Benga evaluated the metal-leaching potential of waste rock and coal reject by first conducting a screening test of shale samples of waste rock and coal reject to determine which had a higher concentration of trace metals compared with the average crustal abundance for shale, and then conducting humidity cell tests on samples of waste rock and coal reject found to have high levels of trace metals. Benga also conducted barrel tests to simulate selenium attenuation (treatment) in the saturated backfill zones.

[858] Benga proposed to place waste rock both in waste rock dumps (constructed as piles), and in the saturated backfill zones (constructed in the mine pit by constructing a berm, backfilling the pit with waste rock, then allowing the area to be flooded with water). The sources of metals used to predict water quality at Grassy Mountain, called geochemical source terms, include the waste rock dumps and the mine pit walls. Benga assumed that waste rock and pit-wall leaching would occur under non-acidic conditions, based on its plans to blend acidic and non-acidic rock in a manner that results in non-acidic conditions. Under these conditions, Benga divided leachable ions into two groups: ions controlled strongly by pH, or ions weakly controlled by pH, which Benga suggested includes sulphate and selenium.

[859] Benga did not consider the saturated backfill zone a source term because it assumed that the design and operation of such a feature would prevent acid rock drainage and metal leaching. In particular, Benga planned to blend the waste rock so it is effectively non-acidic. Once the area is inundated with water, Benga would maintain it in suboxic conditions.

Concentrations of trace metals, including selenium, in effluent may be underestimated

[860] Benga evaluated the selenium content of rocks from key formations associated with the project using screening tests, and leach rates with humidity cell tests. Screening tests indicated that selenium concentrations were as much as eight times higher than the average shale concentration in three Mutz samples. The highest concentrations were associated with the Mutz (which contains coal seams 1 and 2) and the Adanac (which contains coal seam 4) intervals.

[861] Humidity cell tests showed that rocks from these formations released selenium, with the highest release rates occurring in samples from the Hillcrest, Adanac, and Mutz Members as well as the Cadomin Formation. Selenium concentrations in humidity cell tests reached as high as 0.1 mg/L, although the concentration decreased over time. In contrast, Benga’s barrel testing yielded higher selenium leach rates in the control barrel, in which weathered rock was used and no organic matter was added. Selenium levels in leachate increased over the 30 days of the test, reaching 0.95 mg/L. Selenium concentrations increased steeply in the barrel test after 20 days. Benga attributed this to a lack of carbon in the barrels due to biological growth in the injection tube. It does not appear that Benga incorporated the high leaching rates observed in the barrel tests (compared with humidity cell tests) in its predictions of selenium in contact water from the project.

[862] Benga predicted the chemistry of contact water at Grassy Mountain by developing metal release rates based on scaling of humidity cell test data (i.e., multiplying by a factor to translate lab-scale test results to anticipated results at mine operations). Benga adopted scaling factors from work carried out in the Elk Valley and developed two cases: a base case and an upper case. The base case represented Benga’s “most likely” prediction, based on “combining numerical inputs that reflect typical conditions and scientific judgement for some aspects” (CIAR 42, Appendix 10, PDF p. 51). The upper case represented a boundary condition that Benga suggested was unlikely to be exceeded.

[863] Because Benga considered both selenium and sulphate to be weakly controlled by pH, it expected the loading (or leaching) of these two compounds into the environment to increase proportionally to the volume of waste rock placed in the waste rock dumps. Benga determined that calculated selenium and sulphate release rates “for the low end of the range are about three to four times higher than those determined for the Elk Valley” (CIAR 42, Appendix 10, PDF p. 51). Even at the lower scaling factors Benga applied, it found that Grassy Mountain will produce considerably higher selenium and sulphate release rates than those seen in the Elk Valley. Benga used its estimated annual waste rock deposition to calculate the estimated generation rates for selenium and sulphate, as illustrated in Table 13-1.

Table 13-1. Generation rates for sulphate and selenium

Rock type	Sulphate (mg/m ³ /year)		Selenium (mg/m ³ /year)	
	Base case	Worst case	Base case	Worst case
Waste rock	24 000	73 000	3.2	9.4
Co-disposal of waste rock and rejects	33 000	77 000	9.4	15

Source: CIAR 42, Appendix 10, Table 5.1, PDF p. 252.

[864] Benga combined these release rates with flow data for the site to predict the chemistry of water released by waste rock dumps. Benga also evaluated the leach rate of ions strongly controlled by pH and incorporated these rates into its water quality model. Benga noted that, for the two pH ranges used, cations had higher concentrations at a lower pH. Anions such as arsenic and uranium showed no change in concentrations relative to pH, or higher concentrations at lower pH. These results imply that if acid rock drainage does arise at the site, leading to lower pH conditions, then trace-metal concentrations would likely increase. We also note that the data, specifically the results of the humidity cell tests and the barrel tests, suggest that the source terms used in the water quality model introduce uncertainties into Benga’s predictions.

[865] Despite Benga's assumption that sulphates are weakly controlled by pH, we note that Benga's humidity cell tests showed that the highest release rates for sulphate occurred in the three most acidic humidity cells. The influence of low pH on sulphate leaching was demonstrated by HC1 (the Adanac) when, during weeks 30 to 40, the pH steeply declined and the sulphate values increased accordingly. Sulphate leaching reached as high as 2000 mg/L in Benga's Figure 13 and 14 in Appendix 10 of the original EIA. Selenium leaching, on the other hand, showed no such relationship to pH in the humidity cell test data. The assumed covariance of selenium and sulphate underpinned much of the geochemical modelling done by Benga, including the water quality model. However, this information provided by Benga calls this covariance into question if acidic conditions should develop.

[866] Humidity cell data showed that rock at Grassy Mountain released arsenic, selenium, and sulphate after ten weeks. Benga indicated that the maximum exposure time for waste rock before inundation by pit waters is one year for rock from the Adanac and two years for rock from the Mutz. This suggests that the delay between the placement of waste rock in the saturated backfill zones, and the flooding of the saturated backfill zones, could allow for a large amount of metal leaching. It is unclear whether Benga accounted for this metal leaching in the water quality model.

[867] An additional source of uncertainty is the potential for trace-metal leaching in the Fernie Formation. The formation contains large quantities of siltstone and shale, which are the same types of rock that contain sulphides in the coal-bearing units that Benga analyzed (the Adanac, Hillcrest, and Mutz Members). Benga's expert witness, Mr. Day, indicated that the Fernie Formation was not tested because no sample material was available at the time of testing. He also stated that he learned from working in the Elk Valley that, although the Fernie Formation does contain pyrite, it does not generate acid because it also contains considerable carbonate contents, and Benga is therefore not concerned about the Fernie. However, Benga did not identify carbonates on the stratigraphic column for the rocks at Grassy Mountain, suggesting that the weathering pattern and leaching potential of the rock at Grassy Mountain may be different from that in the Elk Valley.

[868] Benga submitted cross-sectional diagrams of the mine pit, one of which illustrates that the pit comprises a portion of waste rock comparable to the Cadomin Formation, and others that show the Fernie Formation is exposed frequently along the pit boundary. It forms the base of the saturated backfill zones and is the major geological unit exposed at the end of mine life. However, Benga did not conduct any analysis of potential metal leaching from the Fernie Formation. During the hearing, Benga acknowledged that the formation appears in cross-sections to be removed in large volumes during mining and will be exposed frequently along the pit boundary. Excluding the possible contribution of the Fernie Formation from the overall metal load could lead to an underestimate of metal concentrations in water draining the site.

[869] We find that by excluding the potential contribution of metals from the Fernie Formation and from the saturated backfill zones before they are fully submerged (even if this is a temporary effect), the metal loads Benga predicts from Grassy Mountain may be underestimated.

Elk Valley geology may not have the same geochemistry and leaching as Grassy Mountain

[870] Benga stated it used the experiences of the Elk Valley to contribute to its development of geological source terms for Grassy Mountain, including basic assumptions, a sample analysis strategy, and a conceptual geochemical model. Experience at Elk Valley informed the management concern posed by selenium and calcite deposition. Benga's assumption that waste rock and pit walls weather under non-acidic conditions, and that acidity is neutralized by the rocks' own mineralogy, is also based on Elk Valley learnings, as are the scaling factors used to determine trace-metal concentrations from waste rock.

[871] Benga's assumption that selenium and sulphate release rates from sulphide mineral oxidation occur at a rate proportional to the cumulative mass of waste rock is based on data from the Elk Valley. Benga relied on this data to calculate source terms for the water quality model at Grassy Mountain. However, Benga reported a difference in low-concentration selenium leaching rates between the rock at Grassy Mountain and the rock at Elk Valley.

[872] We are concerned that this difference in geology may play out in the potential for nitrate to oxidize sulphides within the saturated backfill zone, especially before the saturated backfill zone is fully operational. Benga did not conduct column testing to determine if sulphide oxidation via nitrate could occur under anoxic conditions. Benga was asked whether this process could liberate more trace metals (specifically arsenic) in the saturated backfill zones. It responded that it does not expect the saturated backfill zones to be a significant source of arsenic, but it did not have the data to support that assertion.

[873] Benga agreed that its tests on rock from Grassy Mountain rocks have shown arsenic leach rates to be "definitely high" in association with low pH. Benga also confirmed that arsenic becomes more mobile under low oxygen conditions. In its source term calculations, Benga did not clearly account for increased mobility of arsenic in the saturated backfill zones. The effect of the mobility of arsenic therefore remains uncertain.

[874] Benga assumed a maximum concentration of 1.5 mg/L for the selenium source term in its water quality model. When asked how this number was derived, Benga indicated it was a mass-based term calculated from a dry loading rate for selenium based on the tonnage or volume of waste rock created on an annual basis. It divided this rate by the expected flow of water through the waste rock dumps to estimate the source term. Benga later indicated that it calculated selenium release rates from humidity cell tests using scaling factors. Benga indicated that these factors are conservative and would need to be confirmed through monitoring of contact water entering surge ponds.

[875] Benga conducted humidity cell tests on rock from the Grassy Mountain site. These are small-scale lab tests that do not necessarily represent what would occur at the full-scale mine. To estimate source concentration input rates for the water quality model, Benga applied scaling factors to measured humidity cell test results. These scaling factors were determined for coal mines in Elk Valley; Benga stated during the hearing that the rocks are very similar.

[876] The above statement contrasts with earlier statements made by Benga during the hearing, when the Coalition raised concerns about high levels of uranium at Elk Valley. Benga indicated that it did not examine uranium because its assessments were based on what it found at Grassy Mountain, and not elsewhere. Benga further stated that the rock at Grassy Mountain was "not exactly like anything." The

Coalition asked if the rock at Grassy Mountain was the same type of rock Teck is mining, and Benga responded that it was dealing with the rock at Grassy Mountain, and it did not have rock from Teck to compare with.

[877] We agree that the use of scaling factors to estimate loading rates at large (project-level) scales from lab-scale humidity cell tests is a common technique. Humidity cell tests use small samples of rocks, and leaching rates would be expected to differ at the mine level for multiple reasons. However, the applicability of the scaling factors derived from Elk Valley operations to the Grassy Mountain project remains uncertain. Benga's witnesses provided conflicting testimony on the comparability of Elk Valley geology to that of Grassy Mountain. For the purposes of calculating leaching rates, Benga indicated it assumed the rocks at the two locations were similar. When discussing other constituents of potential concern identified by Teck but not assessed for this project, Benga indicated that this was due to the rocks being different. As a result, we are not convinced that the use of Elk Valley scaling factors at this project is appropriate. This creates uncertainty around Benga's derivation of source terms in its water quality modelling.

[878] We find that Benga's assumption that selenium and sulphate both leach from rock at rates largely independent of pH has not been demonstrated using Grassy Mountain rock. Benga's humidity cell test data indicate that sulphate may leach at rates that depend on pH. The highest sulphate release rates are from test cells with the lowest pH (most acidic), while the lowest release rates are from test cells with the highest pH (least acidic). This is in contrast to selenium, which shows no such relationship. If sulphate release at Grassy Mountain is related to pH, then sulphate leach rates may be underestimated. Benga has not provided clarity on this area of uncertainty.

[879] We also find that Benga, throughout its geochemical characterization, analysis, and implementation, relied heavily on learnings from the Elk Valley. While in some cases this may be reasonable, in other cases the data from Grassy Mountain do not clearly align with Elk Valley-based assumptions about the covariance of selenium and sulphate, attenuation of trace metals in the saturated backfill zones, or the treatment of contaminants of concern such as arsenic. Benga's reliance on these assumptions adds one more element of uncertainty to the source-term analysis, particularly in light of Benga's statement that the rocks at Grassy Mountain are different from those in the Elk Valley.

The assumption that acid rock drainage will not develop is not well supported

[880] Benga stated that the geochemical characterization of waste rock and coal handling and processing plant residues revealed that some waste components can potentially generate acid. Humidity cell tests confirmed this to be true for some materials. Benga completed a detailed assessment of the overburden material for acid rock drainage potential and the results indicate that acid rock drainage potential is associated with the Cadomin Formation and the Mutz, Adanac, and Moose Mountain Members of the Kootenay Group. The Cadomin Formation overlies the Kootenay Group as overburden, while the Mutz and Adanac Members of the Kootenay Group contain coal seams 1, 2, and 4 and occur as interburden. The Moose Mountain Member of the Kootenay Group directly underlies coal seam 4 and rests on the Fernie Group. The Adanac Member and the Cadomin Formation showed the highest acidity and release rates for sulphate, aluminum, cadmium, cobalt, copper, iron, manganese, nickel, and zinc.

[881] Benga planned to mitigate acid generation through underwater disposal of rock to exclude oxygen, which is required for oxidation, and by blending acid-generating rock with non-acid generating rock to offset acid-generation potential. The first measure, excluding oxygen, applies to waste rock deposited in the saturated backfill zones, where organic matter injection will allow suboxic conditions to develop. Under the low-oxygen conditions in the saturated backfill zones, Benga assumed sulphide minerals in the waste rock would oxidize only as fast as oxygen can dissolve in water (i.e., slowly). This slow/nonexistent rate of oxidation means that any acid that is generated will be easily neutralized by naturally occurring carbonate minerals within the waste rock.

[882] Benga's second mitigation measure involved the blending of potentially acid-generating rock (containing sulphides), which may oxidize, with non-potentially acid generating rock (containing little or no sulphides and possibly containing carbonate minerals). Benga will comingle the potentially acid-generating rock and non-potentially acid-generating rock by end-dumping the waste rock in a sequence of alternating potentially acid-generating rock /non-potentially acid-generating rock truck loads. It would also carry out mass-balance calculations using the geochemical characteristics of the rock to determine the neutralization and acid potential of the rocks, and to ensure that neutralization potential is always in excess of acid potential by a certain margin. This approach to blending potentially acid-generating rock and non-potentially acid-generating rock will be used for the waste rock dumps, where oxygen will be present and sulphide oxidation is a risk, and for backfilling acid-generating pit-wall exposures.

[883] Benga indicated that acid-generating pit walls would be actively managed by covering the acid-generating rock with non-acid generating rock. It also developed source terms for the various types of pit walls it expects to create for use in the water quality model. The water quality model assumed that 80 per cent of the loadings generated by acidic rocks in the exposed pit walls would be mitigated, although Benga provided limited data or rationale for this threshold.

[884] Benga stated that there may be more potentially acid-generating rock than it can handle by blending. To mitigate this possibility, Benga suggested temporary stockpiling or prioritizing opportunities for subaqueous disposal. However, the first saturated backfill zone is not expected to come online until the fourth or fifth year of active mine operations. Furthermore, Benga stated that the Adanac will begin acid generation and leaching within one year of exposure. Acid generation from exposed Adanac waste rock early in the mine life could release trace metals and has implications for Benga's water quality modelling. Humidity cell tests indicate that the Adanac produces acid leachates, with a pH as low as 2–3, although in its source calculations for the water quality model, Benga only evaluated leaching under two pH scenarios: pH 8 (base case) and pH 7 (upper case). An increase in acidity (a decrease in pH) would leach more metals, as demonstrated by Benga's sensitivity tests, which demonstrated increased levels of metals in leachate to Blairmore Creek when 100 per cent acidic pit walls were used in the water quality model.

[885] An additional source of uncertainty is Benga's assumption that the Fernie Formation is entirely non-acid generating. The Fernie Formation would form the base of the raw water pond, a portion of the pit walls, and a percentage of the mine waste rock. Benga did not analyze the Fernie Formation during humidity cell tests or other analysis, so its sulphide content and acid-generation potential remain speculative. Benga said the Fernie Formation was non-acid generating in the summary of source terms

listed as water quality model inputs based on visual characteristics, although it provided no evidence for this effect.

[886] Benga indicated that the Fernie Formation contains notable quantities of siltstone and shale, which are the same lithologies that produce acid in the Adanac, Hillcrest, and Mutz Members of the Mist Mountain Formation. It is notable that Benga stated that, “General experience in other coal fields (e.g., SRK 2012) shows that surrounding formations may have variable ML/ARD [metal leaching/acid rock drainage] potential due to differences in paleo-environmental depositional conditions. Marine incursions may result in an increase in the pyrite and carbonate content due to the higher sulphate and alkalinity of seawater. In this region, this applies to the Fernie Formation (which was deposited from the inland Fernie Sea)” (CIAR 42, Appendix 10, PDF p. 15). The uncertainty surrounding the acid-generation potential of the Fernie Formation has bearing on the mass-balance calculations Benga conducted for blending (where it considered the Fernie Formation to be non-potentially acid-generating) and the geochemical source terms for the water quality model.

[887] We find that Benga provided insufficient evidence to support its assertion that acid rock drainage will be completely mitigated, which introduces some uncertainty into the water quality assessment. Benga has not adequately addressed the potential generation of acid leachate from Adanac waste within a year of mine operations, well before the saturated backfill zones are operational. Benga’s characterization of the Fernie Formation as completely non-acid generating is similarly not supported by the evidence.

The collection efficiency of waste rock runoff water is likely overstated

[888] Benga’s water quality analysis indicated that the success of treating contact water that contains elevated selenium concentrations depends greatly on being able to capture the water. Any of this water not captured would represent an opportunity for high concentrations of selenium to enter Blairmore or Gold Creeks. Benga stated that a high capture efficiency of site water with elevated selenium concentrations will be required to achieve its targeted selenium concentrations in the creeks. Benga planned to achieve this capture efficiency through a combination of waste rock dump design and various capture methods.

[889] Benga stated that the primary source of elevated selenium on the site will be runoff and seepage from waste rock dumps (contact water). It proposed to capture contact water in ditches at the toes of the waste rock dumps. Benga’s design planning for the collection of seepage from the toe of the waste rock dumps included grading the foundation to facilitate effective drainage, using end-dumping techniques to establish a coarse permeable layer at the base of the dump, and using collection ditches at the toes of the waste rock dumps. The ditches would direct this water to surge ponds. Benga also stated that it had situated its waste rock dumps on high ground, which would be more costly than depositing the waste rock into valleys, to improve the collection of contact water.

[890] Benga would install groundwater interception (extraction) wells downstream of the waste rock dumps if capture efficiencies for seepage are unacceptably low. Benga also indicated that it could install interception trenches or slurry walls to collect, or act as barriers to, seepage from the waste rock. But it did not provide substantive details about these options.

[891] Benga's water quality model assumed capture efficiency rates of 95 per cent for runoff reporting to Blairmore Creek from the north and south waste rock dumps, and 98 per cent for runoff reporting to Gold Creek from the remaining dump (the central rock disposal area, which in some diagrams is simply identified as the northern section of the south rock disposal area). At the hearing, Benga confirmed that it calculated these capture efficiency rates as model inputs that are required to achieve target selenium concentrations in Blairmore and Gold Creeks, as opposed to modelling capture rates that reflected its engineering design. Benga stated that a combination of the design features of the waste rock dumps, groundwater capture wells, and less cost-effective methods, if necessary, would allow it to meet these collection efficiencies. Benga recognized that it may need to implement additional measures to achieve these targets, such as groundwater extraction wells, but it would confirm this through on-site monitoring during operations.

[892] Benga's modelling results indicated that a decrease in contact-water capture rates from 95 per cent to 80 per cent resulted in a more than doubling of selenium concentrations at closure in Blairmore Creek. This lower capture rate would result in frequent exceedance of Benga's proposed site-specific guideline for selenium during operations, and sustained exceedance throughout the post-closure timeframe. While it did not model this scenario, Benga confirmed at the hearing that if capture rates for contact-water seepage reporting to Gold Creek decreased from 98 per cent to 80 per cent, then Gold Creek selenium concentrations would roughly double.

[893] The Livingstone Landowners Group's expert, Dr. McKenna, who has extensive experience with mine design, submitted that contact-water capture efficiencies at the toes of mine waste structures are usually much lower than what was proposed by Benga, even when the ground is well characterized, unless a fully penetrating, low-permeability cut-off wall with an upstream pumping system is used. Dr. McKenna could not provide any examples of mines in mountainous areas that achieve a 95 per cent capture rate of contact water. Dr. McKenna indicated that 60 to 80 per cent was more typical. Dr. McKenna suggested additional design measures that Benga could implement to try to achieve a 95 per cent capture efficiency. Benga did not propose to implement these designs, but indicated at the hearing that it would consider additional design features.

[894] The Coalition's expert witness, Dr. Fennell, similarly characterized Benga's proposed capture efficiencies as optimistic. Dr. Fennell indicated that the likelihood of being able to achieve high capture rates was low given the presence of unlined water management structures and waste rock dumps sitting on top of fractured bedrock or directly on upland springs and tributary streams.

[895] Benga was unable to provide examples of any mines in a mountain environment that are capturing 95 per cent of seepage, but indicated that it would rely upon good engineering design of the waste rock dump, along with groundwater capture wells if necessary, to achieve its target capture rates. Benga expressed confidence that a good team of engineers with this design objective in mind could achieve the necessary capture rates. Benga further stated that, given its prediction that groundwater beneath the mine would have a long transit time before intersecting with surface water, it would have sufficient time to monitor selenium in groundwater (from any uncollected seepage) and implement additional collection measures if necessary. It suggested that it could implement these measures starting

with the most cost-effective methods (such as additional capture wells), and move to more expensive methods to achieve the targeted collection rate of selenium-rich contact water.

[896] The Livingstone Landowners Group also suggested that the waste rock dumps are not located on high ground, as Benga had submitted, but in creek valleys: “The fact is, the ex pit RDAs [waste rock dumps] were not sited on high ground to minimize the creation of contact water, they were located to take advantage of creek valleys and to minimize sterilization of economic coal.” Benga confirmed that the choice of waste rock dump locations “was driven by the desire to have a pit as large as possible so as to maximize coal production while still leaving room for waste-rock disposal” (CIAR 1351, PDF p. 37).

[897] Benga assumed that it will have ample time to implement additional capture measures should monitoring indicate elevated levels of selenium or other constituents of concern in groundwater. A critical review of the groundwater model and the complexity of the geology in the area led the Coalition’s expert, Dr. Fennell, to suggest this is not necessarily the case. Dr. Fennell stated that Benga’s groundwater model is a “gross simplification” of the complex system that exists in the area. Benga predicted that groundwater transit times would generally be longer than ten years. Dr. Fennell indicated that much shorter transit times for groundwater would be likely, because of the presence of faults and fractures in the underlying rock. In addition, Dr. Fennell indicated that groundwater monitoring wells may miss plumes with elevated contaminant concentrations entirely, given that an individual well would intercept only a small portion of the groundwater.

[898] The Livingstone Landowners Groups’ expert, Dr. McKenna, also raised the possibility of formation of groundwater plumes containing elevated selenium and other parameters under the saturated backfill zones and mine infrastructure. Benga stated that its proposed monitoring well locations were a preliminary indication of the potential distribution of these wells, and it would review these locations in the future. Benga stated that the cost of installing a monitoring well is not prohibitive, and that it could install multiple wells at appropriate locations if multiple preferential paths are identified. Benga said it could discuss the detailed design and locations with the AER after doing additional work. Benga did not specifically address the potential contaminant pathway of groundwater plumes.

[899] Benga assumed that the waste rock dumps will be the primary source of selenium in the project. Benga further assumed that mine pit water (a combination of groundwater infiltration and pit wall runoff) will not be a significant source of selenium, and the water management system would therefore direct this pit water to the sedimentation ponds for treatment of suspended sediments before releasing it to the environment. This may not be the case, as we discuss later in this chapter in a section on other possible sources of contamination in the sedimentation ponds.

[900] Although Benga suggested that it may consider opportunities for enhanced contact-water capture rates in future detailed engineering designs for the waste rock dumps, it did not present such plans for our review. Benga’s current conceptual waste rock dump design focused on maximizing coal production and not on minimizing contact-water generation from waste rock. We agree that designing waste rock dumps to minimize the generation of contact water is an important step and could reduce reliance on high capture and treatment efficiencies. However, Benga did not propose such designs, and its suggestion that it could consider such plans in the future does not give us confidence in its approach to mitigation of project effects.

[901] Benga did not provide any evidence or examples of 95 per cent capture rates at other mountain mines, or its own designs. Benga derives the 95 (or 98) per cent capture rate from the water quality model as the level necessary to achieve water quality objectives. In other words, it worked backward from the water quality model to derive the contact water capture efficiency that it needs to achieve. A more appropriate, precautionary approach would be to model water quality using capture efficiencies observed at other mines using capture techniques similar to those Benga proposed. We find that Benga did not apply an appropriate degree of conservatism to this analysis; instead it used capture rates that are highly optimistic and exceed any examples (in evidence) of capture rates typical for similar mines.

[902] The contact water that needs to be captured from the waste rock dumps includes seepage into the groundwater beneath these dumps, and the geology and groundwater pathways underlying the project are uncertain. Benga admitted that the groundwater model for the project area is simple, and makes a number of assumptions that expert witnesses found questionable, as we discuss in the groundwater chapter of this report. The uncertainty regarding groundwater pathways and flow rates compounds the overall uncertainty associated with Benga's expectation of achieving a 95 per cent capture rate.

[903] Given the concerns raised by participants, we question Benga's ability to detect and mitigate potential groundwater plumes in a timely manner. We further find that Benga provided insufficient evidence to support the assumption that it will have ample time to implement additional capture mitigation measures, should groundwater monitoring indicate elevated levels of selenium or other constituents of concern.

[904] We find that the project, as proposed, is unlikely to capture 95 per cent of contact water needed to achieve modelled selenium concentrations in the effluent and receiving waters. We further find that applying a more realistic capture efficiency rate as part of a conservative approach would result in significantly higher concentrations of selenium in the saturated backfill zone effluent and both Blairmore and Gold Creeks, in the absence of further mitigation.

Claims of selenium removal in saturated backfill zones are not well supported

[905] Benga predicted that selenium would leach from waste rock and report in mine drainage at elevated concentrations. This prediction is consistent with observations and experience at other coal mines in Alberta and British Columbia. Benga acknowledged that it will be necessary to decrease selenium concentrations in drainage from the proposed mine to avoid potential impacts, and proposed various measures to remove selenium from mine water. The main process Benga proposed for selenium removal is the use of saturated backfill zones.

[906] As mining progresses, Benga would construct three saturated backfill zones in the mined-out pit. The first saturated backfill zone would involve constructing three dikes in the south mine pit as it advances, backfilling each area with waste rock, then allowing the area to inundate with a combination of groundwater and precipitation. The other two saturated backfill zones would simply be backfilled pits without dikes. Benga would construct a mechanism to inject a source of carbon (methanol) into the saturated backfill zone to feed microbial growth and create suboxic, reducing conditions.

[907] The water management system would feed contact water with elevated selenium concentrations (in the oxidized form of selenate) into the saturated backfill zones, where the conditions would reduce the selenate to either selenite or elemental selenium. Selenite would adsorb to waste rock surfaces, while elemental selenium, being insoluble, would precipitate out of solution and remain in the saturated backfill zone. After a suitable amount of retention time, Benga would extract the water from the saturated backfill zone and pass it through a cascade to a holding pond. It would test the water in the holding pond to ensure the water meets regulatory limits, and then release the water to Blairmore Creek (potentially with one or two intervening post-saturated backfill zone treatment steps, as we discuss later in this chapter).

[908] Benga developed a model to determine acceptable concentrations of selenium in Blairmore Creek, based on its proposed SSWQO, which we discuss later in this chapter. It calculated that a discharge of mine water containing selenium at concentrations of 15 µg/L or lower would allow it to meet instream water quality objectives. Benga proposed to design the treatment system to achieve this concentration of selenium in the effluent from the saturated backfill zones.

[909] Benga indicated that the saturated backfill zones were modelled assuming 99 per cent removal of influent selenium, based on its predicted conservative selenium concentrations in the contact water of 1.5 mg/L (see the previous section of this chapter), which equals 1500 µg/L (99 per cent selenium removal from this influent would result in saturated backfill zone effluent with 15 µg/L of selenium). We note, however, that the water quality modelling did introduce an artificial cap on influent selenium concentrations in the calculations, such that if a modelled parcel of water exceeded 1.5 mg/L (therefore requiring a selenium removal rate of greater than 99 per cent to achieve the target concentration after treatment), the model ignored this exceedance:

“In the water and load balance model, selenium attenuation in saturated backfills was assumed to amount to 99% or a final concentration of 0.015 mg/L (15 ppb), whichever was lower”
(CIAR 42, Appendix 10, PDF p. 427)

“Q: ...so that was the modelling approach you took. To clarify, you had a water-balance model; some water flowed into the system to be treated, and if the model had a flux of water that actually exceeded 1.5 milligrams per litre, you introduced a cap to say, We’re going to—we’re going to treat it as the outflow as a maximum of 15 micrograms per litre; right?

A: Yes, that’s correct.” (CIAR 881, PDF p. 156)

[910] Benga confirmed during the hearing that these were assumed target values, not empirically derived, which were necessary for the water quality modelling to predict satisfactory results. It planned to confirm these values later during pilot-scale studies.

[911] Benga had consistently maintained through several rounds of information requests that these two values—maximum influent selenium concentrations of 1500 µg/L and 99 per cent removal—will be attained. However, during the hearing, Benga de-emphasized the 99 per cent removal rate and emphasized its target for the saturated backfill zone to discharge effluent with selenium concentration of up to 15 µg/L.

[912] To support its claim, Benga presented several pieces of evidence:

- Responding to information requests (e.g., Information Request 5-5 in the Tenth Addendum), Benga presented several examples of pilot-scale and full-scale treatment systems that achieve high removal rates for selenium. These different examples showed that selenium can be removed at a rate greater than 90 per cent.
- Benga presented an example of a treatment system at a coal mine in Tumbler Ridge, British Columbia that removed 99 per cent of influent selenium (Bianchin et al., 2013).
- Benga submitted the results of a barrel study showing a selenium removal rate of about 90 per cent, using legacy waste rocks collected at the site of the old coal mine on the property, and synthetic feed water (i.e., selenium was added to water to achieve specific influent concentrations).
- Benga submitted a presentation by Teck showing that Teck's saturated rock fill (which is comparable to Benga's proposed saturated backfill zone) was effective in removing more than 90 per cent of the selenium from water with influent concentrations of 50 to 200 µg/L.

[913] Benga argued that its submissions supported its claims that a saturated backfill zone treatment process can produce an effluent with selenium concentrations below 15 µg/L. When asked at the hearing about its degree of confidence in this claim, Benga's expert witness, Mr. Jensen, indicated that he was confident effluent selenium concentrations would be 15 µg/L or lower. Benga proposed to validate its claims through pilot-scale studies after mining operations begin. Furthermore, Benga proposed a contingency measure to install an active water treatment plant, if these studies failed to demonstrate the anticipated treatment performance in the saturated backfill zones.

[914] CPAWS raised concerns about the plan for passive treatment of selenium. They requested additional evidence that a passive scheme to mitigate selenium-affected water through a saturated backfill zone, including surge ponds to collect this water, has successfully removed selenium at other sites in the region. The Timberwolf Wilderness Society noted that, because no consistently satisfactory method of selenium removal has been developed for the scale required by this proposed mine, it would be unsupportable to approve mine construction and operation before an effective method of selenium removal has been developed.

[915] We are not convinced that Benga's proposed saturated backfill zone will reduce selenium concentrations in effluent to less than 15 µg/L. Whether this is an acceptable target concentration for saturated backfill zone effluent is an issue we will examine later in this chapter.

[916] Benga did demonstrate that the processes involved in its saturated backfill zones is likely to have some level of success in removing selenium from contact water. But the proposed treatment efficiency of 99 per cent is extremely high and demands strong supporting evidence. Benga did not present evidence from first principles (e.g., a description of biological processes and their limitations) to support the proposed efficiency of its saturated backfill zones. Benga also did not present any examples of currently operating saturated backfill zones, which would be directly comparable to its planned system, that are achieving a 99 per cent treatment efficiency.

[917] Although Benga de-emphasized the 99 per cent treatment efficiency at the hearing, we note that achieving its targeted effluent concentration of less than 15 µg/L selenium would require an extremely high treatment efficiency for the anticipated influent concentrations expected in the contact water and as illustrated in Benga’s modelling results. At the hearing, Benga confirmed the calculations in Table 13-2.

Table 13-2. Selenium removal calculation performed by Benga

Potential influent selenium concentration to be treated (µg/L)	Target saturated backfill zone effluent selenium concentration (µg/L)	Required saturated backfill zone treatment efficiency
1500	15	99%
750	15	98%
500	15	97%
375	15	96%
300	15	95%

Source: CIAR 881, PDF pp. 167–169.

[918] Benga presented modelling results indicating that the selenium concentration anticipated in surge ponds and the raw water pond would regularly average between 600 and 1100 µg/L. We note that the use of an average case would not represent a conservative analysis. Benga cannot simply choose to de-emphasize the 99 per cent treatment efficiency required for the saturated backfill zones, because, given the expected concentrations of selenium in contact water from the waste rock dumps, the saturated backfill zone treatment efficiency will need to be extremely high.

[919] Benga did not present any engineering design criteria demonstrating that the saturated backfill zone can achieve its treatment targets. For example, Benga did not provide volumetric removal rates that could be used to predict the saturated backfill zone volume necessary to decrease influent concentrations to less than 15 µg/L. Nor did it present a relationship between the hydraulic retention time required (the time that influent water would need to remain in the system to undergo effective treatment) and selenium removal. Benga submitted a study (Bianchin et al. 2013) of a somewhat similar treatment system in Tumbler Ridge, British Columbia that included both of these design criteria; however, Benga did not adopt these design criteria nor propose alternatives, despite requests for such information (e.g., Information Request 5-5, Tenth Addendum). Instead, Benga expressed confidence that the saturated backfill zones were sufficiently large to treat predicted selenium loads to achieve 99 per cent removal (or reduction to less than 15 µg/L) in the effluent.

[920] Benga did conduct and submit the results of a barrel study, but the barrel study failed to provide direct support for a 99 per cent selenium removal rate. The test used weathered rock from the former mine site and synthetic water (i.e., selenium was added to test water to achieve specific influent concentrations), adding an element of uncertainty to its conclusions. The fact that Benga presented us with an inconclusive test, rather than repeating the test to demonstrate a 99 per cent selenium removal rate, diminishes our confidence in Benga’s claim.

[921] In the absence of direct supporting evidence, a precautionary approach demands a high level of indirect evidence in support of Benga’s claims. Benga presented indirect evidence of several examples of treatment systems that remove selenium. However, Benga acknowledged during the hearing that most of these examples were not directly relevant to predicting the treatment performance for its proposed system,

including the case described in the Bianchin et al. study, which achieved 99 per cent selenium reduction. Benga agreed that the only example that was directly relevant to Benga's proposed saturated backfill zone was the saturated rock fill trial at Teck's Elkview operation in the Elk Valley.

[922] Benga provided minimal detail about the saturated rock fill system operated by Teck, and did not supply the results that system has achieved, because Teck had not made data from its system publicly available. The Teck data are mainly found in a single presentation submitted by Benga shortly before the hearing, and includes graphs without supporting tables of data. In one case, a graph lacked a legend (which we discuss later in this chapter). The presentation suggests that during a two-year trial, the saturated rock fill produced effluents with selenium levels between 3 and 13 µg/L, for influent concentrations of 45 to 200 µg/L. This represents a removal rate of 92 to 97 per cent.

[923] Teck's graph also suggests that effluent selenium concentrations increased with increasing influent concentrations. This is important because, based on modelling results, anticipated selenium influent concentrations (and loadings) at Grassy Mountain will be at least several times higher than the influent selenium concentrations tested in Teck's Elkview saturated rock fill trial. Applying the observed selenium removal rates achieved by Teck to the contact water anticipated at Grassy Mountain could yield saturated backfill zone effluent concentrations that exceed Benga's target concentration of 15 µg/L. For example, even if the Grassy Mountain saturated backfill zone removed 97 per cent of the selenium, for influent water containing 1500 µg/L the resulting effluent selenium concentration would be 45 µg/L. The only example of a selenium treatment system submitted by Benga that is directly relevant to Grassy Mountain (Teck's Saturated Rock Fill trial) therefore does not clearly support Benga's claim that the Grassy Mountain saturated backfill zone, with its much higher influent selenium concentrations, will produce an effluent with selenium concentrations below 15 µg/L.

[924] Benga argued that these issues will be resolved during a pilot-scale trial, and it was confident that its claims would be validated. It asserted that:

“Benga considers that the scientific principles and established technology for removal of selenium in a gravel bed reactor (GBR) are well proven and in broad use in the industry. Further Benga considers that the extension of the technology to a larger scale in a coal mine through the implementation of a Saturated Backfill Zone (SBZ) to be a reasonable engineering approach for achieving a high level of selenium extraction in an environmentally elegant manner”
(CIAR 251, Package 5, PDF p. 30).

[925] For well-understood, well-proven systems, it should not be necessary to conduct site-specific tests de novo, yet Benga's expert, Mr. Jensen, claimed that “I would still go back to what I've said many times, which is for these types of systems it really is necessary to ... complete test work on-site to get a handle on exactly how your system would ... perform.” (CIAR 881, PDF p. 203). This statement indicates that Benga requires additional experimental data to understand system performance. To date, site-specific tests demonstrating the treatment principles have been limited to a barrel test that failed to achieve 99 per cent selenium removal.

[926] Benga also did not clearly explain whether treatment effectiveness would vary with distance from the carbon injection source within the saturated backfill zone, and how that might influence effectiveness. Benga claimed at one point that all the treatment in a saturated backfill zone occurs near the injection point: “the vast majority of the treatment in these ... systems will happen within a short distance of your injection point” (CIAR 881, PDF p. 214). This is important because if the majority of treatment does happen near the carbon injection point, then zones of water with varying selenium concentrations could develop within the saturated backfill zone. Then, when Benga extracts water from the saturated backfill zone for release to Blairmore Creek, it would be uncertain whether the extraction well would intersect the lower selenium water. Benga has not addressed the mechanics of carbon injection into the saturated backfill zones.

[927] Benga indicated that no pre-treatment of contact water would be necessary to decrease influent selenium concentrations into the saturated backfill zones. This may represent a missed opportunity.

Additional selenium-treatment approaches

[928] ECCC stated that Benga acknowledged there is adequate physical space on the site to implement multiple selenium-treatment approaches, and recommended that gravel-bed reactors also be put in place when mining operations begin. Ktunaxa noted that Benga should plan contingencies in the event that the saturated backfills do not operate to assumed efficiency. Further, Ktunaxa noted that Information Request 6.17 “refers to an estimated 3 years to develop a selenium treatment plant. Work in the Elk Valley has demonstrated a period of 5 years to develop a plant with an additional year of ramp-up to operational efficiency. It should provide rationale for a 3 year commission, construction, and ramp-up time. In addition, the company should demonstrate sufficient storage should a treatment plant take 5-6 years, similar to other sites (i.e., the Elk valley)” (CIAR 345, PDF p. 3).

[929] Benga addressed its decision on whether to implement additional post-saturated backfill zone selenium-treatment processes. It said the decision would be determined by the pilot project that it intends to launch shortly after project approval to test its assumptions and improve its operational knowledge about the saturated backfill zones. Benga identified that a gravel-bed reactor could be implemented on site as an additional selenium-treatment approach. However, it suggested that additional design details for this treatment system are not necessary for the present assessment.

[930] Benga suggested that it could implement an active water treatment plant as a contingency selenium treatment system, if the saturated backfill zone proves inadequate: “As indicated above, a Fluidized Bed Reactor is the likely choice for a contingency water treatment option for selenium” (CIAR 251, Package 5, PDF p. 49). Although Benga assessed an active selenium treatment plant as economically feasible, it indicated throughout the application that it is not currently planning to implement such a plant because it is confident that the saturated backfill zones will achieve an adequate level of selenium treatment. Benga provided us with no details about a potential active water treatment plant at the Grassy Mountain site. Benga stated that it would follow Teck’s lead on implementing a selenium treatment plant, if necessary, and installation times could be much shorter than those required by Teck.

[931] Benga stated that operations would not necessarily need to cease to correct issues with the saturated backfill zones or to install additional treatment systems. Given that the source of selenium would be from the waste rock, suspending operations would not help reduce this issue. Benga indicated it

would monitor water along the flow path of the saturated backfill zones, and it expected that there would be sufficient time to address problems if they arise. Benga indicated any issues would not arise immediately, but would develop over time.

[932] Benga agreed that Teck has spent significant sums of money to date—and is projected to spend hundreds of millions of dollars more—on selenium treatment in the Elk Valley. Benga stated that by managing and treating selenium from the start of the project, it would effectively avoid spending such large sums of money to resolve selenium issues.

[933] We do not have confidence in Benga’s claim that its proposed saturated backfill zones will decrease effluent selenium concentrations to less than 15 µg/L at Grassy Mountain, nor that Benga’s planned pilot studies support this claim. It is possible that some combination of saturated backfill zones and additional selenium treatment measures can achieve these targeted effluent concentrations. But Benga has not presented evidence about these other treatment systems to support this suggestion.

Benga has not adequately explained the operational aspects of its saturated backfill zones

[934] With limited information to draw upon for guidance, Benga needed to demonstrate that it understood the characteristics of a saturated backfill zone well enough to design and operate it so that it would function as intended. This was especially important because the scale of the saturated backfill zones proposed at Grassy Mountain, once built, would preclude any significant modifications and corrections.

[935] Since its initial description of its proposed saturated backfill zones, Benga has provided more details to flesh out its understanding of their design, construction and operation. Benga proposed to derive specific engineering design, construction, and operational criteria from a pilot-scale trial in the future. This would potentially have been an acceptable approach if Benga had demonstrated a thorough understanding of these treatment systems. Without such an understanding, the pilot-scale trial would be an experiment that might not yield all the information necessary to design and operate a full-scale saturated backfill zone. Benga also did not provide details of its plan for the pilot-scale trial. We are not satisfied that Benga’s pilot-scale trial would provide all the information Benga needs to construct an effective saturated backfill zone.

[936] While a pilot-scale trial would provide some site-specific information, it would not likely address the operational issues discussed below. Such issues are more likely to become apparent in a saturated backfill zone operating at full scale. Further, a pilot-scale test would require production of waste rock through mining and associated ongoing leaching of high-selenium water. If the pilot identified the need for additional treatment, such as an active selenium treatment plant, this would take several years to design, procure, construct, and implement. Overall, Benga proposed a pilot-scale trial that represents a “learn as we go” approach, which we view as inappropriate given the sensitivity of the receiving environment. Consequently, we are not confident that Benga’s mitigation measures will avoid significant adverse effects.

[937] Some key operational considerations that require clear understanding and engineering resolution include the flow of water and retention time within the saturated backfill zone system, isolation of contact water within the saturated backfill zone, maintenance of the suboxic reducing conditions, and management of biofouling.

Water flow and retention time within the saturated backfill zones

[938] Benga presented overviews and cross-sections of the three saturated backfill zones indicating that their combined volume will be greater than 10 million m³. As each new saturated backfill zone became available, Benga would pump mine water to the highest saturated backfill zone and allow gravity to draw it through the saturated backfill zones, eventually collecting the effluent water from the lowest of the three (the first to be constructed). Benga suggested the following design and operating characteristics for the saturated backfill zones:

- Residence times for water in the saturated backfill zones would be targeted to exceed one year, to achieve passive selenium removal.
- Shorter residence times (less than one year) could be offset by providing more aggressive oxygen removal, which could be accomplished by adding more carbon sources.
- Construction of all saturated backfills would include in situ performance monitoring (i.e., groundwater wells) and the ability to inject reactive carbon forms directly into the saturated backfill zone.
- Repeated additions of carbon would be possible to maintain suboxic conditions in backfills with low residence times.

[939] Benga stated that it would not direct water into a saturated backfill zone at one end of the system and allow it to passively flow through the system to the other end. However, Benga did not explain how (or whether) it plans to control water flow through the saturated backfill zones. Benga indicated that at the end of mining, horizontal drainage wells will be drilled at an elevation of 1700 m to direct the water from the final saturated backfill zone (SZ1700) into the first saturated backfill zone (SZ1465).

[940] Benga submitted a diagram with arrows illustrating the direction of subsurface flow, but did not explain the forces or processes (such as elevation gradients) that will drive flow, except for the existence of a dewatering well. Benga planned to cease pumping from this well after mine closure, at which time the water level inside the saturated backfill zone will rise to a portal at an elevation of 1468 m. Altogether, the three separate saturated backfill zones, internal dikes, horizontal wells, and dewatering well represent the entirety of the design on record, which purported to control water flow within the system.

[941] The Livingstone Landowners Group's expert, Dr. McKenna, suggested that some design elements of the saturated backfill zone could promote short-circuiting (i.e., influent water finding new, faster pathways to the end of the system of saturated backfill zones), which would prevent mine water from receiving adequate retention time for full selenium removal. He indicated that rock placement within a saturated backfill zone would favour preferential pathways and that using a single dewatering well in the first saturated backfill zone, SZ1465, would make the system prone to short-circuiting. Benga

expressed an interest in design features that could promote hydraulic control, but did not describe such features in its evidence.

[942] The CPAWS expert, Mr. Bowles, also expressed a concern that short-circuiting could arise in the saturated backfill zones at Grassy Mountain. Where hydraulic retention time is limited because of limited space for treatment to occur, it is important to carefully manage water flows within a treatment system; otherwise treatment would be incomplete. Benga appears to have assumed that its proposed saturated backfill zone is so large that it will provide a large excess of treatment capacity—more than is necessary to decrease selenium concentrations to less than 15 µg/L—effectively downplaying the importance of retention time and management of flows in saturated backfill zone design. However, Benga did not provide any evidence related to necessary or appropriate sizing of the saturated backfill zones.

[943] Benga stated during the hearing that Teck’s saturated rock fill could accept higher selenium concentrations or loads, but did not provide any evidence to support this statement. Benga’s position appeared to be that it would be sufficient to scale up Teck’s saturated rock fill system and replicate it at Grassy Mountain. However, there is no guarantee that a larger, three-part system that receives much higher influent selenium loadings will behave similarly. If Benga had provided us with a discussion of the similarities and differences between its proposed saturated backfill zone and Teck’s saturated rock fill, including the challenges of scaling up to a larger system, it would have offered some reassurance that Benga understood these challenges and had the ability to tackle them.

Isolation of contact water within the saturated backfill zone

[944] Both Dr. McKenna and the Coalition’s expert, Dr. Fennell, pointed out that faults and fractures in this region, including those beneath the planned saturated backfill zones, as well as underground workings, could convey water in or out of a saturated backfill zone without receiving full treatment. For existing mine workings, Benga suggested that it would plug any portals, but did not provide details on how it would do so. Benga also suggested that if it discovers fractures in the mine pit floor, then it could potentially seal such fractures. We discuss this proposed mitigation measure in a later section of this chapter.

[945] Benga did not discuss the exclusion of non-contact water from the saturated backfill zone. This issue could affect the required residence time (additional water decreases residence time), carbon dose (additional water may dilute carbon concentrations), and additional carbon demand (additional oxygen from non-contact water would consume more methanol).

Maintenance of suboxic reducing zones

[946] Benga did not submit detailed descriptions of how it will maintain appropriate reducing conditions within the saturated backfill zones. Benga stated that the saturated backfill zones will incorporate monitoring wells to monitor internal conditions. But the monitoring objectives lacked specific details, for example: “Frequent monitoring of the influent concentrations of NO₃ and Se [selenium] will be performed so that carbon dosing can be adjusted as needed” (CIAR 251, Package 5, PDF p. 34).

[947] Benga offered unclear statements on how it will manage the addition of carbon (in the form of methanol) to maintain the reducing conditions. Responding to Information Request 5.5, Benga stated that “carbon dosing can be adjusted as needed” (CIAR 251, Package 5, PDF p. 34). During the hearing, Benga

indicated that it will adjust carbon dosing in relation to oxidation-reduction potential, but its statements were general in nature.

[948] Responding to the Coalition, Benga stated that it wants to remove nitrate and selenium from the saturated backfill zones, but avoid mobilizing arsenic, manganese, or other contaminants. It intends to achieve this by the slow and measured addition of methanol to create the appropriate level of oxygen in the saturated backfill zones. However, responding to our question about the control of methanol dosing, Benga stated: “We know that there there’s quite a range of—you know, again, we don’t have to be surgically precise about any of this” (CIAR 881, PDF p. 222). Benga also agreed that it is possible to apply an overdose of methanol, and acknowledged that this could mobilize selenium due to the production of sulphide. Benga has not reconciled these conflicting statements.

[949] Benga acknowledged that the control of carbon addition is a challenge, but did not address the issue in a substantive manner. A large carbon dose from a few sources could lead to biofouling problems, as well as the establishment of undesirable bacteria, such as those that produce sulphide. More diffuse dosing over the large volume of the saturated backfill zones will require multiple injection points, which could pose different challenges. Operating many injection points that receive variable inflow and/or loading rates would increase the uncertainty around flow distribution within the saturated backfill zones. A more substantive discussion of these challenges would have reassured us that Benga is aware of the seriousness of these issues and will give them the attention they deserve.

Biofouling

[950] At the hearing, CPAWS asked Benga whether it was aware of biofouling issues (the growth of bacteria near the carbon injection sites, which “clog up” the system to distribute carbon within a saturated backfill zone) at Teck’s saturated rock fill trial. One of Benga’s expert witnesses, Mr. Day, confirmed that he was aware this has been an issue for Teck. Benga acknowledged that biofouling is a potential risk associated with carbon addition in such a system, as demonstrated in its barrel study. Benga indicated that although it does not have a planned strategy to deal with biofouling, methods are available to control biofouling. Benga expects to control the issue through sound design (such as incorporation of redundant injection points) and maintenance practices, and the costs would be within a margin of error. However, the CPAWS expert, Mr. Bowles, indicated that biofouling can be so problematic that it defies treatment and requires installation of a new well/delivery system.

[951] The limited information on the design and operation of Benga’s proposed saturated backfill zones has left stakeholders concerned, with several asking for additional details or worrying about unfavourable outcomes. What happens if oxygenated groundwater enters the system past the carbon injection points? Will partly treated mine water leak out through fractures and other pathways? Throughout the review process, Benga offered assurances that these elements of the saturated backfill zone design and operation, such as rock placement for hydraulic control, saturated backfill zone sizing, carbon dosing/overdosing, or potential contaminant mobilization, will be worked out later, while re-iterating that the science is well understood and maintaining confidence in its proposed system.

[952] We find that the gap between Benga’s claims of thorough knowledge and the information provided on the record is too great to give us confidence. We would have gained greater confidence from more detailed evidence about Benga’s conceptual design and operational features of the saturated backfill

zones. We are not confident that Benga can design and operate its proposed saturated backfill zones at Grassy Mountain in a manner that achieves the project's targeted outcomes, or that Benga's proposed pilot study would resolve the operational challenges posed by the saturated backfill zones, because Benga's descriptions of the challenges have been vague.

[953] Benga presented an optimistic perspective that it could effectively resolve all operational and design challenges with its saturated backfill zones after project approval. Conversely, Benga could have taken a more conservative approach that acknowledged the challenges. It could have provided us with a comprehensive description of the design and operation of a conceptual model, and how it would manage carbon addition and distribution, flows within the system, and isolation of contact water in the saturated backfill zones until fully treated.

Saturated backfill zone effluent is likely to contain selenite and organic selenium

[954] In Alberta, a provincial guideline for aquatic concentrations of selenium exists to protect fish species in the province. Benga has suggested that the provincial guideline is overly protective. Instead, it has proposed we approve a sulphate-adjusted, SSWQO for selenium in receiving waters downstream of the project, one that Benga suggested will still protect aquatic species health. The proposed guideline, and Benga's selenium risk assessment incorporating this guideline, assumed that all selenium released into the receiving waters following treatment in the saturated backfill zones would be in the oxidized form of selenate. This section evaluates that assumption, and whether the residual selenium exiting the saturated backfill zone may contain other forms of selenium, including the reduced form of selenite or elemental selenium.

[955] Benga made contradictory statements on the question of the form of selenium that it expects to be released from the saturated backfill zones. On the one hand, it stated that selenium treatment in a saturated backfill zone would yield selenite in the effluent. This is corroborated by evidence from the saturated backfill zone operated at Tumbler Ridge (discussed earlier), which showed that incoming selenate was chemically reduced, mainly to selenite. Indeed, the saturated backfill zone process operates by biochemically reducing selenate, providing no opportunity for reduced selenium species to re-oxidize to selenate. On the other hand, during the hearing Benga indicated that selenite was unlikely to be an issue and argued that the majority of selenium discharged by the saturated backfill zones would be in the form of selenate.

[956] Benga has not performed any speciation studies on selenium to determine the form of selenium that would be released from the saturated backfill zones, either in the receiving streams, or as part of on-site tests such as the barrel study. ECCC identified this as a concern because the SSWQO and ecological risk assessment of selenium assumed all selenium released to Blairmore Creek will be in the form of selenate. A baseline selenium speciation study would have revealed the forms of selenium currently present in Blairmore Creek, potentially explaining differences in algal tissue concentrations of selenium in the creek versus the lab (see later sections of this chapter on SSWQOs and the risk assessment) and confirming whether selenite is converted fully to selenate under natural conditions in Blairmore Creek. Selenium speciation from the barrel study would have provided further information on the predominant form of selenium present after treatment using a process similar to that of the saturated backfill zone.

[957] Benga stated that sulphate competes for the uptake of selenate in algae (the base of the aquatic food web), reducing bioaccumulation of selenate at higher trophic levels. However, because sulphate does not compete with the uptake of selenite or organo-selenium species, it would not reduce the rate of bioaccumulation of these forms of selenium at higher trophic levels. Teck experienced such an event at its Elk Valley selenium treatment plant: “Water quality monitoring results from 2016 and 2017 indicated that the facility was removing 95 per cent of the total selenium and 90 per cent of the nitrate from the water. However, biological monitoring results showed elevated concentrations of selenium in the tissues of aquatic organisms collected in Line Creek immediately downstream of the facility. An investigation determined that the treatment process was converting the remaining selenium in water to a form that is more easily accumulated by aquatic organisms” (CIAR 313, PDF, p. 1085).

[958] ECCC noted that following passage through a saturated backfill zone, selenium may be released in the form of selenite, and that transformation back to selenate can be a slow kinetic process. Benga concurred with ECCC’s analysis and in response proposed to construct a cascade from the discharge point of the saturated backfill zones to ensure that oxygen levels in the effluent were compatible with the natural conditions in Blairmore Creek. Although the Tenth Addendum appeared to suggest this cascade would convert selenite to selenate, Benga confirmed in the Eleventh Addendum that the intent of the cascade was to increase the oxidation-reduction potential and levels of dissolved oxygen in the effluent. Benga then suggested that it would implement an advanced oxidation process using hydrogen peroxide or ozone to accelerate the conversion of selenite to selenate, if necessary. ECCC expressed concerns that Benga did not provide any evidence of the efficacy of an aerated cascade combined with advanced oxidation in converting residual selenite to selenate.

[959] This advanced oxidation process is the same process that Teck developed to remove organo-selenium compounds from effluent at its West Line Creek active water treatment plant. Benga confirmed that it first proposed the advanced oxidation process in the Eleventh Addendum, and stated at the hearing: “it really is not our expectation that a unit like that will be necessary ... that’s the primary reason why you didn’t hear about it before” (CIAR 884, PDF p. 21). This contrasts with an earlier statement by Benga: “residual selenium leaving the SBZ [saturated backfill zone] is likely to be substantially comprised of selenite, given the reducing treatment environment of the SBZ” (CIAR 251, Package 5, PDF p. 13).

[960] Benga’s witnesses stated they were not familiar with the specifics of the advanced oxidation process that Teck installed at the West Line Creek operations, and that they had only seen pictures of it. When asked about the cost of the process, Benga responded that it had not costed the advanced oxidation process but “just looking at the size at the complexity of the unit that was installed at West Line Creek ... it’s going to be in the contingency factor of the cost estimate” (CIAR 884, PDF p. 23). We are uncertain whether this estimate is based on any information more substantive than photographs that Benga reviewed from West Line Creek.

[961] Benga submitted a Teck presentation on its selenium treatment results shortly before the hearing, which included a figure apparently illustrating results for the advanced oxidation process at West Line Creek (Figure 13-3). The figure did not have a legend, and Benga provided no explanation of the results, but given that Benga suggested the advanced oxidation process successfully converts other forms of selenium into selenate, we can assume that the bars on the right represent an increase in selenate. If so, we

note that the figure appears to indicate that a mix of selenium species remained in the effluent, even after Teck applied the advanced oxidation process.

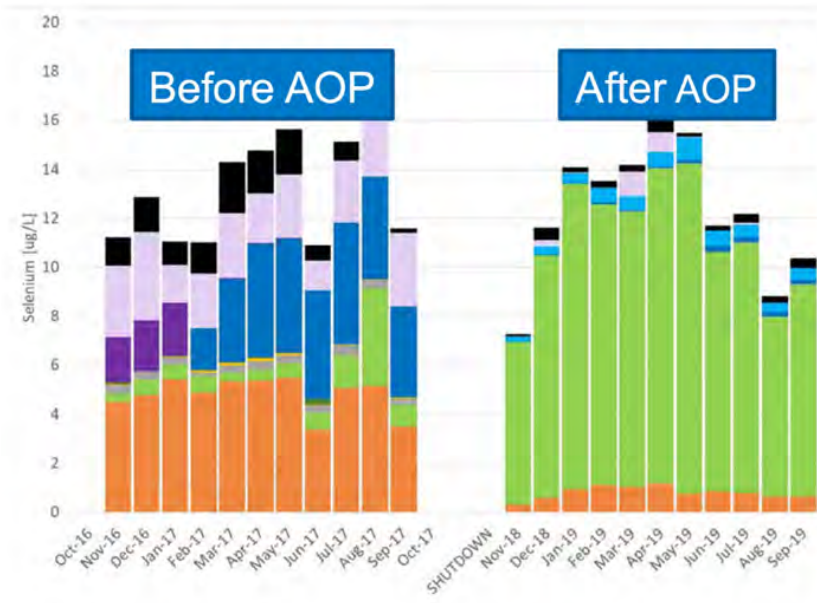


Figure 13-3. Selenium species remaining in effluent after application of an advanced oxidation process (AOP), in a presentation slide supplied by Teck Resources. Source: CIAR 503, PDF p. 65.

[962] Benga's proposed SSWQO and selenium risk assessment assumed that all selenium released into Blairmore Creek would be in the form of selenate. The presence of selenite and organo-selenium species would affect this SSWQO, because those forms of selenium would not face competition from sulphates for uptake into algal tissues, and then the food chain. The presence of selenite and organo-selenium species would also affect the risk assessment, because we would expect to see a higher rate of bioaccumulation of selenium in algae, which in turn results in higher selenium concentrations in invertebrates and fish through dietary processes.

[963] Adopting a precautionary approach, and in the absence of speciation data for selenium, we must assume that saturated backfill zone effluent will contain at least some selenite and potentially some organic selenium. Benga has acknowledged this possibility and indicated that if selenite is present it will implement an advanced oxidation process as additional post-saturated backfill zone treatment. However, Benga provided almost no details about this process to support its efficacy claims. Benga provided no plans for target effluent concentrations or removal rates for the advanced oxidation process, or indicated what monitoring results would trigger its implementation. This increases the risk that the advanced oxidation process proposed by Benga will not decrease selenite and organic selenium sufficiently. Rather, it would lead to higher selenium bioaccumulation in organisms downstream in Blairmore Creek. This in turn directly affects Benga's proposed site-specific selenium objective and the selenium risk assessment, both of which assumed all selenium leaving the site would be in the form of selenate.

Concentrations of other potential contaminants were predicted to increase, and the predictions were not conservative

[964] Other contaminants of potential concern besides selenium might also negatively impact water quality downstream of the project. Benga provided two sets of predicted concentrations of contaminants of potential concern in receiving water bodies. It produced the first set using water and load-balance model runs for three scenarios: a base case using average hydrological conditions and base-case source terms; a stochastic model run using 1000 runs to sample the range of flows that result from annual variability; and a worst case using upper-limit source terms with average hydrological conditions.

[965] This modelling included the assumption that a metals treatment plant would be in operation. However, Benga subsequently indicated it only intended to build such a plant if monitoring eventually demonstrated it to be necessary. In the Eleventh Addendum, Benga produced a second set of predictions using synthetic monthly hydrographs, developed from the hydrological record with climate changes incorporated, to predict mean monthly concentrations in Blairmore and Gold Creeks.

[966] In the first set of modelling results, 39 water quality variables, including metals, major nutrients (ammonia, nitrite, nitrate, and phosphorus), and major ions (calcium, magnesium, potassium, sodium, chloride, and sulphate), were modelled. Of the 39 variables, 21 have published Alberta water quality guidelines. Benga stated that predicted concentrations of all 21 regulated water quality variables during the construction, operation, closure and post-closure periods of the project fell within published Alberta guidelines (or, in the case of selenium, within its proposed site-specific objective) in Gold Creek. Benga concluded that in Blairmore Creek, predicted concentrations of all variables except sulphate fell within Alberta guidelines or the proposed selenium objective.

[967] Benga indicated that some metals (e.g., cobalt and cadmium) have the potential to occur in the discharge of the saturated backfill zones at levels above water quality guidelines. Benga stated that monitoring of the discharge from the saturated backfill zones during operations would determine whether water treatment is required and the timing of such treatment. In the event treatment is required, Benga would construct a water treatment facility to ensure that any direct discharge of saturated backfill zone effluent to the receiving creeks meets provincial and federal guidelines.

[968] The second set of modelling results were “significantly more variable” than had been previously calculated based on annual average flows. Benga noted that mean monthly selenium levels in Blairmore Creek peaked at approximately 9 µg/L, which was higher than the annual average of 7 µg/L. Benga did not discuss results for other contaminants of potential concern in the Eleventh Addendum. However, in its final argument, Benga recognized that the modelling results in the Eleventh Addendum predict that the Alberta guidelines for chromium, cobalt, ammonia, and nitrate² would be exceeded in Blairmore and Gold Creeks, and that predicted phosphorus concentrations would exceed the Canadian environmental quality trigger value.

² This should be nitrite, not nitrate. Benga referenced the transcript (CIAR 884, PDF p. 210) for this statement. The transcript is in error.

[969] The Livingstone Landowners Group noted that Benga's approach does not adequately address contaminants of concern other than selenium. For example, there is a potential for mobilization of arsenic in saturated backfill zones. The group noted that Benga stated at the hearing that it did not consider this a significant issue, but it does not have the data to support such an assertion. The group also described how Benga acknowledged that Teck's saturated rock fill was associated with important uncertainties regarding the mobilization of metals. The group stated that Benga's own expert had advised Benga to provide a post-treatment mechanism for saturated backfill zone effluent because he could not categorically state that arsenic, manganese, and iron would not be mobilized in the saturated backfill zones.

[970] CPAWS stated that Benga's plan includes exceedances of the Alberta water quality guidelines for chromium, cobalt, ammonia, and nitrate in Blairmore and Gold Creeks, and for selenium, arsenic, cadmium, cobalt, copper, nickel, and zinc in the end-pit lake. CPAWS indicated that Benga disregarded those exceedances as the product of "conservative analyses." CPAWS noted that considering conservative results unimportant for planning purposes defeats the purpose of a conservative analysis. They suggested that we should conclude that Benga failed to take an appropriately conservative approach to this issue.

[971] We asked Benga a three-part question about non-selenium contaminants of potential concern during the hearing. First, how confident was Benga that the combined contaminants of potential concern (ammonia, nitrite, chromium, cobalt, and phosphorus) predicted to exceed water quality guidelines would not result in significant adverse effects on the aquatic environment, particularly westslope cutthroat trout? Second, how confident was Benga that predicted concentrations of contaminants of potential concern in the end-pit lake would not result in significant adverse effects on aquatic life? Third, given the uncertainties associated with the predicted concentrations, and the potential consequences to westslope cutthroat trout, would Benga deploy treatment from the beginning for the additional contaminants of potential concern predicted to exceed guidelines?

[972] Benga's response did not fully address our questions. First, Benga focused on ammonia and explained that it used an "overly conservative" estimate of source ammonia concentrations in its modelling. It noted that after re-modelling provided in Undertaking 18 (CIAR 856), it did not consider ammonia a contaminant of concern. Benga stated that, with respect to other metals, "exceedances are an artifact of quite conservative analyses," such as conservative source terms (CIAR 884, PDF p. 212). Benga stated that "with the conservatism, and given the nature of the exceedances, we consider at this point that it may be unlikely, or at least it's not certain, that we'll require a metals treatment plant" (CIAR 884, PDF p. 213).

[973] We discuss Benga's predicted exceedances of water quality guidelines for ammonia, nitrite, chromium, cobalt, and phosphorus in Blairmore Creek below.

Ammonia

[974] Benga stated that it does not expect ammonia (NH₃) to be a concern and that it would instead focus on nitrate treatment. Benga's final argument regarding ammonia referenced Undertaking 18, which presented re-modelling of ammonia due to what was described as a "mis-step" in the original modelling. Benga's new modelling was based in part on data from analogous coal mines that indicate that most ammonia in contact water is converted to nitrate over time before the water reaches the point of release. The new modelling assumed that 2 per cent of all nitrogen from residual explosives would be ammonia

once discharged to Blairmore Creek. The revised model predicted that ammonium (NH_4^+) concentrations in Blairmore Creek would be below 1 mg/L. Benga noted that the results did not include any attenuation of ammonia in the saturated backfill zones.

[975] Benga did not appear to predict total (NH_3 and NH_4^+) or un-ionized (NH_3) ammonia concentrations. Un-ionized ammonia is a toxic form and would predominate at median pH conditions in Blairmore Creek of 8.1 to 8.5. Ammonium (NH_4^+) is a relatively non-toxic form and predominates in acidic conditions. Labelling of predicted ammonia-nitrogen concentrations as NH_4^+ only, as opposed to total ammonia, in CIAR 856 may be an error although we cannot be certain of this. If it is in fact ammonium only that Benga modelled, this would represent a likely underprediction of total ammonia concentrations in Blairmore Creek.

[976] The Alberta ammonia guideline for the predicted pH and temperature conditions in Blairmore Creek varies seasonally. If the revised predicted ammonia concentrations are considered to be total ammonia rather than NH_4^+ , seasonal exceedances of temperature/pH-adjusted guidelines would occur until the post-closure period, as indicated in Table 13-3. The first column of the table identifies the specific reference for each row of information.

Table 13-3. Ammonia guidelines for conditions in Blairmore Creek

	Spring	Summer	Fall	Winter
Median baseline pH (CIAR 42, CR 5, PDF p. 44)	8.49	8.08	8.3	8.46
Median baseline temperature (°C) (CIAR 42, CR 5, PDF p. 44)	4.88	12	7.3	0.8
Predicted temperature (°C) (CIAR 313, Table 6.15-1, PDF p. 199)	5.28–5.78	12.2–13.9	6.7–10.6	2.0–2.5
Total ammonia guideline at baseline temperature/pH combination (mg/L) (<i>Alberta Water Quality Guidelines</i> Table 1.2, p. 39) ^a	0.412	0.588	0.551	0.567
Total ammonia guideline at predicted temperature/pH combination (<i>Alberta Water Quality Guidelines</i> , Table 1.2, p. 39) ^a	0.382–0.412	0.634–0.736	0.406–0.551	0.483–0.523
Predicted mean monthly ammonia concentrations (mg/L) (estimated from CIAR 856, Figure 3, PDF p. 4) ^b	2021–2030 ~0.1–0.6	2031–2043 ~0.1–1.0	2043–2055 ~0.1–0.5	2055–2100 <0.1

^a Values expressed as total ammonia-N ($\text{NH}_3 + \text{NH}_4^+ - \text{N}$).

^b CIAR 856 labelled as “Ammonia-N”. Assumed to mean total ammonia-N ($\text{NH}_3 + \text{NH}_4^+ - \text{N}$).

Sources: CIAR 42, CR 5; CIAR 313; CIAR 856, Undertaking 18a; and *Alberta Water Quality Guidelines* (2018).

[977] We find that while the updated modelling of ammonia concentrations predicts much lower concentrations in Blairmore Creek, mitigation of ammonia concentrations during operations would still be an issue. Benga stated that the proposed cascade following saturated backfill zone treatment would help convert residual nitrogen from ammonia to nitrate, but it did not submit any detailed designs for this measure or its efficacy.

Nitrite

[978] Benga presented its predicted mean monthly nitrite concentrations in Blairmore Creek in a series of Figures in the Eleventh Addendum, Appendix 6.25-1. We estimate the actual values from these figures. Nitrite values ranged from about 0.001 to about 0.023 mg/L, reflecting a 20-fold increase as a result of the project compared with baseline conditions.

[979] The toxicity of nitrite to aquatic life is influenced by chloride concentrations, as reflected by the Alberta nitrite guideline for the protection of aquatic life. Baseline chloride concentrations in Blairmore Creek ranged from 0.14 to 1.9 mg/L. Benga's predicted that chloride concentrations in Blairmore Creek ranged from less than 0.5 to greater than 3.5 mg/L with a plateau after year 25 ranging from 1.5 to greater than 3.5 mg/L. Benga did not present the model assumptions that resulted in a decrease in chloride concentrations relative to the upper range of baseline.

[980] At chloride concentrations below 2 mg/L, the Alberta nitrite guideline for the protection of aquatic life is 0.02 mg/L (30-day average) with a maximum concentration of 0.06 mg/L (*Alberta Water Quality Guidelines 2018*). At chloride concentrations between 2 and 4 mg/L, the guideline for nitrite is 0.04 mg/L (30-day average), with a maximum of 0.12 mg/L. Benga predicted nitrite concentrations would be slightly above the guideline from about year 18 to year 23. This guideline applies when chloride concentrations are less than 2 mg/L. Benga did not discuss the potential effects of nitrite on aquatic life in Blairmore Creek.

[981] We have concerns about Benga's predicted nitrite concentrations. Benga did not provide clear evidence to support the conservatism of its nitrite modelling, but stated that experience at "analogous" coal mines indicated that "most ammonia is converted to nitrate before the water is treated and reaches the point of release" (CIAR 856, PDF pp. 1–2). Nitrite would be an intermediate step in this conversion. Benga did not define the time period required for conversion of nitrite to nitrate.

Chromium and cobalt

[982] Benga predicted that mean monthly chromium concentrations would exceed the Alberta water quality guideline of 1 µg/L for hexavalent chromium (the form most likely to occur in a well-oxygenated environment such as Blairmore Creek) about 31 times between model years 40 and 80. The exceedances were marginal, but chronic. The Alberta guideline for trivalent chromium (which may be present in the immediate vicinity of the discharge to Blairmore Creek due to reducing conditions in the saturated backfill) is 8.9 µg/L. None of the predicted concentrations exceeded the guideline for trivalent chromium.

[983] The Alberta guideline for chronic cobalt at a predicted hardness of 340 to 365 mg/L is 1.7 µg/L, and at a predicted hardness of 370 to 375 mg/L the cobalt guideline is 1.8 µg/L (*Alberta Water Quality Guidelines 2018*, Table 1.3). Benga's mean monthly predicted cobalt concentrations of 1.3 to 1.7 µg/L were below or equal to the lower of these two guidelines.

[984] Benga did not assess these revised chromium exceedances in terms of potential to adversely affect aquatic species, including westslope cutthroat trout. However, Benga assessed the original predicted cobalt concentrations in Blairmore Creek (1.7 to 2.3 µg/L) in the context of a cobalt biotic ligand model, which accounts for water chemistry factors beyond hardness that influence cobalt bioavailability and toxicity. Benga derived a conservative cobalt benchmark of 2.7 µg/L using predicted

dissolved organic carbon, pH, and alkalinity, all of which affect cobalt bioavailability. Benga concluded that the likelihood of cobalt-related toxicity to aquatic organisms in Blairmore Creek was negligible.

Phosphorus

[985] Benga presented its predicted mean monthly total phosphorus concentrations in Blairmore Creek in the Eleventh Addendum. The results ranged from less than 5 to 23 µg/L from year 20 to 80. Benga indicated that phosphorus increases in Blairmore Creek would be minimal, and while they would increase productivity slightly, Benga predicted they would not trigger a shift in trophic status in the stream from the current baseline status of “oligotrophic.”

[986] The *Alberta Water Quality Guidelines* state that “for surface waters not covered by specific guidelines, nitrogen (total) and phosphorus concentrations should be maintained so as to prevent detrimental changes to algal and aquatic plant communities, aquatic biodiversity, oxygen levels, and recreational quality. Where priorities warrant, develop site-specific nutrient objectives and management plans.” Benga did not provide any additional assessment of predicted phosphorus concentrations in Blairmore Creek during the hearing, nor in its final argument.

[987] The effect of the predicted increase in phosphorus concentrations in Blairmore Creek may result in a shift from oligotrophic to mesotrophic status because concentrations would be above the trigger values defining oligotrophic status set out in *Phosphorus: Canadian Guidance Framework for the Management of Freshwater Systems* (Canadian Council of Ministers of the Environment 2004). This guidance states that if the increase from baseline phosphorus concentrations is greater than 50 per cent, the risk of observable effects is high. We note that median seasonal baseline phosphorus concentrations in Blairmore Creek range from 5 to 11 µg/L. Benga’s predicted seasonal phosphorus concentrations in this stream frequently exceeded 150 per cent of baseline. We also note that if nitrogen is the key limiting nutrient in a stream, then increases in phosphorus may not pose as high a risk of causing observable effects. However, Benga did not provide evidence regarding the role of limiting nutrients, nor the predicted ratios of nitrogen to phosphorus in Blairmore Creek.

[988] It is not clear how a shift to a mesotrophic status in Blairmore Creek would affect westslope cutthroat trout. However, oligotrophic systems are known to provide the highest-quality habitat for westslope cutthroat trout, and as the trophic status shifts to more productive systems, overall habitat suitability could be reduced.

[989] Increases in nutrients may result in changes in the algal community (biomass and composition). This may in turn result in differing selenium uptake rates, changes in the invertebrates that feed on algae, and ultimately changes in the fish populations that feed on invertebrates. Benga did not provide a detailed examination of the trophic cascade or food-web effects of changes in nutrient concentrations. We discuss Benga’s approach to assessing uptake from water to algae and subsequent food-web transfer later in this chapter.

Calcite

[990] Benga stated that increases in hardness affect not only the toxicity of cobalt, selenium, and sulphate, but also the formation of calcite deposits in Blairmore Creek. Calcite deposition, which alters and degrades fish habitat, occurs naturally in environments with naturally high hardness, such as those in

the LSA. The Métis Nation of Alberta – Region 3 raised the issue of calcite deposition in spawning areas and other non-depositional zones, and requested that baseline calcite deposition information be provided.

[991] Benga included calcite as one of the parameters that may not meet approved project-related water quality limits. It then made the following commitments:

[992] In the event that water quality parameters, including those for metals or calcite, exiting the saturated backfill zone were found to not meet approved project-related water quality limits, Benga would ensure any off-specification water would be managed accordingly. This could include redirecting the water to the raw water pond or recirculating it back to the saturated backfill zone or a gravel-bed reactor for additional treatment. In the event that monitoring trends indicated additional mechanical treatment for specific water quality parameters were required, Benga would construct the appropriate water treatment plant.

[993] Benga developed a calcite-monitoring approach to document the extent of calcite deposition and the degree to which deposition has occurred, and to characterize the calcite depositions in Blairmore and Gold Creeks.

[994] Benga would construct a cascade from the discharge point of the saturated backfill zone that would promote off-gassing of carbon dioxide and atmospheric equilibration and reduce the volume of calcite precipitates.

[995] Hardness can become a toxicity issue itself through the creation of osmotic stress in aquatic organisms. However, the evidence presented by Benga does not indicate that the predicted hardness (which is about 370 mg/L in Blairmore Creek) would be an issue. We discuss the potential impacts of calcite deposition on westslope cutthroat trout and their habitat in more detail in the chapter on fish and aquatic habitat.

Benga's modelling of concentrations of contaminants of potential concern is not reliably conservative

[996] We do not accept Benga's claim that it followed a conservative approach to modelling the potential impacts of the project on water quality for non-selenium contaminants. Our concerns with Benga's modelling include

- Benga's "worst case" modelling scenario only used worst-case assumptions for source terms;
- it developed these "worst case" and "upper case" source terms on the basis of humidity cell tests which did not include tests on Fernie Formation materials and only considered situations where the pH would be 7 or 8; and
- Benga used non-conservative and overly optimistic assumptions in its modelling of contact-water capture efficiency.

[997] Benga did not provide sensitivity runs for non-selenium contaminants of potential concern, which would have allowed us to understand the sensitivity of the modelling results to different assumptions.

[998] Benga presented modelling results in its original application that assumed the use of a metals treatment plant for treatment of the water leaving the saturated backfill zone. In the EIA, it wrote: “Early iterations of this modelling effort indicated that water in the saturated zones would require treatment for removal of some metals prior to release to the environment. This will be confirmed by on-site monitoring but at this point is expected to be required” (CIAR 42, Appendix 10, PDF p. 234). “The extent of the model mitigation measures were developed over multiple iterations of modelling efforts. Mitigation strategies and assumed parameters were adjusted in the model to achieve the modelling performance objectives in the downstream environment. For example, the previous round of water quality predictions (SRK 2015) indicated that ARD related metals in the [saturated backfill zone] discharge would remain problematic to downstream water quality without additional treatment. As a result, a Water Treatment Plant (WTP) was included as a mitigation measure in the current model” (CIAR 42, Appendix 10, PDF p. 232).

[999] These statements indicate that Benga could only achieve the modelled concentrations of the non-selenium contaminants by assuming the use of a metals treatment plant. This implies that, without the use of such a plant, predicted concentrations of these contaminants might be higher than Benga presented in its modelling. Benga’s expert witness, Mr. Jensen, echoed this concern when questioned about potential arsenic mobilization at the hearing:

“...the one thing we are, let’s say, unsure about and we want to test through on-site testing is this potential for—you know, we do see reductive dissolution of not just arsenic but manganese and iron. Those are typically the ones we’re worried about. So one thing we specifically want to look at through that ongoing test work is to what extent we might see manganese, iron, arsenic, and—and potentially other constituents be released as part of that process. So it’s one reason we did propose—I did advise Benga to plan for—for post treatment of [saturated backfill zone] effluent is precisely for that reason, because we can’t categorically say that this won’t be an issue, and so we wanted to have mitigation in place to accommodate that” (CIAR 881, PDF p. 86).

[1000] Benga indicated that it would run a pilot study, while mine construction is underway, to better understand and quantify metal leaching and the effectiveness of the saturated backfill approach. Benga also indicated that it would not install a metals treatment plant unless levels of contaminants of potential concern became elevated and were detected by its water monitoring system during mine operation. And it stated that discharge monitoring would confirm whether such a plant was necessary.

[1001] We asked Benga about what threshold of arsenic or other contaminants would trigger the building of a metals treatment plant, to which its expert responded:

“... I don’t have a specific answer to what would trigger a specific number. Again, we—we think that a pilot-scale test on-site at a—at a scale that is significant is necessary to, you know, have a better handle on—on this. We—we would monitor. We would expect that any indications of arsenic or—other metals of concern that would need treatment would develop gradually. Basically these—these issues arise from the gradual deposit of waste rock external to the pit and subsequently to water percolating through those waste rock dumps. So that volume of water and, more importantly, the amount of elements or chemicals that would leach out of the rock is going to develop gradually with the project. So our expectation is that monitoring the trends would

provide a significant—sufficient advanced warning of the need to implement a metals treatment plant. But I—it’s difficult to provide an exact number as a—as a trigger point.” (CIAR 881, PDF p. 94).

[1002] In summary, Benga provided modelling results for non-selenium contaminants that assumed the operation of a metals treatment plant. Despite that, the predicted concentrations of some contaminants exceeded guidelines. However, Benga later stated that it would not construct a metals treatment plant until monitoring revealed that levels of metals and other contaminants become elevated. The modelled metal concentrations are therefore not conservative, and we do not have confidence in Benga’s results.

[1003] We find that predicted concentrations of several contaminants of potential concern in Blairmore Creek exceeded water quality guidelines for the protection of aquatic life and that Benga’s assessment of these exceedances was not thorough. Furthermore, Benga used assumptions in the modelling that were not reliably conservative. Benga’s assessment of the residual adverse effects of non-selenium contaminants of potential concern did not represent a precautionary approach, and we do not have confidence in these results.

Surface water contamination may be underestimated in sedimentation ponds

[1004] Benga identified the waste rock dumps as the major source of selenium enrichment and other contaminants of potential concern associated with the project. This section examines potential surface water quality contamination from other sources that may report to the sedimentation ponds, and then contribute to impacts on Blairmore and Gold Creeks.

[1005] Benga indicated that it expects that surface runoff water from mining areas, or groundwater pumped from the mine pit, would not contain elevated selenium concentrations. The on-site water management system would therefore direct this water to either sedimentation ponds (for eventual release to either Blairmore or Gold Creek) or the raw water pond (for use in coal cleaning). Benga suggested that if monitoring of the sedimentation ponds showed this water required additional treatment, it would divert this water to the saturated backfill zones. Benga also indicated that it would only infrequently monitor for selenium in these ponds.

[1006] The Livingstone Landowners Group’s expert, Dr. McKenna, suggested that the mine pit could generate leachate water (water that has come into contact with mine waste or pit walls) with elevated levels of selenium, nitrate, salts, and metals. We note that the waste rock and pit walls are composed of the same material and both will be exposed to similar conditions.

[1007] Benga indicated that selenium enrichment for water in contact with pit walls would be much less than water in contact with waste rock. Benga’s assessment of groundwater quality indicated that the potential exists for elevated selenium concentrations to be present. Selenium concentrations in groundwater ranged from less than 0.4 µg/L to 5.30 µg/L, with 13 of the 29 samples exceeding the Alberta selenium water quality alert concentration of 1 µg/L, and 7 of the 29 samples exceeding the Alberta selenium guideline concentration of 2 µg/L. Benga developed groundwater quality source terms for water quality modelling based on groundwater data, but for those contaminants (including ammonia and phosphorus), with no available groundwater data, it assumed concentrations of 0 mg/L for modelling purposes.

[1008] Benga also did not provide any evidence with respect to concentrations of other contaminants of potential concern in the sedimentation ponds, including those predicted to exceed water quality guidelines in Blairmore Creek. While Benga proposed that sedimentation pond water could be diverted to the saturated backfill zones for further treatment if it does not meet release criteria, this was proposed as a contingency measure only. Implementing it as a permanent mitigation measure would take four to six months. Benga indicated that if a more rapid response were required, a mobile diesel pump could be procured and kept on site, allowing a response within a day or two.

[1009] Benga proposed to use the raw water pond water for road dust watering, and suggested the required volume could be up to 60 million L (60 000 m³) per year. This water would contain elevated levels of parameters of concern associated with waste rock runoff, including selenium, because it will receive contact water from the southeast surge pond and the south rock disposal area. Benga did not explain how it would manage runoff from road dust watering on site. But in its final reply argument, Benga indicated that water for road dust control could be drawn from other locations, such as pit dewatering sumps, if water quality issues were a concern.

[1010] While we agree that the highest levels of selenium from the project would likely be found in contact water from the waste rock dumps, we find that Benga has not demonstrated that runoff from the mine pit walls and groundwater infiltration into the pit will not also be enriched in selenium, and possibly other parameters of concern. Given that Benga has proposed to divert this water to the sedimentation ponds before releasing it to Blairmore and Gold Creeks, this raises concerns about potential risks to water quality, as this water would not be treated for selenium and Benga would only infrequently monitor it for selenium.

[1011] If selenium became a concern in the sedimentation ponds, Benga suggested that it could divert the sedimentation pond water to the saturated backfill zones for treatment. However, as we discuss in the surface water quantity and flow chapter, Benga indicated that it could use sedimentation pond water from the eastern side of the mine site area to augment flows in Gold Creek during periods of low flow. If the sedimentation pond water is not available for flow augmentation due to elevated selenium levels, then this increases the risks to critical habitat for westslope cutthroat trout in Gold Creek, as discussed in the chapter on fish and aquatic habitat and the chapter on surface water quantity and flow.

The derivation of the proposed site-specific water quality objective for selenium did not incorporate sufficient precaution

[1012] Benga developed an SSWQO, a term that is used interchangeably with “site-specific water quality guideline” for selenium, arguing that the Alberta guideline of 2 µg/L was overly conservative. Alberta based its water quality guideline for selenium on British Columbia’s guideline, with a goal of protecting aquatic life, agricultural use, recreation and aesthetics, drinking water, and industrial water supplies. In both provinces, the guidelines are intended to result in negligible risks of adverse effects on all species and all life stages, over indefinite exposure periods.

[1013] The Alberta guideline states that because all uses of water should be protected, waters should be managed so that, at a minimum, the water quality guideline for the most sensitive use is met. Guidelines for the protection of aquatic life are usually the most stringent because aquatic life is often the most sensitive user of water. The selenium guideline of 2 µg/L is based on the lowest observed effect

concentrations for a number of fish species (the most sensitive use), the effect on which converged at 10 µg/L. Division of this value by an uncertainty factor of 5 yielded the 2 µg/L guideline.

[1014] Alberta adopted British Columbia's alert concentration of 1 µg/L because in some environments, such as wetlands, ponds, and lakes, selenium can bioaccumulate to high levels in aquatic species, as well as piscivorous birds and mammals, at concentrations below the guideline. Benga included the effect of sulphate on selenium uptake from water by algae in its derived SSWQO, as sulphate and selenate compete for the same uptake mechanism in algae, and it expects contact water to show elevated levels of both sulphate and selenium. This resulted in a proposed selenium objective that varied directly with sulphate concentrations (a higher objective when sulphate concentration is higher, and vice versa).

[1015] The provincial and federal governments have established guidance for the development of site-specific objectives or guidelines. The following section provides a brief outline of this guidance as it pertains to the Grassy Mountain project.

Alberta Guidance

[1016] Alberta's *Guidance for Deriving Site-Specific Water Quality Objectives for Alberta Rivers, 2012* states that three management directions are possible:

- **Use protection** identifies ambient limits beyond which water quality should not deteriorate but which allow some further contaminant loading (i.e., some degradation of water quality) within that constraint.
- **Maintain water quality** implies no further degradation of water quality and no increase in overall contaminant loading.
- **Improve water quality** implies reduction of overall contaminant loads such that improvement occurs.

[1017] Benga's derivation of selenium site-specific guidelines appears to align with the first management direction. The Alberta guidance states: "If the management approach is to 'protect uses' while potentially allowing increased contaminant load, then the use-protection guidelines or a more stringent value, may become the SSWQO (target) that dictate allowable loads. A 'use protection' approach does not necessarily mean 'polluting up to' the guidelines: a target may be established that is more stringent than the guideline or ambient limit."

[1018] The Alberta guidance also states: "In surface water quality, an ambient limit is a level or condition beyond which the most sensitive use may not be protected." Ambient limits are generally intended to define a boundary that should not be exceeded because the risk to aquatic ecosystem health and water uses is too high and unacceptable. The most sensitive use of Blairmore Creek is as habitat for westslope cutthroat trout.

Federal guidance

[1019] The Canadian Council of Ministers of the Environment's 2007 guidance (Canadian Council of Ministers of the Environment 2007) presents minimum toxicological data requirements for the derivation of water quality guidelines, and provides guidance for the incorporation of exposure and toxicity-modifying factors. It provides guidance regarding a species at risk as follows: "The protection clause may be invoked if an acceptable single (or, if applicable, geometric mean) no-effect or low-effect level endpoint ... for a species at risk (as defined by COSEWIC) is lower than the proposed guideline (i.e., is

below the 5th percentile intercept to the fitted curve), then that endpoint becomes the recommended guideline value.”

[1020] Benga’s methods do not reference, and its approach did not follow, this guidance, including the guidance for species at risk. Benga stated that, while the conservative approach inherent in the derivation of province- or nation-wide guidelines is appropriate, these guidelines “may be overly protective or not relevant to all water bodies.” Therefore “site-specific water quality objectives may be developed that account for site-specific information and the latest scientific advances” (CIAR 251, Package 5, PDF p. 9). “The site-specific selenium guideline developed by Benga is intended to be a preliminary benchmark for assessing whether modelled selenium concentrations may pose an unacceptable risk to fish, as represented by Westslope Cutthroat trout (WSCT) in Blairmore Creek” (CIAR 251, Package 5, PDF p. 10).

Derivation of the SSWQO

[1021] Benga developed the SSWQO using a lab study of uptake of selenium into two algal and one aquatic plant species under varying selenium and sulphate concentrations. Selenium was added as sodium selenate, as selenate was expected to be the predominant form present in the rivers. As discussed earlier, sulphate does not modify the uptake of other selenium species, such as selenite. The presence of species other than selenate would modify or invalidate the derived SSWQO.

[1022] In the lab study, Benga measured tissue selenium concentrations in the algae and aquatic plant after seven days of exposure to water enriched with varying amounts of selenium and sulphate. It used measurement of selenium concentrations in tissue at the end of the study to derive an “enrichment function” for selenium uptake from water to algae and aquatic plants, which it calculated as the tissue selenium concentration divided by the water selenium concentration. As sulphate concentrations increased, the uptake of selenium into algae at a given selenium concentration decreased, decreasing the enrichment function. Benga plotted the calculated enrichment function against measured sulphate concentrations, to determine the slopes of the resulting figures, and then pooled the slopes to derive the SSWQO for selenium.

[1023] Assuming a sulphate concentration of 529 mg/L for Blairmore Creek (modelled at location BC-07), Benga’s proposed SSWQO for selenium (based on the original formula) would be 10.6 µg/L. This value was calculated using the equation $\text{selenium } (\mu\text{g/L}) = 0.594 \times \text{sulphate } (\text{mg/L})^{0.46}$. During the hearing, Benga revised this to $\text{selenium } (\mu\text{g/L}) = 0.563 \times \text{sulphate } (\text{mg/L})^{0.48}$ due to the discovery of transcription errors in its original submissions. Benga indicated that the changes in the equation did not have a large impact on previously submitted results. We refer below to Benga’s calculations using the original SSWQO.

[1024] Benga used figures showing plots of enrichment function versus sulphate, each containing five data points, to derive the slopes in the equation used to calculate its proposed SSWQO. Each point represented a calculated enrichment function for a given sulphate concentration. Benga agreed that the number of data points in the lab-derived enrichment function was limited. Benga further agreed that the lowest sulphate concentration had a much higher derived enrichment function relative to the other four sulphate concentrations, and this data point would have “high leverage” on the enrichment function—sulphate curve.

[1025] Benga indicated that with lab studies, doses are set ahead of time without a complete understanding of the response of the organisms, and that further lab tests could resolve the lack of data for low sulphate concentrations (i.e., repeat tests with a larger number of dilution series and dose responses). A “high leverage” indicates that the SSWQO formula would be affected strongly if this one data point were removed when deriving the slope or curve of the relationship. Benga further suggested that because it would be operating in a sulphate range of 200 mg/L or more, the lower end of the curve could be ignored and a linear relationship could describe the remaining data points.

[1026] We noted at the hearing that the enrichment function values were all similar at higher sulphate levels (greater than 200 mg/L), which Benga expected to find in Blairmore Creek during mine operations, and questioned the necessity of developing a complicated sulphate-adjusted SSWQO. Benga stated that its SSWQO was conservative and meant more for lentic environments than lotic environments. Benga stated that it had demonstrated a “clear and consistent” relationship between sulphate and selenate uptake. Benga claimed that its derivation of the SSWQO was conservative because it would apply to receiving waters in a lotic environment. It stated that the relationship it derived was a “good foundation” for a sulphate-based selenium objective.

[1027] Benga acknowledged that there are other issues to consider in implementation of its proposed SSWQO, including its practicality under highly variable flows. In this case the selenium objective would change with sulphate concentrations in variable flows. Benga provided examples of water quality guidelines for other substances that depend on another parameter (e.g., metals), but it acknowledged that a guideline with a single value for selenium would be easier to implement.

[1028] We note that the original lab study that produced these results was apparently conducted in 2015 and 2016. Benga had the opportunity to conduct additional studies to better define the relationship between selenium uptake and sulphates, given that this relationship was essential to its proposed SSWQO.

Sulphate and selenium predictions

[1029] Benga originally predicted that concentrations of sulphate would increase in Blairmore Creek from a background concentration of approximately 20 mg/L to greater than 500 mg/L as a result of leaching from waste rock. As both selenium and sulphate were expected to co-occur over the project life, Benga expected that when selenium concentrations were higher, sulphate concentrations would also be higher, and vice versa.

[1030] We note that the relationship between the occurrence of sulphate and selenium may be affected by factors such as pH and reduction of sulphate in a saturated backfill zone. Benga indicated that leaching of selenium and sulphate were only weakly controlled by pH and that the concentrations of these ions were instead related to the volume of waste rock. However, as discussed earlier in the section on contaminant sources, Benga’s humidity cell tests showed that the highest sulphate release was from the most acidic cells (Adanac claystone HC1 and Cadomin conglomerates HC7 and HC8). Sulphate release rates from these three cells were much higher than other results.

[1031] In response to questions at the hearing, Benga indicated that sulphate reduction in the saturated backfill zone is a possibility. Benga’s expert witness, Mr. Jensen, indicated that, in his experience, sulphate concentrations could be reduced by up to 200 mg/L in a saturated backfill zone. In response to

concerns about the reduction of sulphate in the saturated backfill zones, Benga indicated that potential sulphate reductions would be monitored in the pilot study. Benga further indicated that a 20 to 30 per cent decrease in sulphate concentrations later in mining life would still leave sufficient sulphate to ameliorate selenium uptake. If selenium and sulphate release rates become uncoupled, this could have implications for the risk assessment of selenium (discussed later in this chapter). This remains an area of uncertainty.

[1032] Benga predicted no significant adverse effects as a result of predicted increases in selenium concentrations in Blairmore Creek on the basis of the proposed SSWQO for selenium. Benga stated that peak mean monthly selenium concentrations were approximately 9 µg/L, which is higher than the annual average calculation of 7 µg/L but still lower than the proposed SSWQO of 10.6 µg/L. Updated modelling in the Eleventh Addendum predicted mean monthly sulphate concentrations would vary widely. This resulted in wide variations in the SSWQO for selenium, with some predicted mean monthly selenium concentrations exceeding the SSWQO.

[1033] ECCC stated that it had concerns with the process Benga used to derive the SSWQO, as well as the data used in its development. Its concerns included Benga's decision not to include more sensitive toxicity endpoints, to not follow the Canadian Council of Ministers of the Environment 2007 protocol, and to not provide sufficient data to support incorporation of sulphate as a toxicity modifying factor. ECCC stated that the objective may not accurately characterize the risk to receptors from exposure to selenium during and following mine operations because the SSWQO developed by Benga was derived from pre-mining (baseline) conditions.

[1034] ECCC stated that the development of a sulphate-modified selenium guideline went well beyond what was recommended in ECCC's guidance for developing SSWQOs. ECCC further expressed concerns with developing enrichment factors on the basis of selenate alone, and that it would be more comfortable if more selenium speciation information was available, which was absent from the record.

[1035] ECCC emphasized that no jurisdiction in the world currently uses a sulphate-adjusted selenium guideline. While ECCC recognized that such a guideline for selenate is based on sound science, if selenium is present as selenite (the expected form of selenium after saturated backfill zone treatment), sulphate would not compete with the uptake of selenium in aquatic organisms as it does with selenate. That is, for any selenium released to Blairmore Creek as selenite, sulphate levels would not modify its toxicity and the proposed site-specific guideline for selenium would be invalid. On this basis, ECCC recommended that the risk assessment assume selenium is present in the form of selenite or organo-selenium. In its final argument, ECCC stated it continues to hold the opinion that bioaccumulation may be underestimated, which undermines the establishment of a reliable risk-based SSWQO.

[1036] ECCC stated that a selenium guideline of 2 µg/L should be applied to the project given the potential issues with the assumptions Benga made in its food-web modelling, the lack of a demonstrated ability to attenuate 99 per cent of selenium in the saturated backfill zones, and a potential lack of mitigating effects of sulphate on selenium uptake where selenium is present as selenite.

[1037] The Livingstone Landowners Group stated that the proposed guideline currently lacks validation and may be harmful, as it does not address important elements such as selenium speciation. The group indicated that, in its view, the proposed SSWQO for selenium on the basis of sulphate is part of a larger

scientific debate but cannot be considered protective of the environment in part because evidence to support this claim is lacking.

[1038] The Coalition noted that the assumption that sulphate ions will outcompete selenate for uptake into algae does not account for other potential reactions with the sulphate ion, making these sulphate ions unavailable for uptake by algae. The Coalition noted that this potential interference effect was not assessed by Benga. The Coalition further pointed out in its final argument that the long-term chronic guideline for selenium of 2 µg/L is exceeded beginning around year 13. However, even Benga’s sulphate dependent SSWQO is exceeded around year 27 and years 47 to 54.

[1039] CPAWS expressed concerns that a conservative approach to setting selenium limits was discarded when Benga realized that the provincial water quality guideline for selenium of 2 µg/L could not be achieved. CPAWS noted that a risk-tolerant approach was used instead. The Timberwolf Wilderness Society also expressed concerns around reliance upon sulphate for the selenium objective, emphasizing Benga’s use of adaptive management that relies on future monitoring to identify a problem has occurred, when that problem is what was to be prevented.

[1040] Several submissions identified a need for more site-specific data to develop a selenium guideline as opposed to reliance on models. The Ktunaxa Nation raised the issue of the lack of site-specific data to support development of a site-specific selenium objective. They recommended additional monitoring, bench-scale pilot studies, and modelling prior to full-scale implementation. The Timberwolf Wilderness Society requested a comparison of Benga’s project with the nearby Teck Elk Valley mines to consider the applicability of models with more sensitivity analysis to potential issues at Grassy Mountain, along with a review of other coal-mine data.

[1041] Benga repeatedly emphasized ECCC’s statement that “a sulphate-adjusted guideline for selenate is based on sound science.” Benga provided “a range of SSWQOs” approved for other projects and modelled results for Blairmore Creek, and stated that these all support the conclusion that the SSWQO will “adequately” protect aquatic life. Benga’s document describing the derivation of the selenium SSWQO (CIAR 42, CR 5, Appendix A1) made no reference to the Alberta guidance for development of site-specific objectives. Yet the SSWQO was used as the basis for determining the significance of adverse effects of selenium on water quality as well as on westslope cutthroat trout.

[1042] Benga’s SSWQO represents a “pollute up to” approach whereby the SSWQO would be used as a “preliminary benchmark” for indicating whether selenium concentrations pose unacceptable risks to westslope cutthroat trout. Benga stated that the SSWQO would be confirmed through monitoring and if it was shown that selenium was having an adverse effect, mitigation measures would be implemented, including revising the SSWQO downwards. We do not accept Benga’s proposed approach of confirming the SSWQO through monitoring and applying mitigation measures after an effect has been detected for several reasons:

- By the time effects are detected, a large volume of waste rock would exist and mitigation may not be possible.
- As selenium bioaccumulates and therefore persists in aquatic ecosystems, it is unlikely that mitigation and reversal of observed effects would be successful.

- Given the recent decrease in westslope cutthroat density in the Elk River watershed and the after-the-fact efforts Teck has expended to date to address elevated selenium concentrations, this approach is not appropriate for this project.

[1043] The risks associated with the use of a “pollute up to” approach are illustrated by monitoring information from the Elk Valley in British Columbia, where a combination of legacy-related selenium loadings and current loadings from Teck’s operating mines has created selenium concentrations well above the water quality guideline of 2 µg/L. In the upper Fording River (in the Elk River watershed), a decrease in juvenile and adult westslope cutthroat trout density took place in 2019, compared with 2017 data. Selenium concentrations in the upper Fording River from 2014 to 2018 ranged from about 25 to 70 µg/L. Bioaccumulation was also noted in other fish species, with concentrations substantially higher than the provincial guideline for egg/ovary tissue of 11 milligrams per kg (mg/kg) dry weight.

[1044] Benga has demonstrated that selenium toxicity, or more specifically uptake of selenium, may be mitigated by increases in concentrations of sulphate. Based on testimony provided by Benga about the potential for sulphate to be reduced by up to 200 mg/L in the saturated backfill zones, as well as the evidence from Coalition expert witness Dr. Fennell and data published in the paper by Bianchin et al., sulphate concentrations may be decreased in the saturated backfill zones at Grassy Mountain. Such a decrease would diminish the protective effect of sulphate on selenium toxicity. There will be a complex balance between removal rates for sulphate and selenium—and the ameliorative effects of uptake of selenium by sulphate at different concentrations—which will differ by time and location in the receiving environment.

[1045] Benga argued that there is sufficient scientific evidence regarding the influence of sulphate on selenium uptake and that “there is often a lag time for regulations to catch up with the state of the science” (CIAR 251, Package 5, PDF p. 11) and “...the possibility of accounting for sulphate as a mitigating factor for selenate enrichment in algae should be reviewed based on scientific evidence, not only on existing regulation” (CIAR 251, Package 5, PDF p. 12). While there is credible scientific evidence for an influence of sulphate on selenate uptake, this does not negate the argument that the lack of site-specific data, as well as the lack of consideration of the presence of selenite, are critical issues from a scientific as well as a policy perspective.

[1046] In addition to the lack of site-specific data regarding the relationship between sulphate and selenium uptake, there are discrepancies in Benga’s predictions regarding whether predicted selenium concentrations exceed the SSWQO. Updated modelling results presented in Figure 24 in the Eleventh Addendum show mean monthly selenium concentrations exceed monthly site-specific objectives in about year 27 and years 47 to 54. Therefore, even if we were to accept the SSWQO, Benga’s predictions do not support the statement that peak mean monthly selenium concentrations are lower than the proposed SSWQO. Instead, the modelling results indicate prolonged periods when the SSWQO would be exceeded.

[1047] Benga did not adequately support its statement regarding the conservatism it applied in deriving the enrichment function used to develop the SSWQO equation. Benga’s single lab study used relatively few data points and few species, and did not include algae species known to be among the most dominant species in Blairmore Creek. A single data point in all three species tested strongly influenced the best-fit curves from the relationship between the enrichment function and sulphate concentration. To ignore the

results of sulphate concentrations below 200 mg/L (as mentioned by Benga during the hearing, given that Benga predicts the waters downstream to be in the 200 mg/L and higher range for sulphate), would result in a weak relationship between enrichment functions and sulphate concentrations. We do not accept Benga's proposed SSWQO for the following reasons:

- The SSWQO was not derived in the context of any of the three Alberta management approaches to the development of site-specific objectives.
- The SSWQO was based on a water-to-algae enrichment function derived from a single lab study with insufficient data and a high degree of uncertainty in results, including the applicability of results to Blairmore Creek.
- The use of the SSWQO would be logistically challenging to implement due to the dependence on sulphate concentrations, which fluctuate seasonally and over the project life.
- The SSWQO applies only to selenate and not to selenite or organic selenium, which may be present in water following saturated backfill zone treatment.
- The assumption that sulphate release rates are coupled to selenium release rates (that is, higher selenium concentrations are offset by higher sulphate concentrations) has not been proven and may not be valid in all situations (for example, low pH and high acidity situations).
- The SSWQO depends on high levels of sulphate and hardness, which may create issues such as sulphate and/or hardness reaching toxic concentrations, shifts in the composition of invertebrate communities toward species more tolerant of high sulphate conditions and/or hardness, and the formation of calcite under high hardness conditions.

[1048] Benga's proposal to confirm the SSWQO through monitoring and applying mitigation measures after an effect has been detected is unacceptable, given the status of westslope cutthroat trout as a species protected both federally and provincially. As selenium bioaccumulates and therefore persists in aquatic ecosystems, attempting to reverse a problem after it has occurred would be very challenging.

[1049] ECCC has developed draft *Coal Mining Effluent Regulations* that could have implications for this project, when and if implemented. The current draft proposes end-of-pipe (point of discharge) limits for total suspended solids, selenium, and nitrate. For existing mines, the total selenium limit would be a monthly mean of 10 µg/L, while for a new mine (starting operations within three years of the regulations coming into force) the selenium limit would be 5 µg/L, as was discussed in information request 5.8 in the Tenth Addendum. ECCC stated that the Government of Canada has signalled its intent to regulate and has been consulting on the draft regulations for several years. The federal government currently has a goal of bringing the regulations into force in 2021 or 2022. However, ECCC also acknowledged that there is a possibility the regulations may not come into force. Furthermore, the current draft regulations may change before being finalized. We cannot make decisions based on draft regulations, but we note that if these regulations do come into force as currently proposed, the end-of-pipe limit of 5 or 10 µg/L could pose a challenge for Benga, given the project is designed to achieve an end-of-pipe concentration of 15 µg/L for effluent water quality, following treatment in the saturated backfill zones.

Increases in sulphate and hardness may result in adverse impacts on aquatic biota

[1050] Benga relied upon sulphate to reduce the uptake of selenate by algae and, ultimately, bioaccumulation of selenate in westslope cutthroat trout eggs. However, at elevated concentrations, sulphate can be toxic to aquatic biota. Benga's predictions of sulphate concentrations in its original EIA would exceed Alberta's *Environmental Quality Guidelines* for the protection of aquatic life of 429 mg/L in very hard waters (181 to 250 mg/L of hardness). For water in which hardness exceeds 250 mg/L, the Alberta guidelines state that the sulphate guideline should be based on site water.

[1051] Benga carried out a sulphate toxicity study using water from Blairmore Creek amended with sulphate and hardness. The results indicated that the species tested (algae, invertebrates, and rainbow trout [*Oncorhynchus mykiss*]) were able to tolerate sulphate concentrations in excess of 700 mg/L with minimal effects. Benga stated that sulphate concentrations greater than 1,000 mg/L "may not result in adverse effects on sensitive species based on the Elk Valley toxicity studies that are more representative of predicted Blairmore Creek conditions" (CIAR 89, PDF p. 1025).

[1052] We note that the Technical Appendix to the *British Columbia Ambient Water Quality Guidelines* for sulphate reported potential osmotic stress effects on the water flea (*Ceriodaphnia dubia*) test organism at elevated hardness concentrations. Benga's toxicity test results showed that all three test species (the alga *Pseudokirchneriella subcapita*, *C. dubia*, and rainbow trout) were all able to tolerate hardness concentrations of greater than 834 mg/L.

[1053] Benga updated its modelling results in the Eleventh Addendum to predict that mean monthly sulphate concentrations would range from about 400 mg/L to about 1250 mg/L from year 25 to year 80. Benga initially proposed a sulphate toxicity threshold of 593 mg/L based on published toxicity data in the literature. Benga indicated this was a conservative threshold, based on the results of several tests on water with a hardness lower than predicted for Blairmore Creek.

[1054] Predicted mean monthly sulphate concentrations after year 15 were well above published guidelines for sulphate, Benga's derived toxicity threshold, and the most sensitive toxicity endpoints identified in Benga's lab tests. When asked at the hearing about why higher sulphate concentrations were not used in laboratory toxicity tests to reflect modelled predictions, Benga indicated that the high sulphate concentrations were predicted after the trial was completed, but this could be expanded on by further testing. Benga confirmed that the most recent modelling showed sulphate concentrations exceeding maximum concentrations tested in the toxicity tests. Benga acknowledged that the hardness concentrations used in the sulphate toxicity tests were high, and that the tests could be repeated to better reflect the anticipated hardness of Blairmore Creek. Benga went on to state that sulphate concentrations near the end of mine life are important and that close monitoring would be required.

[1055] Benga indicated that it had not witnessed shifts in species assemblage at other mines, and that aquatic biota appear to be quite tolerant of elevated concentrations of sulphate. However, Benga provided the caveat that these observations were for sulphate concentrations below 1000 mg/L, and higher concentrations may result in effects. Benga went on to say that while effects of sulphate on benthic communities are not common, they can happen.

[1056] Benga stated that the sensitive life stages of westslope cutthroat trout occur mainly during higher flows, and therefore lower sulphate concentrations. It added that westslope cutthroat trout are salmonids, which are tolerant of sulphate because they are “built to manage osmotic stress by going to the ocean where it’s ...quite salty” (CIAR 884, PDF p. 51). Benga did not cite evidence in support of its statement regarding salmonid tolerance to sulphate, nor did it support the implied similarity of sulphate to ocean salts.

[1057] Benga was asked about how tightly linked selenium, sulphate, and hardness are and how much leeway there may be in terms of preventing selenium toxicity while not creating sulphate toxicity or calcite formation. Benga replied that sulphate levels of between 300 to 400 mg/L are needed to be protective against selenium uptake. Benga also stated that sulphate and hardness go hand in hand, and if one is reduced then so is the other. Benga acknowledged that additional site-specific information is needed to validate the lab data. It pointed out that, because concentrations are currently low in the natural environment, validation at higher concentrations of sulphate/selenium/hardness will need to wait until mining progresses. Benga suggested one possible solution may be a spiked in situ study. Benga agreed that areas of uncertainties exist about the applicability of SSWQO data to the project area and the use of models of selenium trophic transfer derived from other sites.

[1058] The Timberwolf Wilderness Society raised concerns with Benga’s decision not to incorporate a duration-of-exposure factor in its analysis of the effects of high sulphate concentrations. They stated that exposure to high-sulphate water is likely to be important to such an analysis. They further stated that they are concerned with extremes (peaks) and how this will affect biota in the receiving environment.

[1059] As discussed previously, the site-specific selenium objective relies on sulphate. A higher SSWQO selenium objective is derived at higher sulphate concentrations. Based on predicted selenium concentrations in Blairmore Creek of about 7 µg/L, sulphate concentrations would need to be at least 200 mg/L to result in a derived SSWQO that meets or exceeds predicted concentrations. This represents a significant increase from existing background concentrations of sulphate, which are approximately 20 mg/L.

[1060] If predicted concentrations in Blairmore Creek were at or below endpoints identified in Benga’s sulphate toxicity study, we would have more confidence that risk to aquatic life was low. However, Benga’s predicted sulphate concentrations exceed 1,000 mg/L, accompanied by high hardness. Although high hardness may ameliorate sulphate toxicity, it lessens our confidence that the risk to aquatic life will be low. At a minimum, there may be shifts in aquatic communities toward species adapted to elevated hardness and sulphate concentrations. These species may not be preferred food species of westslope cutthroat trout. Further, Benga has not conducted lab toxicity tests on higher sulphate concentrations, or lower hardness, both of which would reflect predicted concentrations in Blairmore Creek. Increases in hardness not only affect the toxicity of selenium and sulphate, but also the formation of calcite deposits in Blairmore Creek. We discuss issues associated with calcite formation in the fish and aquatic habitat chapter.

[1061] We find there is insufficient evidence to support Benga’s position that elevated sulphate and hardness will not result in adverse impacts on aquatic biota in the receiving environment. Benga’s evidence shows consistent, long-term exceedance of derived no-effects-level concentrations of sulphate.

As with selenium, Benga's proposed approach to gathering additional site-specific information as the project proceeds is not appropriate given the status of westslope cutthroat trout as a species listed in Schedule 1 of *SARA*.

We do not have confidence in Benga's conclusion of negligible risk to westslope cutthroat trout

[1062] Benga and other participants, particularly ECCC, stated that once selenium is in the receiving environment, it enters the food chain through uptake from water to algae that grow on the surfaces of plants and sediments in stream beds. Uptake at higher trophic levels (benthic invertebrates and fish) would be dietary. Bioaccumulation via the food chain is the primary process that could expose sensitive species such as westslope cutthroat trout to elevated selenium, as has been demonstrated at nearby coal mines in the Elk Valley. This bioaccumulation would be highly site-specific. Benga and ECCC each submitted that it is generally recognized that egg-laying fish and birds are most susceptible to selenium toxicity, predominantly through maternal transfer to ovaries and eggs. At elevated concentrations in eggs, selenium may adversely affect the development and survival of larvae.

[1063] ECCC also stated that developmental abnormalities or reproductive failures can occur in fish as well as other egg-laying vertebrates, such as waterbirds and amphibians, when exposed to elevated levels of selenium in water.

[1064] Benga conducted a selenium risk assessment by modelling uptake through the food web (water to algae to invertebrates to westslope cutthroat trout eggs) using a combination of predicted selenium concentrations in Blairmore Creek, lab results for algal uptake of selenium (previously discussed in the SSWQO section), and models from previously published studies for food-chain transfer of selenium to invertebrates and fish. The predicted selenium concentrations in the most sensitive receptor of interest (westslope cutthroat trout egg tissue) were compared to known published effects levels for westslope cutthroat trout.

[1065] The four steps of the risk assessment were as follows:

Step 1 (predicted selenium concentrations)

Benga estimated that selenium concentrations at modelled nodes in Blairmore Creek would increase from background concentrations of less than 1 µg/L to about 7 µg/L after applying treatment to reduce contact-water selenium concentrations and mixing with Blairmore Creek. Benga's updated modelling on a mean monthly basis, with climate changes incorporated, concludes that peak mean monthly selenium levels in Blairmore Creek would be approximately 9 µg/L. Benga also predicted mean monthly sulphate concentrations as high as 1250 mg/L in Blairmore Creek. Because Benga presented these updated modelling results after the selenium risk assessment was conducted, the selenium risk assessment relied on previously predicted selenium and sulphate concentrations of 6.8 µg/L and 529 mg/L, respectively.

Step 2 (uptake of selenium from water to algae)

Benga used data from the Nautilus laboratory study of uptake of selenium from water to algae for multiple linear regression analyses to model selenium concentrations in algae, as a function of selenium and sulphate concentrations in water. Initial modelling assumed a baseline sulphate

concentration of 13 mg/L and a range of selenium concentrations in water. The results were calibrated against measured baseline selenium concentrations in algae collected from Blairmore Creek.

Benga used this model to calculate predicted algal tissue selenium concentrations using modelled water selenium and sulphate concentrations at mine closure for the Blairmore Creek modelling nodes (Figures 7-4 and 7-1 respectively in CIAR 42, Appendix 10, PDF pp. 260–262). At model node BL-03, the background concentrations of selenium and sulphate remain the same as pre-mining as this node is upstream of mine discharges. Predicted selenium concentrations in algae at this site are 5.3 µg/g with a 95 per cent confidence interval of 4.1 to 6.9 µg/g.

At node BC-07, which is downstream of the project release of saturated backfill zone effluent into Blairmore Creek, Benga predicted that selenium and sulphate water concentrations (from CIAR 42, Appendix 10) would be 6.8 µg/L and 529 mg/L, respectively. The predicted selenium concentration in algae was 5.0 µg/g with a 95 per cent confidence interval of 3.7 to 6.8 µg/g, indicating virtually no change from baseline. This is a result of the ameliorating effects of selenium uptake by elevated concentrations of sulphate, which is included in Benga's multi-linear regression model.

Step 3 (transfer of selenium from algae to benthic invertebrates)

Benga used two published regression models to estimate the transfer of selenium from algae to macroinvertebrates. Benga indicated this was necessary because, at the time of completing the risk assessment for selenium, no locally available invertebrate tissue selenium data were available. One of the two models was developed for the Elk Valley using co-located selenium data for algae and benthic macroinvertebrates. The other was from a more recent 2017 publication using co-located selenium data for algae and benthic macroinvertebrates from multiple locations throughout Canada and the U.S.

Using model node BC-07 for illustrative purposes, Benga predicted macroinvertebrate concentrations of selenium based on the predicted algae selenium concentration of 5 µg/g. Utilizing the two models, concentrations in macroinvertebrates were predicted to be 6.4 µg/g and 9.5 µg/g.

Benga stated that models used for algae to macroinvertebrates appear to be conservative because they predict macroinvertebrate selenium concentrations above what were measured from baseline studies (i.e., models predict a greater accumulation of selenium at baseline selenium concentrations than what was observed from site-specific measurements). This comparison is on the basis of three macroinvertebrate samples collected at the project site, with concentrations ranging from 2.6 to 2.7 µg/g dry weight.

Step 4 (transfer of selenium from benthic invertebrates to westslope cutthroat trout eggs)

Benga applied two regression models to estimate selenium concentrations in westslope cutthroat trout egg tissue from predicted benthic macroinvertebrate tissue selenium concentrations. Benga used a model developed for the Elk Valley, and a more recent model developed from data compiled for the Elk Valley and from additional sites in Canada and the U.S. If egg selenium concentrations were not reported in the model, Benga multiplied whole-body selenium concentrations by a factor of 1.96 to obtain an estimate. It based this conversion factor on United States Environmental Protection Agency

data. Benga applied each model to both of the predicted macroinvertebrate concentrations at each modelling node on Blairmore Creek (two invertebrate concentrations per node, five nodes total).

Baseline data for selenium concentrations in eight whole-body samples of brook trout (*Salvelinus fontinalis*) and rainbow trout (which Benga indicated may have been rainbow trout–westslope cutthroat trout hybrids) were available, but egg samples were not taken. Benga used United States Environmental Protection Agency whole body–egg conversion factors of 2.44 for rainbow trout and 1.38 for brook trout to estimate egg selenium concentrations under current conditions ranging from 6.8 to 15.8 µg/g dry weight. Benga’s models for invertebrate–to–westslope cutthroat trout predict concentrations at upstream node BL-03 (which represented background conditions throughout the project life) would range from 11.5 to 20.6 µg/g dry weight. Benga indicated that the results, while not strictly comparable, produced reasonable estimates of trout egg selenium concentrations under baseline conditions. This appears to be intended to demonstrate the applicability of the models used in predicting selenium concentrations in westslope cutthroat trout egg tissue.

Benga again used model node BC-07 as an example, predicting westslope cutthroat trout egg concentrations that range from 11.0 to 20.1 µg/g dry weight. Both egg models for invertebrates to westslope cutthroat trout predicted selenium concentrations in westslope cutthroat trout eggs at downstream model nodes on Blairmore Creek that were slightly lower than predicted concentrations at the upstream model node (BL-03), reflecting the influence of sulphate on trophic-transfer factors and the uptake of selenium in the food web.

The transfer factor (or enrichment function) used for modelling of the critical step of selenium uptake from water-to-algae (step 2 in the risk assessment chain) greatly influences the ultimate estimate of selenium in westslope cutthroat trout eggs. ECCC emphasized this in its hearing submission, stating the uptake of selenium into algae is the rate-limiting step affecting selenium accumulation in an aquatic ecosystem. ECCC noted that, unlike higher trophic levels where uptake is dietary, the uptake of selenium in primary producers (algae) is influenced by the presence of sulphate. The degree of confidence in the water-to-algae enrichment function is therefore critical.

Benga compared predicted selenium concentrations in westslope cutthroat trout eggs to a concentration-response relationship based on one study (CIAR 89, PDF p. 1032), which was used by Golder in support of developing benchmarks for selenium in the Elk Valley. This relationship implies that the egg selenium concentration that results in a 10 per cent effect (EC₁₀) compared with controls is 24.8 µg/g dry weight. Benga’s interpretation of the concentration-response relationship was that its predicted baseline egg selenium concentrations of 11.0 to 20.1 µg/g dry weight at node BC-07 would be associated with predicted effect levels of 0 to 2 per cent.

Application of the SSWQO

[1066] With a predicted sulphate concentration of 529 mg/L at BC-07, the proposed SSWQO for selenium would be 10.6 µg/L. This selenium concentration would result in westslope cutthroat trout egg selenium concentrations of between 13.5 and 22.4 µg/g dry weight, which is below the EC₁₀ value of 24.8 µg/g. On this basis, Benga concluded in its risk assessment that the SSWQO would be protective of westslope cutthroat trout in Blairmore Creek.

[1067] Benga acknowledged some of the limitations in the approach utilized in its selenium risk assessment. Uncertainties include

- applying a unicellular algae model that extrapolated from laboratory uptake studies to algae communities in Blairmore Creek;
- assuming the mean algae selenium concentrations were representative of Blairmore Creek; and,
- assuming regression relationships for invertebrates and westslope cutthroat trout from other sites apply to Blairmore Creek.

[1068] As part of the response to concerns regarding the site-specific risk assessment and guidelines proposed, Benga stated that a conservative approach to risk assessment was taken. Once mining commences, site-specific monitoring data would be evaluated and the proposed site-specific objective would be updated if required.

[1069] Benga described what would be needed to confirm the food chain modelling used to derive the SSWQO, as well as the risk assessment. This included monitoring tissues from algae, benthic invertebrates, perhaps drift invertebrates, and multiple tissues from rainbow trout. Benga suggested that collection of such data would start “right away”—before mining—to get a useful baseline data, and then annually after that. Benga acknowledged that sampling of westslope cutthroat trout fish tissue, including eggs, would prove challenging given the protected status of the westslope cutthroat trout. Benga suggested that it might be able to compare rainbow trout and westslope cutthroat trout fin-clip data and perhaps conduct non-lethal westslope cutthroat trout sampling; however, it was Benga’s opinion that data from rainbow trout would be sufficient. Benga did not assess the feasibility of using rainbow trout as a surrogate species for tissue sampling in westslope cutthroat trout.

[1070] ECCC concluded that Benga’s site-specific risk assessment and the derived water quality objective may not accurately characterize the risk to receptors from exposure to selenium during and following mine operations. ECCC indicated that the uptake of selenium through the food web into reproductive tissues of aquatic species is highly variable; therefore, the rate of selenium uptake must be treated with sophistication when models are used to inform risk assessments and site-specific environmental criteria. ECCC stated that the risk assessment incorporates erroneous assumptions about selenium bioavailability and this mistake is compounded at each step of the risk assessment. ECCC recommended that Benga’s risk assessment consider both selenate and selenite, as these will vary over operations and affect enrichment factors used in the food web model.

[1071] Benga agreed that the risk assessment was conducted on the basis of selenium being present in the form of selenate. Benga further agreed that the presence of selenite or organo-selenium species would affect the results of the risk assessment because selenite and organic selenium species are more likely to bioaccumulate and sulphate does not mitigate bioaccumulation. Benga stated that it would expect higher bioaccumulation (i.e., higher tissue selenium concentrations) if these selenium species were present at sufficiently high concentrations.

[1072] ECCC highlighted a number of other potential issues in Benga's risk assessment. One of these concerns was that Benga missed more sensitive toxicity endpoints. If endpoints for more sensitive fish species were included, the derived egg selenium EC₁₀ value would likely be lower. ECCC stated that Canada has not recommended the use of sulphate-modified, site-specific, predicted no-effects concentrations, and that ECCC considered the appropriate predicted no-effects concentrations for selenium in fish egg/ovary and fish tissue to be 14.7 and 6.7 µg/g dry weight, respectively, with no modification to reflect sulphate levels. As discussed, Benga's predicted westslope cutthroat trout egg selenium concentrations ranging from 11.0 to 20.1 µg/g dry weight may exceed ECCC's accepted predicted no-effects concentrations. ECCC expressed concern with the lack of site-specific data, because Benga's approach relied mainly on modelling with little or no empirical validation.

[1073] DFO stated that it understood that ECCC had outstanding concerns regarding Benga's risk assessment methods and proposed SSWQO, such that risk to aquatic receptors including westslope cutthroat trout may not be accurately characterized. DFO concluded that the application of the precautionary approach was not evident in Benga's assessment of effects to westslope cutthroat trout.

[1074] The Coalition indicated a very narrow window of assessment was completed as part of the risk assessment, focusing primarily on selenium and ignoring other contaminants of potential concern. The Coalition stated that this indicates that Benga had not taken a conservative approach and the application represents an optimistic case as opposed to a worst-case scenario. Benga stated that updated seasonal model predictions in the Eleventh Addendum would not substantially change the results of the risk assessment. It asserted that when selenium concentrations go up, so do sulphate concentrations.

[1075] Benga acknowledged that it lacked site-specific data for trophic transfer of selenium, from water to algae, algae to benthic invertebrates, and benthic invertebrates to fish. The lack of site-specific information for trophic transfer (that is, the rate at which selenium bioaccumulates at each trophic level of the food chain) is a primary source of uncertainty in the assessment. Given the threatened status of westslope cutthroat trout, lethal sampling to collect muscle and egg/ovary selenium data would not be possible. Benga suggested that collection of rainbow trout egg/ovary data would be possible; however, Benga did not collect such data in support of the risk assessment, despite the central importance of such data.

[1076] The differences between observed and modelled data creates a large amount of uncertainty. Benga's models appear to underpredict selenium accumulation in periphyton, and overpredict accumulation in macroinvertebrates. The amount of baseline data for tissue selenium concentrations is limited, which creates difficulty in validating model predictions.

[1077] We are concerned that the results demonstrate a potential poor fit between published models and project-specific data, whether under- or overpredicting selenium tissue concentrations. Benga has acknowledged that future monitoring is required to validate the models. Considering the protected status of westslope cutthroat trout as the main receptor of concern in this risk assessment, we do not have confidence that the models used in Benga's risk assessment models produced sufficiently conservative estimates of the risk of significant adverse environmental effects on this species.

[1078] Benga used two datasets to model selenium uptake from algae to benthic invertebrates, one from Elk Valley monitoring data (co-located selenium data for benthic invertebrates and algae in receiving waters) and one using data from multiple locations in Canada and the U.S. However, it is unclear whether these two datasets were for selenate only or for other selenium species—notably selenite and elemental selenium species. We previously discussed concerns that all selenium released into Blairmore Creek may not be in the form of selenate.

[1079] The food web models used by Benga to predict the bioaccumulation of selenium are based on pre-mining (baseline) conditions in the watershed, which would likely favor the presence of selenate over selenite. The ratio of selenate to selenite will affect the model's enrichment factor, which is a measure of the bioavailability to primary receptors (algae) and is a critical step in food web modelling. We agree with ECCC that basing the food web models on pre-mining conditions and assuming that all selenium will be in the form of selenate underestimates the exposure and bioavailability assumptions applied in the risk assessment. We also agree with ECCC that a sulphate-modified predicted no-effect concentration should not have been used for the risk assessment.

[1080] Even if we accepted the derived EC_{10} of 24.8 $\mu\text{g/g}$ dry weight as adequately representative of the data and appropriately conservative, the predicted selenium concentrations of westslope cutthroat trout eggs hover just below the EC_{10} for much of the modelled time period and are always above the British Columbia egg/ovary tissue guideline of 11 $\mu\text{g/g}$ dry weight. Given the uncertainties associated with the derivation of selenium concentrations in water, the lack of selenium speciation data, the lack of site-specific data in support of food-chain modelling and the derivation of the EC_{10} , and that predicted concentrations are always above the British Columbia guideline and just below the EC_{10} , our confidence in Benga's assertion that there will be negligible effects on westslope cutthroat trout is low.

[1081] Benga's risk assessment for selenium relies on inadequately conservative predictions of selenium concentrations in water, as well as assumptions and data that have not been validated for this project location. We find that, while the overall approach to the assessment of the risk posed by selenium is appropriate, there is a significant lack of data to support and validate Benga's approach. This results in a large amount of uncertainty compounded at each step of the risk assessment, and undermines our confidence in Benga's results.

Long-term capture and treatment of water will likely be required

[1082] Benga stated that for any mine, elevated concentrations of contaminants of concern persist for some period of time following cessation of operations. Seepage from waste rock dumps will continue to occur even after reclamation, albeit at a slower rate due to reduced rates of infiltration of precipitation. These dumps would be the primary source of elevated levels of selenium, sulphate, and other constituents. Benga expected that the waste rock will leach these contaminants until the source is exhausted, and therefore long-term water capture, management, and treatment is required.

[1083] Benga stated that leaching can only be eliminated through the use of a low-permeability cover over the waste rock dumps, which it determined is not be feasible for this project. It predicted that selenium concentrations could increase to between 120 and 210 $\mu\text{g/L}$ in Blairmore Creek in the absence of contact-water management.

[1084] Benga stated that selenium concentrations would begin to decline at some point in the future, based on observations at other mines. Benga added that selenium concentrations do not appear to be elevated in Blairmore or Gold Creeks despite the existence of historical mining activities and waste rock piles at Grassy Mountain, although it acknowledged that this was a qualitative assessment. Benga stated it modelled the concentrations of selenium to “plateau” in the long term because it could not accurately predict when selenium concentrations would begin to decline, and therefore did not include a decline in the model.

[1085] Benga stated that it expected to treat water until safe levels of contaminant concentrations are demonstrated in the waste rock dump effluent, which could be decades. It indicated that it is unlikely that contaminant leaching would extend to centuries, as has been observed at some other high-sulphide, high-metal mines.

[1086] Benga stated that water treatment facilities, pumps, monitoring stations, and injection facilities for methanol would be left in place after the end of mining. It suggested that sediment ponds would require management until total suspended solids approach background conditions, and surge ponds and saturated backfill zones would have to be managed until selenium levels are within guidelines. Benga provided an estimated cost of approximately \$20 million over 25 years to operate the long-term water treatment system. We discuss these cost estimates in more detail in the reclamation and closure liability chapter.

[1087] Benga indicated that its 25-year treatment estimate was based on professional judgement, and the issue would become clearer closer to the end of mine life. Benga stated that if it looks like a longer treatment period would be required, it would consider additional mitigation measures. Importantly, Benga’s estimated closure costs did not include the additional treatment systems discussed in this chapter, such as advanced oxidation, gravel-bed reactors, or a metals or selenium treatment plant. Benga stated that these additional cost estimates would be included in the Mine Financial Security Program estimates. As the costs increase, Benga would be “motivated to look at what other measures could be put in place” (CIAR 884, PDF p. 94).

[1088] We find that the issue of long-term leaching of selenium (and potentially other contaminants) remains unresolved and that accurate predictions of the duration of selenium leaching are unavailable. Benga’s assumption that selenium leaching from the waste rock dumps will naturally decline over time is not supported by the evidence. Benga suggested that selenium at Grassy Mountain appears to have declined due to historical mining activity at the site, but we note that it has no historical water quality data from earlier mining operations to compare against current water quality data.

[1089] We are concerned with modelled results that show a significant increase in selenium concentrations in Blairmore Creek over several decades, in the absence of continued post-closure management of water. This highlights the need for continued management of selenium-enriched water in the post-closure landscape. Benga did not provide details on how additional long-term treatment costs would be funded, aside from indicating the implications to its Mine Financial Security Program deposit would motivate it to explore other treatment measures.

[1090] The effectiveness of the saturated backfill zones alone to address selenium issues remains a concern. We find that by not explicitly accounting for any of the additional water treatment approaches that may be necessary (for selenium as well as other contaminants), Benga has underestimated—perhaps massively—the costs required for long-term management and maintenance of water treatment infrastructure. Benga has not evaluated these additional long-term treatment costs in any detail. Additionally, the calculation of post-closure costs that are based on a treatment for 25 years is not conservative. Underfunding of closure-related costs represents a liability risk to Alberta taxpayers.

The assessment of Oldman Reservoir impacts is not precautionary

[1091] Over time, selenium released from the project to Blairmore Creek will enter the Oldman Reservoir via the Crowsnest River. The reservoir is a lentic (standing water) system, in which longer selenium residence times, cycling within the reservoir system, and potentially higher reducing conditions and biological productivity could lead to increased selenium uptake from water by aquatic life. Water quality guidelines for lentic waters are typically lower than for lotic (flowing) waters; for example the United States Environmental Protection Agency's ambient water quality criteria for selenium in lentic and lotic waters are 1.3 µg/L and 3.1 µg/L, respectively.

[1092] Benga's initial EIA for the project did not include the Oldman Reservoir in its RSA for the valued component of water quality. The Timberwolf Wilderness Society requested Benga expand the RSA to include the whole of the reservoir, at a minimum. Several participants, including the Timberwolf Wilderness Society and Mr. A. Garbutt, argued that the effects observed at Lake Koochanusa support the case for including areas downstream of the Crowsnest River, including the Oldman Reservoir, within the RSA.

[1093] We agreed that the potential effects of the project on water quality in the Oldman Reservoir should be assessed, and asked Benga to undertake this analysis in an information request. Benga submitted its Oldman Reservoir water quality assessment in the Eleventh Addendum.

Selenium concentrations

[1094] Benga stated that baseline data for selenium concentrations in the Oldman Reservoir were limited to data from 1994. The mean selenium concentration in the reservoir was less than 0.2 µg/L, with a maximum value at the detection limit of 0.2 µg/L. However, historical maximum selenium concentrations in the Crowsnest River from 1974 to 2008 exceeded the *Canadian Environmental Quality Guideline* of 1 µg/L in the summer and fall. Median, minimum, and maximum selenium concentrations in the Crowsnest River in 2013–2014 exceeded the Canadian guideline of 1 µg/L in spring, summer and fall, and closely approached the Alberta guideline of 2 µg/L in the summer.

[1095] Benga estimated future concentrations of selenium in the Crowsnest River by using the water balance and load model that it originally used in its water quality assessment. Benga made several key assumptions in the modelling exercise:

- Predicted flows and selenium loads were adopted from Blairmore and Gold Creeks.
- A 50-year synthetic flow series was applied to the Crowsnest River.

- The 2013–2014 median seasonal background selenium concentrations in the Crowsnest River ranged from 1.2 to 1.9 µg/L.
- The combined loadings from the project plus background flowed via the Crowsnest River to the Oldman Reservoir and mixed completely with the full volume of water in the reservoir (which Benga assumed to be 380 million m³).
- The mean annual contribution of the Crowsnest River to the reservoir was 17 per cent of total inflow.
- A simple mass-balance approach was used to calculate monthly selenium concentrations in the Reservoir, where influent selenium loads would be fully mixed with the reservoir volume of water.

[1096] Benga predicted that the 95th percentile selenium concentration in the Oldman Reservoir would be 0.41 µg/L, although it did not explicitly state the basis for describing this prediction as being the “95th percentile” for the calculated selenium concentration in the reservoir. Benga concluded that “the predicted 95th percentile selenium concentration for the Oldman Reservoir is below protective guidelines and criteria, including Alberta’s alert concentration of 1 µg/L, which indicates that selenium is not of concern for bioaccumulation and toxicity in fish in the Oldman Reservoir” (CIAR 313, PDF p. 267).

[1097] During the hearing, Benga’s expert, Mr. D. DeForest, stated that for reservoir systems, more conservative guidelines would sometimes be warranted, but he stated that he was “not familiar with any aspects of that reservoir that ... would make me rethink whether a criterion or guideline on the order of 1.5 to 2 micrograms to per litre would not be protective” (CIAR 884, PDF p. 114).

[1098] Loading to the Oldman Reservoir depends both on sources of selenium and flows into the reservoir. Benga used the original water quality modelling from its initial application to predict loadings and subsequent concentrations of selenium in the Reservoir. This modelling used average annual flows in Blairmore and Gold Creeks, and predicted a peak selenium concentration in Blairmore Creek of 7 µg/L.

[1099] However, Benga updated its water quality modelling results in the Eleventh Addendum and these updated results show substantial flow-related seasonal and annual variations in selenium concentrations, particularly in Blairmore Creek, over the 80-year modelling period. The updated modelling in the Eleventh Addendum produced peak selenium concentrations above 10 µg/L in Blairmore Creek, which was not used to calculate loadings to the reservoir. Benga acknowledged that its calculation of loadings to the reservoir was not based on the results of the updated water quality modelling in the Eleventh Addendum.

[1100] Benga assumed that the loading of selenium from the Crowsnest River would mix completely with the full volume of the Oldman Reservoir, but it did not present any evidence to support this assumption. By comparison, data from the Koochanusa Reservoir showed that incoming water from the Elk River did not fully mix with reservoir water until some distance downstream. Factors such as varying water levels throughout the year, incomplete mixing, or thermal stratification within the reservoir could lead to selenium concentrations in specific locations, exceeding Benga’s prediction of a fully mixed concentration of 0.41 µg/L.

[1101] Benga's description of the predicted selenium concentration in the Oldman Reservoir of 0.41 µg/L as "somewhat above typical baseline conditions, but well within the *Environmental Quality Guidelines for Alberta Surface Waters*" is not based on consistently conservative modelling. Furthermore, data from the Koocanusa Reservoir illustrate that average water selenium concentrations below the 2 µg/L guideline for the protection of aquatic life still produced bioaccumulation in fish tissues (including egg/ovary tissues) which were above established or accepted guidelines. This, in turn, indicates that a protective selenium guideline for a system such as the Oldman Reservoir may be lower than that suggested by Benga (1.5 to 2 µg/L), and potentially less than the Alberta alert concentration of 1 µg/L.

[1102] There is insufficient and unclear evidence in the record to provide a confident understanding of the degree to which the project will contribute to increased selenium concentrations in the Oldman River downstream of the reservoir. Elevated selenium loadings will exit the Oldman Reservoir over the entire modelled period (to 80 years) and potentially cause elevated concentrations downstream. The evidence presented by Benga does not clearly address the issue of selenium discharges leaving the Oldman Reservoir.

[1103] Benga stated that because its predicted selenium concentration in the reservoir of 0.41 µg/L was the 95th percentile, the actual selenium loading should be lower 95 per cent of the time. It based this assertion on the conservatism of its modelling approach. However, Benga's use of non-conservative selenium concentrations in Blairmore Creek, its lack of consideration of seasonal maximum concentrations and seasonal flow variations, and its assumption of complete mixing of selenium loadings with the entire volume of the reservoir all reduce our confidence in Benga's assertion that selenium loading should be lower 95 per cent of the time. Data from the Koocanusa Reservoir show that seasonal maxima can be substantially higher than annual means and that mixing of incoming river water does not occur for long distances into the reservoir.

[1104] We find that Benga did not apply a sufficient level of precaution in assessing the selenium loadings to the Oldman Reservoir. Because modelling was not consistently and sufficiently conservative, selenium loadings and subsequent concentrations in the reservoir may be underestimated.

Koocanusa Reservoir

[1105] The Koocanusa Reservoir receives selenium loadings produced by Teck's metallurgical coal mines in the Elk Valley, and is therefore a relevant analogue of possible future selenium concentrations in the Oldman Reservoir. In the Eleventh Addendum, Benga submitted the 2019 report of the Environmental Monitoring Committee established under the *Elk Valley Water Quality Plan*.

[1106] The committee report includes monitoring data from the Koocanusa Reservoir that shows the effect of discharge of the Elk River on reservoir water quality. The average selenium concentration at a monitoring station downstream of the mouth of the Elk River from 2014 to 2018 was 1.1 µg/L, with a range of 0.12 to 3.4 µg/L. The 95th percentile concentration was 2.1 µg/L. Monthly average selenium concentrations at this location varied seasonally with flow. For example, monthly concentrations in 2018 ranged from about 0.7 to 2.7 µg/L. The environmental monitoring committee report shows that predicted mean monthly selenium concentrations at this location will decline from a peak of between 2.0 and 2.5 µg/L to between approximately 0.7 and 1.8 µg/L, after implementation of additional active water treatment plants at the Teck mines.

[1107] The committee report states that studies conducted from April to August 2018 showed when water levels in the reservoir are low and the reservoir is river-like, the Elk River does not mix substantially with water from the Kootenay River until 4 or 5 km downstream of the monitoring station at the mouth of the Elk River. At higher water levels (June through August and beyond), substantial mixing did not occur until 15 km downstream of the monitoring station.

[1108] The report compared the selenium concentrations in the tissues of several fish species in the Koochanusa Reservoir to United States Environmental Protection Agency and British Columbia Ministry of Environment guidelines, with particular attention on concentrations in ovaries because it is selenium in eggs that poses a risk of reproductive effects in fish. The average concentrations of selenium in the ovaries of fish collected from the reservoir were frequently above the British Columbia guideline of 11 mg/kg dry weight, particularly in peamouth chub (*Mylocheilus caurinus*), northern pikeminnow (*Ptychocheilus oregonensis*) and reidside shiner (*Richardsonius balteatus*).

[1109] The average concentrations of selenium were also above the United States Environmental Protection Agency guideline of 15.1 mg/kg dry in reidside shiner. The ovaries of individual fish including peamouth chub, northern pikeminnow, longnose sucker (*Catostomus catostomus*) and rainbow trout had selenium concentrations above the United States Environmental Protection Agency Level 1 benchmark of 18 mg/kg dry weight. The committee noted that these results do not necessarily mean that there will be an effect on the fish, given that critical levels have not been established for all of the species that occur in the Koochanusa Reservoir. Ongoing and future studies will evaluate the sensitivity of the species with elevated selenium concentrations.

[1110] Benga stated that mean ovary concentrations for largescale sucker and yellow perch (*Perca flavescens*) in the Koochanusa Reservoir were “well below” the British Columbia guideline. Benga further stated that, while the egg/ovary concentrations in peamouth chub, northern pikeminnow and reidside shiner (referred to collectively as cyprinids) were “interesting and unusual,” field and lab evidence indicates that cyprinids are less sensitive to selenium compared with other fish such as trout. Benga noted that ovary selenium concentrations were not available for westslope cutthroat trout in the Koochanusa Reservoir but that mean concentrations in muscle were 4.4 (± 3.2) mg/kg dry weight for samples collected near the Elk River mouth, 3.1 (± 1.5) mg/kg dry weight for samples upstream of the Elk River mouth, and 3.0 (± 2.1) mg/kg dry weight farther downstream of the Elk River mouth. The British Columbia guideline for muscle tissue is 4 mg/kg dry weight. Benga stated that this guideline is conservative and provided a calculated muscle selenium EC₁₀ (defined earlier in this chapter) of 12.2 mg/kg dry weight.

[1111] Benga summarized its interpretation of the Koochanusa Reservoir data as follows: “... considering the selenium data for the Koochanusa Reservoir, which has mean and 95th percentile concentrations of 1.1 and 2.1 µg/L, respectively, the resulting selenium concentrations in fish tissue, including Westslope Cutthroat trout, are not at concentrations of concern. These data for the Koochanusa Reservoir provide further supporting evidence that fish in the Oldman Reservoir are not at risk from the predicted 95th percentile surface water selenium concentration” (CIAR 313, PDF p. 269).

[1112] We note that despite Benga’s assertion that selenium concentrations were not at levels of concern in the Koochanusa Reservoir, fish tissue concentrations of selenium were frequently observed to exceed established guidelines. The Oldman Watershed Council noted that its concern regarding the potential for

selenium to spread to the Oldman Reservoir and the Oldman River is illustrated by how selenium has spread from Teck’s Elk Valley mines downstream to the much larger Koochanusa Reservoir and the Kootenai River below. The council also noted that although some recent treatment efforts in the Elk Valley are showing promise, the problem of selenium in the Koochanusa Reservoir continues. CPAWS noted that the Oldman Reservoir is only 40 km from the project site, far less than the 165 km between the Elk Valley coal mines and Lake Koochanusa.

Risk to fish from selenium exposure in the Oldman Reservoir

[1113] Precaution is required with respect to the assessment of risk to westslope cutthroat trout because it is a threatened species under *SARA*, it declined substantially in the Oldman River after the construction of the Oldman Reservoir, and the few remaining fish in the reservoir would be at potential risk from selenium accumulation in egg/ovary tissue. Evidence from the Koochanusa Reservoir indicates that selenium accumulation approaching or exceeding guidelines for egg/ovary tissue can occur, even when water concentrations are largely below the water quality guideline. Other fish species could also be at increased risk – notably bull trout, mountain whitefish (*Prosopium williamsoni*), rainbow trout, lake whitefish (*Coregonus clupeaformis*), and small-bodied fish such as longnose dace (*Rhinichthys cataractae*) and brook stickleback (*Culaea inconstans*).

[1114] In the Elk River system, mountain whitefish appear to accumulate selenium to a greater degree than do westslope cutthroat trout. Mountain whitefish sampled in 2018 at four of six Teck mine–influenced locations had selenium concentrations in ovary tissue above the interim screening value of 29.3 mg/kg dry weight proposed by Teck. This screening value is well above both the United States Environmental Protection Agency Level 1 benchmark of 18 mg/kg dry weight for reproductive effects, and the British Columbia egg/ovary guideline of 11 mg/kg dry weight. By comparison, all westslope cutthroat trout sampled by Teck in 2018 had selenium concentrations below the Level 1 benchmark, except for fish collected from Line Creek, which was releasing selenite (which bioaccumulates more easily than selenate).

[1115] Comparisons with available evidence from the Koochanusa Reservoir suggest that project-related selenium bioaccumulation in fish egg/ovary tissue of westslope cutthroat trout, bull trout, mountain whitefish, and other fish species in the Oldman Reservoir may occur as a result of selenium loadings from the project. Bioaccumulation in small-bodied fish in the Oldman Reservoir may also become an issue over time, as it already has in Koochanusa Reservoir.

[1116] We find that Benga’s insufficient precaution in water quality modelling and estimation of loading of selenium to the Oldman Reservoir underestimates the risk of bioaccumulation of selenium in fish species in the reservoir, and therefore increases the risk of negative effects in these fish over time.

End-pit lake water quality is likely to pose long-term risks to aquatic life

[1117] In its EIA, Benga described the end-pit lake as an “ecologically sustainable” part of the post-closure drainage system. Benga planned the lake as an “aesthetic waterbody” without a fisheries component. The lake would be 1.8 km² in size, with a highwall feature on the west side and a much more gently sloped eastern edge. Benga explained in the Eighth Addendum that a contoured littoral zone 1.8 to 2.0 ha in size would be created on the east side. The littoral zone would be seeded with

representative wetland plant species and monitored to ensure the established plants were trending toward the desired trajectory.

The importance of end-pit lake design in determining water quality

[1118] Suitable water quality is required for a sustainable end-pit lake. Benga stated in the Eighth Addendum that it would avoid placing waste rock inside the lake's drainage area, and that all acid-generating pit walls would be actively managed by covering the acid-generating rock with non-acid-generating rock. Benga also indicated that it would let water drain from the end-pit lake to Gold Creek through horizontal drainage holes. Benga stated that with these design measures, no water quality issues are expected with the water discharging from the end-pit lake.

[1119] In the Eleventh Addendum, Benga noted that there would be no need for end-pit lake water to flow to Gold Creek to meet instream flow needs. This meant that the horizontal drainage holes would not be constructed. Benga explained during the hearing that it was now planning an overflow for the end-pit lake to allow water from the end-pit lake to decant to the saturated backfill zone and eventually report to Blairmore Creek. Benga committed to constructing an engineered outflow connection between the end-pit lake and the upper saturated backfill zone. This commitment addressed concerns raised by the Livingstone Landowners Group regarding the need for designed outflows that reduce the risk of creating an end-pit lake with very poor water quality.

Predicted concentrations of many contaminants of potential concern exceeded water quality guidelines

[1120] Benga's modelling of end-pit lake water quality predicted exceedances of the Alberta guidelines for the protection of freshwater aquatic life, as illustrated by the results in the Table 13-4. We compiled the table below, using the results of the water balance and load model. We also present the predicted concentrations used for the wildlife health risk assessment, because these concentrations are often different (and sometimes noticeably higher) than those produced by the water balance and load model. Benga stated that it is aware that predicted concentrations of various contaminants in the end-pit lake including selenium, arsenic, cadmium, cobalt, copper, nickel and zinc exceed guidelines.

Table 13-4. Water balance and load modelling predicted concentrations for the end-pit lake

Contaminant of potential concern	Alberta Guideline for Aquatic Life	EIA Appendix D of Appendix 10b, PDF pp. 362-411	Eleventh Addendum, PDF p. 1310
Aluminum	50	370	42.9 (dissolved)
Arsenic	5	0.6–0.65	6.9
Cadmium	0.32	1.2–1.3	1.77
Cobalt	1.4	8–10	45.2
Chromium	1	2.5–3	6.29
Copper	7	14–16	22.9
Iron	300	10 000–11 500	20 (dissolved)
Mercury	0.005	0.012–0.013	0.0155
Molybdenum	73	4-4.5	23
Nickel	110	30–35	142

Contaminant of potential concern	Alberta Guideline for Aquatic Life	EIA Appendix D of Appendix 10b, PDF pp. 362-411	Eleventh Addendum, PDF p. 1310
Nitrite	0.08–0.10 mg/L	0.1 (mean); 0.75 (max) mg/L	0.107 mg/L
Nitrate	3 mg/L	5 (mean); 33 (max) mg/L	4.67 mg/L
Phosphorus	>10 (trigger value)	14–16	609 ^a
Lead	7	0.25	0.479
Selenium	2	6	30.3
Sulphate	429 mg/L	90–100 mg/L	190 mg/L
Uranium	15	0.55–0.6	0.88
Zinc	30	50-55	177

Notes: All concentrations in µg/L unless otherwise specified. Assumed hardness of 230 mg/L. Assumed pH of 7–9.

^a Questionable results; possible unit error.

Methods used to model end-pit lake water quality are unclear and the level of conservatism questionable

[1121] Benga did not provide a clear, detailed explanation of how it produced its predictions for end-pit lake water quality. We assume that the water balance and load model was used to model the water quality in the end-pit lake. Benga stated that all modelling scenarios used for the water balance and load model adopted conservative assumptions in its characterization of loading sources and flows to “reduce the likelihood of underestimating concentrations” (CIAR 42, Appendix 10, PDF p. 236).

[1122] Conservatism in the modelling of end-pit lake water quality was based on the use of upper-case source terms and the assumption that incoming water has been in contact with rock that is leaching contaminants of potential concern. Benga assumed that the end-pit lake will have a constant volume. Benga stated that uncertainty in the water quality predictions resulted primarily from the source terms because they vary over a wider range than the hydrological inputs. Base-case and upper-case source terms were derived for the following sources: background surface water, groundwater, pit-wall runoff, waste rock, and co-disposal of waste rock and rejects. Background surface and groundwater quality was based on the average and 95th percentile of monitoring data.

[1123] The rock types of the pit wall are generally prone to acid generation. Only two of the pit-wall rock types (together amounting to 28 per cent of the pit wall) are listed as non-acidic (the Blairmore and the Fernie Formations, although the Fernie Formation was not tested and contains pyrite and shale). The rock type of the footwall was not indicated, although it will account for 21 per cent of the final pit wall and is composed of 50 per cent acid-generating rock.

[1124] Benga assumed that 80 per cent of loading generated by acidic rock types in exposed pit walls would be mitigated at closure. It is unclear whether Benga will have adequate non-acid generating rock to manage the pit walls, and the steep angle of the pit walls makes covering these pit walls challenging.

[1125] In response to an information request, Benga provided sensitivity analyses for pit-wall runoff in relation to creek modelled input. This analysis examined what outputs would look like if 100 per cent of the pit walls were acid-producing. It did not look at how inputs would change if runoff was of a lower pH than expected. Benga argued that this analysis indicated that metal leaching would not increase

significantly even if the entire pit wall was acid-prone. Benga's modelling does not show any decline in concentrations of contaminants of potential concern in the end-pit lake (except for nitrogen compounds) over the modelling time period (the year 2100). Benga stated that without a mathematical relationship, it could not build natural attenuation into its water quality models. Benga agreed that metal leaching can occur for extended periods after mine closure.

[1126] Benga did not explain why predicted concentrations of contaminants of potential concern used in the human and wildlife health risk assessments were higher than what was predicted by both the water balance and load model described in Appendix 10b of the original EIA and the updated modelling presented in Appendix 6.25 of the Eleventh Addendum.

[1127] We find that the inconsistent water quality predictions, the lack of any explanation of those inconsistencies, and uncertainty regarding mitigation of acidic pit walls reduce our confidence in the conservatism and reliability of the modelling of end-pit lake water quality.

Predicted water quality indicates aquatic life in the end-pit lake may experience adverse effects

[1128] Benga did not assess predicted exceedances of water quality guidelines in the end-pit lake with respect to effects on aquatic life inhabiting the lake. In the EIA, Benga stated that water in the lake should not contain elevated levels of selenium because it would direct selenium-enriched contact water to the saturated backfill zones. Subsequent water quality modelling results (Appendix 10b of the EIA, as well as in Eleventh Addendum) suggested that selenium would be found at elevated levels in the end-pit lake, but Benga did not assess these results.

[1129] Benga's plans for the end-pit lake do not include the introduction of fish. At the hearing, Benga stated that it understands that life in the end-pit lake could include fish. Benga said that the ultimate objective would be an end-pit lake that is a healthy part of the environment, and that it would have time to gather more information and adjust the design of the end-pit lake accordingly. Benga assessed the risk of exposure to end-pit lake water to human health and wildlife health and identified several risks that exceeded risk benchmarks. We discuss those results in the chapters on human health and wildlife health.

[1130] We find that given the uncertainty associated with the actual level of conservatism in the modelling of end-pit lake water quality, as well as the fact that even with assumed mitigation, many exceedances of water quality guidelines were predicted, adverse residual effects on aquatic life in the end-pit lake are possible.

The end-pit lake design is uncertain and may contribute to residual adverse effects

[1131] In addition to the uncertainty produced by the inconsistent application of conservatism discussed above, the lack of sufficient detail regarding fundamental design features of the end-pit lake adds more uncertainty to the likelihood of adverse residual effects on water quality in the end-pit lake. Benga intends the end-pit lake to be a part of the closure water management system. However, the lack of detailed information regarding the design for a surface outlet and channel produces uncertainty with respect to whether the lake will, in fact, contribute to water management.

[1132] Benga stated that the end-pit lake will be “ecologically sustainable.” But apart from a table of basic characteristics such as maximum depth and mean subsurface outflow, and a commitment to mitigate acid-generating rock in the pit walls, little information supports a conclusion that the end-pit lake will, in fact, be sustainable. The Coalition expressed concern about the potential stratification of the end-pit lake and the creation of anoxic conditions at the base of the end-pit lake, and how resulting geochemical effects from changing between oxic and anoxic conditions in the future might manifest themselves.

[1133] The Coalition also argued that because the end-pit lake will be up to about 80 m deep, the chances of creating anoxic conditions at its base are reasonable. The development of such conditions, in the presence of residual organic substrate such as carbonaceous rocks or coal fines, could mobilize trace elements from bottom sediments and/or rock layers and lead to the mobilization of harmful trace elements known to be present in the project area. Benga did not assess this risk.

[1134] We agree that Benga did not need to submit detailed end-pit lake designs at this stage of the review process. However, it should have provided a conceptual design with sufficient detail to allow us to evaluate the potential to create a sustainable end-pit lake. We find that, given the exceedances of water quality guidelines by predicted concentrations of several contaminants in the end-pit lake, the long-term nature of these exceedances (to the end of the modelling period in 2100), the unclear and inconsistent water quality modelling results, the lack of conservatism in the modelling of water quality, and the lack of sufficient information on basic pit-lake design elements required to create a sustainable water body, the available evidence indicates that the end-pit lake would pose a long-term risk of adverse effects on aquatic life.

The project is likely to result in significant adverse effects to water quality

[1135] Benga presented the results of its evaluation of the significance of residual effects on surface water quality in the Twelfth Addendum. Benga considered several effects. They include the effects of surface water runoff from the project, released process water from project activities associated with operations and closure, changes in released process water parameters from proposed selenium management mitigation measures, nitrogen-based explosives used in blasting during mine operations, domestic wastewater releases, acidification due to air emissions, acidification due to water exposure to acid-generating rock, and accidental leaks and spills. For all potential effects to surface water quality, Benga found the residual effects would not be significant.

Benga’s assessment of residual effects in Blairmore Creek

[1136] Benga assessed the significance of residual effects on water quality in Blairmore Creek. It determined the magnitude of the effects was low for all parameters, except for sulphate in Blairmore Creek, where the magnitude was moderate. The extent of the project was local. Benga stated that concentrations of parameters are not expected to substantially increase from baseline within the Crowsnest River. The duration of the impact was short (within the project lifespan), except for sulphate, for which the duration was residual (extending after the facility closes for a long period of time). The effects were reversible in the short-term, except for sulphate, for which they were irreversible (do not diminish upon cessation of activities and does not diminish with time). The residual effects were not significant. The overall significance of project-related activities on the receiving environment after mitigation was not significant, with a moderate level of confidence in the assessment.

[1137] Benga appeared to recognize that elevated sulphate concentrations could create adverse impacts on Blairmore Creek. It rated the magnitude of the effect as moderate, which it defined as a “disturbance predicted to be considerably above background conditions but within scientific and socio-economic effects thresholds, or to cause a detectable change in ecological, social or economic parameters within range of natural variability” (CIAR 42, Section C, PDF p. 166).

[1138] We note that Benga’s assessment of effects resulting from increases in selenium relied on its proposed SSWQO, which itself relies on large increases in sulphate concentrations. We disagree with many aspects of Benga’s significance assessment, but particularly its assessment of the magnitude of impacts from selenium as “low,” the duration of effects as “short,” and the reversibility of effects as “reversible in the short term.” Overall, Benga’s assessment of surface water quality impacts from the project leaves many unanswered questions, compounds risk and uncertainty throughout the entire chain of analysis, and does not give us confidence that significant adverse environmental effects can be avoided, considering the sensitivity of the surrounding environment.

[1139] We find that Benga’s conclusions regarding the significance of residual effects on water quality with respect to selenium and sulphate are not convincing. There is a high degree of uncertainty associated with the effectiveness of Benga’s proposed selenium mitigation measures, and the derivation of the SSWQO for selenium and the associated risk assessment introduce even more uncertainty. Benga has not proposed any mitigation measures for sulphate releases, and in fact is relying on large increases in sulphate concentrations in Blairmore Creek to offset potential effects of increased selenium concentrations.

Benga’s assessment of residual effects in the Oldman Reservoir

[1140] The only contaminant of potential concern that Benga evaluated for significance of residual adverse effects in the Oldman Reservoir was selenium. Benga evaluate the magnitude as low: “somewhat above typical baseline conditions but well within Alberta EQG.” It characterized the geographic extent as regional, the duration as longer than 50 years, and the frequency as continuous, but only at the 95th percentile as these concentrations occur infrequently. The effects were considered reversible in the long term as they “extend for some time into post-closure, but will diminish with time. The water sampling at the historic mining [sic] does not show much, indicating that if there was ever anything, then it was reversible.”

[1141] Based on these criteria, Benga determined that the residual effect of selenium on the Oldman Reservoir is not significant.

[1142] We find Benga’s reasoning for the reversibility and magnitude criteria to be flawed. For magnitude, we were not convinced that Benga adopted sufficiently conservative assumptions to rule out the risk that bioaccumulation of selenium in fish could take place to levels that could exceed guidelines. As for reversibility, predicted selenium concentrations remain elevated to the last modelled year (year 80) with little to no sign of a significant declining trend. Benga asserted that selenium attenuation would occur naturally at some point in the future, and speculated that this natural attenuation must have occurred at the Grassy Mountain site from presumably elevated selenium levels due to historical mining. However, Benga provided no evidence to support this speculation.

Our assessment of the significance of residual effects on surface water quality

[1143] Throughout this chapter, we identify a large number of uncertainties that arise from Benga’s analysis of surface water quality. At many points in the analysis of the pathway of effects by which contaminants from the project could impact surface water quality, Benga made optimistic assumptions that were not well supported by evidence and submitted that it would effectively adopt an “adaptive management” approach, which involved proceeding with the project and determining later whether its assumptions were correct. If they were not, Benga did not have well-developed backup plans in hand.

[1144] If Benga’s assumptions turned out to be incorrect, it might have been too late to avoid surface water quality impacts that, as was demonstrated in the nearby Elk Valley, could prove challenging and expensive to resolve. This does not represent a conservative approach appropriate to the sensitivity of the project location and the threatened status of one of the main receptors, westslope cutthroat trout.

[1145] Throughout the many sections of this chapter, we identify several optimistic and non-conservative assumptions made by Benga that undermined our confidence in the results it presented. We summarize some of our main findings below.

[1146] The current project as proposed is unlikely to capture the 95 or 98 per cent of selenium-rich contact water coming from the waste rock dumps that would be needed to achieve modelled selenium concentrations in the effluent and receiving streams. Applying a more realistic capture efficiency rate, as part of a conservative approach, would result in significantly higher concentrations of selenium in the effluent, and in both Blairmore and Gold Creeks, in the absence of further mitigation.

[1147] Benga overestimated the effectiveness of its primary mitigation approach to managing selenium: saturated backfill zones. These structures are unlikely to achieve the extremely high performance level (removal of 99 per cent of influent selenium concentrations, or the production of effluent with selenium concentrations below 15 µg/L) that would be needed to achieve Benga’s modelled selenium concentrations in the effluent and receiving streams. Benga did not demonstrate that the saturated backfill zones can achieve the necessary high level of effectiveness, at the scale of this project. Even a modest reduction in effectiveness from Benga’s assertions would yield a large increase in selenium in saturated backfill zone effluent. And even if the saturated backfill zone did work as effectively as Benga suggested, modelled selenium concentrations in Blairmore Creek would eventually exceed Benga’s proposed site-specific objective.

[1148] Benga did not adequately describe or assess the alternative, additional selenium mitigation measures it would pursue if it turns out that the saturated backfill zones are not as effective as needed. Benga provided almost no substantive information on alternative treatment measures, and only intends to implement them “if needed” based on monitoring results, which introduces the possibility that there could be an unacceptable time lag between discovery of a contamination problem and construction of an alternative treatment approach. The strategy of “putting all one’s eggs in one basket,” when the basket (in this case, saturated backfill zones) is unproven, does not give us confidence that significant adverse environmental impacts can be avoided even if additional mitigation measures were later put in place.

[1149] Other sources of selenium, such as pit-wall runoff captured in sedimentation ponds or unassessed rock from the Fernie Formation or contaminated groundwater plumes, could affect the surrounding environment. Benga did not have a realistic plan to manage the selenium it already anticipates, and did

not propose any mitigation measures for these additional sources because it considered the potential for selenium in sediment ponds to be low, and did not assess the potential for groundwater plumes. At most, Benga planned to direct sedimentation pond water to the saturated backfill zones for treatment if necessary, and to monitor selenium in groundwater and install extraction wells if necessary, presumably to direct such contaminated groundwater to the saturated backfill zones.

[1150] Benga predicted slight but chronic exceedances for a number of non-selenium contaminants of potential concern, despite not taking a conservative approach to modelling water quality nor to capturing all the potential sources of metal leaching in its model. In particular, Benga's water quality modelling predictions assumed a metals treatment plant would be implemented. But then Benga did not commit to building such a plant; instead it planned to monitor and manage this issue through adaptive management.

[1151] We do not have confidence in Benga's sulphate-adjusted SSWQO for selenium in receiving waters. In particular, Benga did not adequately consider the potential for non-selenate forms of selenium to be present in water released to Blairmore Creek. Benga based its risk assessment on the assumption that all selenium would be released as selenate, which may not be correct. Benga proposed to implement an advanced oxidation process, if necessary, to convert selenium in waters exiting the saturated backfill zone to selenate. But it provided essentially no details to evaluate whether this process would be effective. We note that both we and ECCC requested, through the review process, that Benga redo its risk assessment using more conservative and established methods, but Benga did not provide such a revised assessment.

[1152] Based on the evidence and findings discussed in this chapter, we assess the residual effects of the project to surface water quality as the following:

- **Magnitude:** high (local extent) and moderate (regional extent). We expect increases in parameters of concern to exceed established guidelines, resulting in ecological changes beyond the range of natural variability. Regionally, we expect concentrations of selenium to increase in the Oldman Reservoir, to a lesser extent than in Blairmore and Gold Creeks, but to an extent that ecological changes may be detectable.
- **Geographic extent:** regional. We expect increases in parameters of concern, even with mitigation measures applied, to extend downstream to the Oldman Reservoir and potentially beyond. While the assessment focused on selenium concentrations in the Oldman Reservoir, we expect that other parameters of concern (e.g., sulphate) would also persist and become elevated in the reservoir.
- **Frequency:** continuous. We expect elevated concentrations of contaminants of concern to occur over the project operational period and into closure. We expect these concentrations to quickly increase during the first years of the project life, and remain elevated.
- **Duration:** persistent. We expect increased concentrations of parameters of concern to persist for an extended period after the facility closes. As a result, we expect that any effects of these elevated concentrations would also persist for an extended period.
- **Reversibility:** reversible in the extremely long-term; could be decades post-closure, and irreversible with respect to calcite deposition. There is no reliable predicted timeline for when concentrations of parameters of concern would return to background levels, at which point treatment and mitigation

would not be required, but the evidence indicates this could require many decades. Calcite deposition would be a near-permanent or permanent effect on receiving streams, which could not be reversed through mitigation measures applied after the deposition occurs, except possibly by mitigation measures that would result in the destruction of aquatic habitat.

- **Ecological/social context:** positive. The ecological setting of Blairmore and Gold Creek is relatively unimpaired, and water quality parameters are within defined regulatory or policy thresholds.

[1153] We conclude the project is likely to cause significant, adverse effects to surface water quality. We have high confidence in our assessment.

Significance of cumulative effects on surface water quality

[1154] Because project effects have the potential to interact with other projects within the Crowsnest River watershed, Benga defined the entire watershed as the RSA for evaluation of potential cumulative effects. It selected this RSA for the cumulative effects assessment to consider the potential effects of construction and operation of the project on flows, water levels, and water quality in regional water courses, including potential surface water–groundwater interactions. Together, Blairmore and Gold Creeks represent roughly 16 per cent of the watershed.

[1155] Benga’s cumulative effects assessment of surface water quality considered a baseline case, application case, and planned development case to evaluate potential cumulative effects on surface water quality. And it assessed the impacts of past, present, and future projects and activities. Past projects included construction of the Canadian Pacific Railway, the legacy Greenhill Mine, Bear Valley Mine, Bellevue Mine, and the Grassy Mountain Mine situated within the project footprint and operated off and on from 1952 through 1976. Benga included the current activities of timber operations, ranching, and other agricultural activities in its assessment.

[1156] Benga concluded that past and existing physical activities can interact with the project’s surface water quality. However, it stated that no certain and/or reasonably foreseeable future projects or activities would interact with the project from a surface water standpoint within temporal boundaries (which extend post-closure). Benga therefore concluded that the planned development case of the cumulative effects assessment was equivalent to the application case.

[1157] Benga concluded that there was not enough evidence to demonstrate that historical operations have a material effect on selenium levels in Blairmore and Gold Creeks, as these selenium levels did not appear to follow patterns or trends related to historical mining. Benga concluded that there were no notable residual effects related to historical mining activities. Benga also concluded that there was little potential for selenium loading from irrigation runoff within the spatial boundaries of the cumulative effects assessment.

[1158] Benga concluded that no cumulative effects for surface water quality are anticipated due to the project. The basis for this conclusion was that Benga predicted there would be no significant residual adverse effects on surface water quality for the application case.

[1159] We asked Benga to expand its assessment boundaries to include the Oldman Reservoir in its cumulative effects assessment. Benga stated that “there is insufficient evidence to indicate that selenium

levels in local creeks and downstream waterbodies (e.g. Oldman Reservoir) have resulted in issues related to loading and/or bioaccumulation” (CIAR 313, PDF pp. 273 and 264). It summarized the potential for cumulative effects by stating “the Castle and Crowsnest watersheds have experienced past and existing activity since the late 1900s with 25 per cent being altered by human development. The influence of historic mining on water quality is undetermined, and there is little potential for selenium loading from irrigation runoff in this area” (CIAR 313, PDF p. 274) and “it was determined that there are no certain or reasonably foreseeable projects within the temporal boundaries that are expected to contribute to future selenium loading in the Oldman Reservoir” (CIAR 313, PDF p. 275). Benga determined that the cumulative effects of selenium loading on the Oldman Reservoir in the planned development case would be the same as those in the application case.

[1160] Benga stated that, based on its assessment, the cumulative effects of the project are not significant.

Our assessment of the significance of cumulative effects on surface water quality

[1161] We find that Benga’s evidence that supports ruling out historical mining contributions to selenium loading is limited. In particular, in earlier years (1970s) the effects of historical mining may have been more evident. Benga’s baseline data provided some evidence that there may have been elevated levels of selenium in Gold Creek, due to the legacies of the Bear Valley Mine, Bellevue Mine, and the Grassy Mountain Mine. Benga’s baseline data also provided some evidence of elevated levels of selenium in the Crowsnest River just upstream and downstream of Blairmore Creek, in the vicinity of the legacy Greenhill Mine. As Benga does not have historical data pre-dating mining in the area, we do not know whether these elevated selenium levels were due to mining or a natural product of the area’s geology, yet Benga determined there was no notable residual effect related to historical mining activities.

[1162] We note that the impact of earlier mining activities on water quality would have been reflected in the baseline data that Benga used for its project assessment.

[1163] We find that the main impacts on surface water quality in the waters downstream of the project would come from project effects. Previous activities did not cause adverse cumulative effects on surface water quality in Blairmore and Gold Creeks, and we are not aware of any other reasonably foreseeable activities that could interact with project effects to trigger adverse cumulative effects. The evidence regarding potential cumulative effects on the Crowsnest River and the Oldman Reservoir from other such activities is less clear, and does not allow us to make a clear finding for these downstream waters.

[1164] We conclude that, although the project would have significant project-related effects on surface water quality, there would not be a broader significant adverse cumulative environmental effect on water quality due to other previous and reasonably foreseeable future activities.

Recommendation 3: We recommend that the Government of Canada finalize and implement *Coal Mining Effluent Regulations* under the *Fisheries Act* as soon as possible.

We recognize that there was uncertainty about whether the project as proposed could satisfy the requirements of these regulations. We also recognize that Benga did not have clear regulated effluent limits (such as those proposed in the draft regulation) to incorporate into its project design and planning. Finalizing the *Coal Mining Effluent Regulations* would help proponents and decision makers evaluate the acceptability of proposed discharges from coal mines.

14. Fish and Aquatic Habitat

Westslope cutthroat trout are a species at risk, and require a precautionary approach

[1165] The Grassy Mountain project is bordered by Gold Creek on the east and Blairmore Creek on the west. These streams flow south past the proposed mine, and empty into the Crownsnest River near the town of Blairmore. Each of these streams contains aquatic habitat that supports a number of different fish species, and westslope cutthroat trout (WSCT) in particular.

[1166] Benga’s assessment of aquatic ecology effects identified WSCT as the valued component for fish and aquatic habitat. Benga stated that it selected WSCT because of the species’ provincial and federal status and their presence, distribution, and abundance in the LSA, and because they are the only native fish within the LSA to be potentially and directly affected by loss or alteration of habitat. We explore Benga’s assessment approach in the next section of this chapter. First, we set the stage for this assessment by discussing the status of WSCT and concerns about the existing local population.

[1167] WSCT are the only subspecies of cutthroat trout native to Alberta. Due to major range contractions and large population declines over the last century, WSCT now occupy less than 20 per cent of their historic range in Alberta. Currently, genetically pure WSCT occur as small, disconnected populations, primarily in mountainous regions.

[1168] In 2009, Alberta listed WSCT as threatened under the provincial *Wildlife Act*, and in 2013, Canada also listed WSCT as threatened under *SARA*. In 2009, both governments established a joint federal/provincial recovery team for WSCT to produce a federal recovery strategy and provincial recovery plan that would satisfy federal and provincial requirements. This effort led to the publication of a provincial *Recovery Plan for the Westslope Cutthroat Trout* in 2013, and the federal *Recovery Strategy for the Westslope Cutthroat Trout (Oncorhynchus clarkii lewisi) Alberta Populations in Canada* in 2014 (the 2014 Recovery Strategy).

[1169] In May 2019, Canada published an updated *Recovery Strategy and Action Plan for the Alberta Populations of Westslope Cutthroat Trout (Oncorhynchus clarkii lewisi) in Canada 2019* (the 2019 Recovery Strategy-Action Plan) which built on and updated the 2014 federal recovery strategy. Both levels of government have a role to play in managing fisheries. For example, the federal *Fisheries Act* prohibits the harmful alteration, destruction, or disruption of fish habitat and the deposition of deleterious substances into waters frequented by fish, unless authorized by regulations under the *Fisheries Act* or other federal legislation, while the province manages fish populations in the province. The successful recovery of this species will depend on the commitment and cooperation of many different constituencies involved in implementing the 2019 Recovery Strategy-Action Plan.

[1170] The 2019 Recovery Strategy-Action Plan includes direction for recovery of the species, including population and distribution objectives to “protect and maintain the existing distribution of at least 99 per cent genetically pure populations of WSCT, and re-establish genetically pure populations to self-sustaining levels, within the Saskatchewan–Nelson River watershed in Alberta.” (CIAR 493, PDF p. 9). DFO reports that 51 genetically pure populations of WSCT remain in Alberta outside of national parks.

[1171] The 2019 Recovery Strategy-Action Plan proposed several objectives to meet the population and distribution objectives and address threats to the survival of the species:

- identifying and protecting critical habitat for remaining pure populations
- improving knowledge of population genetics, size, distribution, and trends
- identifying opportunities to help recover genetically pure and near-pure WSCT, partly by restoring habitat and eliminating or suppressing populations of non-native fish that are having negative impacts on WSCT
- increasing education and awareness of WSCT

[1172] Habitat for aquatic species is defined under *SARA* as the “spawning grounds and nursery, rearing, food supply, migration and any other areas on which aquatic species depend directly or indirectly in order to carry out their life processes, or areas where aquatic species formerly occurred and have the potential to be reintroduced” (CIAR 493, PDF p. 25). *SARA* states “critical habitat means ... the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species’ critical habitat in the recovery strategy or in an action plan for the species” (CIAR 493, PDF p. 25).

[1173] DFO noted that the 2019 Recovery Strategy-Action Plan identified 16.7 km of watercourses in the Gold Creek watershed, including the mainstem and tributaries, as critical habitat for at least 99 per cent genetically pure WSCT. The 2019 Recovery Strategy-Action Plan expanded the extent of WSCT critical habitat compared with the 2014 federal recovery strategy, upon which Benga based its fisheries assessment for the project. The expanded critical habitat now includes the primary riparian zone around watercourses, as well as headwaters.

[1174] The 2019 Recovery Strategy-Action Plan also identified 10 km of near-pure (genetic purity between 95 and 99 per cent) WSCT habitat in Blairmore Creek, but did not designate this as critical habitat. DFO indicated that the 2019 Recovery Strategy-Action Plan also has the objective of helping recover near-pure “conservation populations” of WSCT with a high potential for recovery, because they can contribute to the preservation of “unique ecological and behavioural traits” that represent “the least introgressed populations within a geographic area” and may represent opportunities to employ “genetic swamping” to increase genetic purity (CIAR 493, PDF p. 115). DFO stated that, although Blairmore Creek is not protected under *SARA* because the population of WSCT is only near-pure, Blairmore Creek is important because of its potential to support the population and distribution objectives in the 2019 Recovery Strategy-Action Plan.

[1175] DFO submitted that we must consider specific recovery measures outlined in the 2019 Recovery Strategy-Action Plan in assessing the risk of the project, including: the need to restore and recover priority populations where feasible; the need to expand genetically pure populations and re-establish populations in candidate areas within the recovery areas; and the need to protect and/or restore habitat. In addition, DFO stated that we should consider applying cumulative effects considerations to manage the effects of resource extraction, and land and water use, when making regulatory decisions that may affect WSCT critical habitats.

[1176] We considered the threatened status of WSCT and the 2019 Recovery Strategy-Action Plan in our assessment of Benga’s analysis of the fish and aquatic habitat valued component. We agree that Benga’s use of WSCT as the ecological valued component for its assessment is appropriate. We have applied a careful and precautionary approach to the assessment of project impacts on WSCT, and have evaluated the evidence on the record when determining whether we have confidence that significant adverse environmental effects on WSCT can be avoided by Benga’s proposed mitigation measures. In this respect, we do not consider a lack of full scientific certainty as cause for postponing cost-effective measures to prevent environmental degradation.

Gold Creek is critical habitat for WSCT, but current WSCT population estimates are cause for concern

[1177] During the hearing, Benga stated that Gold Creek is “not good habitat” for WSCT, despite its designation as critical habitat in the 2019 Recovery Strategy-Action Plan (CIAR 848, PDF p. 57). Benga’s opinion was that the population in Gold Creek had low resilience given existing habitat stressors, particularly the cooler stream temperatures (due to the large contribution of flows from Caudron Creek), which affect overall productivity of the system, and existing habitat fragmentation, which prevents portions of the WSCT population from utilizing higher-productivity habitats. Benga also stated that there are serious deficiencies in Gold Creek related to overwintering habitat and stream connectivity that need to be urgently repaired.

[1178] We do not agree with the characterization of Gold Creek as “not good habitat” when we consider the Gold Creek population compared with other populations in Alberta.

[1179] In 2013, the Alberta Westslope Cutthroat Trout Recovery Team recommended the use of the AEP Fish Sustainability Index to help guide the recovery of the species in Alberta. Using this tool, this team determined the adult density in the Gold Creek watershed in 2013 to be “low,” which is higher than the majority of Alberta populations, which were identified as “very low.” Due to adult density and habitat degradation from various human activities, the team described the Gold Creek watershed as having a “very high” need for habitat protection. In 2016, COSEWIC identified Gold Creek as one of ten WSCT populations in Alberta, outside of national parks, with enough individuals to be considered viable in the long term.

[1180] DFO acknowledged that COSEWIC had recognized Gold Creek as one of the ten populations in Alberta with potential long-term viability. However, DFO indicated that the COSEWIC assessment of the WSCT population (1818 adults, 788 to 3257 range at 95 per cent confidence interval) is toward the low end of viability (1600 to 4200) and the current habitat extent (16.7 km) may be low, considering the range of uncertainty. It stated that for populations below the abundance and habitat values needed for population viability, long-term survival is in jeopardy and would be exacerbated further with additional harm. DFO confirmed that any activities that may jeopardize this population would not align with the population and distribution objectives of the 2019 Recovery Strategy-Action Plan.

[1181] The Coalition’s expert, Mr. L. Fitch, noted that AEP had identified Gold Creek as the last major tributary of the Crowsnest River that still contains pure-strain WSCT. He said that the fact Gold Creek is inhabited by the sixth-largest WSCT population in Alberta suggests that the current habitat of Gold Creek

is clearly capable of supporting a large and robust WSCT population. However, we note some troubling uncertainties about the current population estimates for WSCT in both Gold Creek and Blairmore Creek.

[1182] Benga conducted fish inventory surveys from 2014 to 2016 in the study area, employing a suite of standard protocols, including active capture (e.g., electrofishing) and direct visual observation (e.g., snorkel surveys). The goal of these surveys was to characterize fish species composition, distribution, and abundance using a mark-recapture assessment technique. Given the low number of recaptures during the mark-recapture population assessment, Benga utilized the Chapman adjusted-population estimator to determine fish densities. To estimate the total number of fish (subadult and adult) for the WSCT populations in upper Gold and Blairmore Creeks, mark-and-recapture fish densities (fish per square metre) calculated from the sample sites were applied to the total reach length.

[1183] In Gold Creek, fish densities were much lower in the lower reaches relative to the upper reaches, although fish captured in the lower reaches were generally larger than those captured in the upper reaches. Using a blend of methods (i.e., both angling and electrofishing) to ensure all habitat types were sampled during the surveys, Benga estimated the total population of WSCT at 1625 individuals.

[1184] In Blairmore Creek, fish densities based on electrofishing and snorkel surveys were higher in the upper reaches of Blairmore Creek compared with the lower reaches, but were dominated by smaller fish. The total population of WSCT in Blairmore Creek based on the calculated fish densities was 3210 individuals. Benga noted that it deployed non-invasive snorkel surveys to avoid causing undue stress to fish, after its initial sampling conducted in 2016.

[1185] Benga did not initially provide confidence intervals for its mark-recapture population estimates. In response to questioning at the hearing, Benga provided an updated population estimate for Gold and Blairmore Creeks, along with 95 per cent confidence intervals. The updated total WSCT population estimate in Gold Creek was 1613 individuals, with a 95 per cent confidence interval of 485 to 2741. For Blairmore Creek, the updated population estimate was 3162 individuals, with a 95 per cent confidence interval of 1857 to 4467 individuals. Benga confirmed that obtaining an accurate population estimate in Gold and Blairmore Creeks was difficult and that its population estimates were, at best, not statistically significant.

[1186] To establish a more reliable baseline population estimate of WSCT, Benga continued to conduct annual fish surveys after 2016. Benga stated that its population assessments showed a declining trend in both creeks every year from 2016 up to and including 2020, with counts ranging from more than 100 in 2016 to fewer than 20 in 2019. The data show a large decrease in the population of both creeks after 2016. Several participants reported observing high turbidity in Gold Creek in 2015 resulting from the mobilization of coal fines from legacy coal-mining operations, which they suggested may have been a cause of the WSCT population decline in Gold Creek.

[1187] Mr. J. Rennie, a local fly fisherman who provided his personal catch rates from Gold Creek for 1993 through 2020, noted that rates declined dramatically following the 2015 spill. He stated that his catch data showed the spill killed 95 per cent of the trout in two study areas 6 km downstream from Caudron Creek. Because Benga's fish surveys were carried out after the 2015 spill, its surveys downstream of Caudron Creek measured only the survivors of the spill. Mr. Rennie suggested that a

number of spoil piles along the east side of Grassy Mountain are at a steep angle, and could easily be disturbed by future mining activity. CPAWS suggested that a major collapse in WSCT numbers occurred after Benga engaged in drilling on Grassy Mountain. CPAWS suggested that we conclude that Benga's core drilling program and associated roadwork in 2015 caused the 2015 incident in Gold Creek.

[1188] The Coalition stated that Benga did not acknowledge that one primary reason for declines in Gold Creek trout numbers is that the 2015 event allowed legacy mine spoil to spill into the stream, turning the stream black to the confluence with the Crowsnest River and possibly causing either a large fish kill or interfering with successful spawning for several years. The Coalition noted that Benga was the property owner at the time of the spill, and stated that the spill makes clear that the risk to aquatic resources posed by legacy and future coal-mining activities cannot be mitigated.

[1189] Benga indicated that it did not believe any of its ongoing activities could have contributed to this event, or the observed population declines. Benga stated that the AER's *Investigation Summary Report* relating to the Gold Creek sedimentation incident in 2015 found that the incident followed a heavy rainfall event and was the result of surface water runoff that flowed off the historical disturbance area on Grassy Mountain.

[1190] When questioned about the potential causes of the population declines, Benga hypothesized that natural stressors in each system may be contributing to population variation, which appeared to be more pronounced in Gold Creek than in Blairmore Creek. Benga stated that unreclaimed mining disturbances on Grassy Mountain are an existing and continuing threat to Gold Creek and WSCT, with or without the project. Benga stated that, without action, erosion and sedimentation events would continue.

[1191] DFO concluded that the limited time period of baseline data collection for WSCT and variability among methods creates uncertainty in population estimates and Benga's ability to effectively monitor population status over time. DFO stated that understanding the limitations of data collection and estimates is critical for evaluating impacts of this scale on a species at risk.

[1192] We question whether the baseline population data collected by Benga are sufficient. We find the small sample size achieved during the mark-recapture population assessment in both creeks during the baseline sampling, and the large variation in the 95 per cent confidence intervals, even after five years of data collection, highlight the significant uncertainty in the population sizes of WSCT in Gold and Blairmore Creeks. The additional information that Benga provided in response to an undertaking during the hearing underscored the variability in the population estimate for Gold Creek because of the large confidence intervals.

[1193] We agree that accurate population estimates are essential to determining the resilience of the population during the various stages of mine development, and also to demonstrating through monitoring and adaptive management measures whether the WSCT population is increasing or declining, and whether any changes in the population are caused by the project.

[1194] Finally, we are concerned by recent trends in the local populations of WSCT in Gold and Blairmore Creeks. These population declines exemplify the sensitivity and precarious situation faced by WSCT populations isolated within headwater streams in Alberta. We take this into consideration in

determining whether we are confident that Benga's proposed mitigation measures can avoid significant adverse environmental effects on WSCT.

Benga assessed a range of pathways of effects on WSCT

[1195] Benga conducted an aquatic ecological effects assessment to identify linkages between project activities and the environment and determine the residual effects of the project on fish and fish habitat. Benga presented this assessment in its First Addendum. Benga determined that the project would affect aquatic habitat and riparian habitat of WSCT through construction and operation of the project, including waste rock placement, water management pond placement, and pit excavation. In addition, Benga identified changes to hydrology resulting in the alteration of Gold and Blairmore Creeks that can affect WSCT habitat quantity, suitability, or connectivity through the implementation of the water management plan and mine operations. Benga also identified a number of secondary effects pathways that it concluded would have no residual effect or significant impact on WSCT or their habitats. Benga stated that its pathways analysis approach is similar to the "pathways of effects" approach used by DFO.

[1196] Benga concluded that several pathways of effects had no residual effect on WSCT or their habitat. In particular, Benga determined there would be no residual effects on WSCT from: changes to surface water, sediment or soil quality, which can affect WSCT habitat quantity or suitability; release or spills of hazardous substances; changes in recreational access to fish-bearing reaches of Gold and Blairmore Creeks; and blasting activities potentially causing direct mortality of WSCT.

[1197] In addition to the pathways that Benga determined would result in direct effects on WSCT, Benga identified several pathways that would result in a secondary linkage to effects on WSCT. These secondary pathways included changes in

- water temperature, which may cause changes to the thermal regime;
- WSCT food supply in Gold and Blairmore Creeks, which can directly affect WSCT as well as habitat quantity or suitability;
- sediment supply, transport mechanisms, and sediment yield;
- surface water quality, which can affect WSCT habitat quantity and suitability and/or survival and reproduction, from surface water runoff, surface, and groundwater interactions and discharge of mine influenced water; and
- calcite precipitation, which may result from surface runoff from the project footprint and discharge of treated effluent.

[1198] Benga determined that effect pathways involving a secondary linkage were likely to be negligible or not significant.

[1199] Benga used the hydraulic habitat component of the instream flow incremental methodology in its instream flow assessment to predict the effect of flow changes on fish habitat in the two streams. This approach is consistent with the British Columbia instream flow methodology and is supported by DFO for projects of similar magnitude and complexity. The instream flow methodology uses models to simulate

habitat quantity and quality over a range of stream flows and allows various scenarios to be compared and evaluated simultaneously and iteratively.

[1200] The hydraulic habitat component of the instream flow methodology links a traditional hydraulic engineering model to fish habitat suitability criteria curves based on water depth, velocity, and bed particle size. In the instream flow methodology, this model component is called the physical habitat simulation. Instead of this model, Benga used System for Environmental Flow Analysis software, which it suggested was the most advanced tool for hydraulic habitat analysis. Both are programs that build hydraulic habitat models to determine how fish habitat quantity and quality vary as functions of stream discharge. Benga considered a number of habitat suitability curves developed for other cutthroat trout that could be applicable to WSCT in the project area, and applied the habitat suitability curves developed by Golder and the British Columbia Ministry of Environment for key life stages of these fish.

[1201] DFO described the Grassy Mountain project as unique in that it was one of the first projects reviewed within the Prairies and Ontario region with impacts of this magnitude on an aquatic species at risk. They emphasized repeatedly throughout the hearing that WSCT are a sensitive species, and that the habitat surrounding the project is of high importance. It is therefore important to have confidence that significant adverse impacts from the project on WSCT can be effectively mitigated.

[1202] DFO stated that Benga identified pathways of effects that were generally aligned with DFO's pathways of effects guidance. However, DFO also stated that the significance framework Benga applied to those effect pathways, while appropriate in a more typical setting, fails to reflect the sensitivity of isolated populations of WSCT with unique genetic pools that are critical to the species survival and recovery as a whole. While the pathways of effects were well defined, the methods, analysis, and conclusions for many of the pathways have limitations and likely underestimate the effects on WSCT.

[1203] DFO indicated that there is too much uncertainty to date to support Benga's conclusions. The quantification of impacts presented is incomplete, and the ability of the mitigation measures and offsetting plan to counterbalance the potential impacts of the project remains uncertain. Benga did not assess any impacts on fish species downstream of the aquatic LSA. However, as we discuss in the surface water quality chapter, project effects could extend downstream of the aquatic LSA as far as the Oldman Reservoir.

The project will result in direct loss of critical habitat for WSCT

[1204] Benga characterized the biophysical habitat of Gold Creek as dominated by cobble with sparse gravel patches and boulders. Only small portions of the substrates showed any embeddedness, with the exception of the middle reaches, which contained varying amounts of coal sediments and fines, likely from coal outcrops or legacy mining. Benga identified groundwater inputs along both the east and west slopes of Gold Creek at various locations and identified base flows as important sources of water during low-flow months. It identified two permanent and one seasonal barrier within Gold Creek that limited migration of WSCT out of Gold Creek into the Crowsnest River.

[1205] Benga indicated that the pool-riffle mesohabitat type was the most common morphology in Gold Creek, with the majority of the pools being tertiary (less than 50 per cent of the wetted width). Benga concluded through its overwintering habitat survey that primary deep pool habitat was extremely limited,

but it indicated it may not have observed all overwintering habitat use because a large portion of Gold Creek was frozen during the assessments. Spawning habitat within Gold Creek was not geographically concentrated but spread throughout reaches based on habitat availability.

[1206] Benga predicted that the project's direct pathways of effects, after mitigation, would result in the destruction of 26 947 square metres (m²) of aquatic habitat in the LSA, comprising 1796 m² in fish-frequented aquatic habitat (758 m² in Gold Creek and 1038 m² in Blairmore Creek) and 25 251 m² in non-fish frequented aquatic habitat (5221 m² in Gold Creek and 19 929 m² in Blairmore Creek). Benga also predicted that the project, after mitigation, would result in the destruction or harmful alteration of 584 263 m² of riparian habitat in the LSA, within the defined setbacks established by Benga (50 m buffers on Gold Creek and Blairmore Creek mainstems, 30 m buffers on fish-frequented tributaries, and 20 m buffers on non-fish frequented tributaries). Of this total, 442 433 m² are located in the Blairmore Creek watershed and 141 830 m² in the Gold Creek watershed. Based on the 2014 Recovery Strategy, Benga calculated that the project would result in the loss of 758 m² of aquatic critical habitat and 18 868 m² of riparian critical habitat in the Gold Creek watershed.

[1207] To assess the impacts on critical habitat resulting from changes to hydrology, Benga used the instream flow assessment and habitat suitability curves to determine the area-weighted suitability in a defined reach of Gold and Blairmore Creeks, based on a range of expected flows (modelled as average, dry and extreme dry periods) and the proportion of habitat types present. The amount of physical habitat area can be predicted for a range or time-series of flows (e.g., monthly flow values or across life stages). Benga's System for Environmental Flow Analysis model was then used to determine the change in area-weighted suitability as a result of the predicted changes in flows from development and operation of the mine. The predicted changes to critical habitat as a result of development and operation vary depending on the hydrological condition used in the model, and are exacerbated under the low and extreme-low-flow scenarios.

[1208] As stated earlier, in 2019 DFO released the 2019 Recovery Strategy-Action Plan while review of this project was underway. This update included a revised definition of critical habitat for WSCT in the project area. DFO indicated that the key difference between the current extent of critical habitat, and that identified at the time of the project's environmental impact statement, was the inclusion of riparian and headwater habitat. Riparian habitat within 30 m of critical aquatic habitat was designated as critical habitat along with headwater habitats that support the features, functions, and attributes defined in the 2019 Recovery Strategy-Action Plan. The 2019 Recovery Strategy-Action Plan also indicated that habitats with high potential for re-establishment of WSCT may be identified as critical habitat in the future.

[1209] DFO stated that under the 2019 Recovery Strategy-Action Plan, critical habitat for WSCT within the LSA now includes approximately 16.7 km of the Gold Creek mainstem, and the tributaries of Gold Creek. The population of WSCT in Blairmore Creek was identified as being only "near pure" (95 to 99 per cent genetically pure) and was therefore not afforded protection under *SARA*, and Blairmore Creek was not identified as critical habitat. However, during the hearing DFO indicated that, given the importance of Blairmore Creek to the potential recovery of WSCT, it would apply the 30 m critical

habitat designation associated with riparian habitats to Blairmore Creek in its calculation of impacts resulting from the project.

[1210] DFO expressed concern that alteration and destruction of habitat in the Gold Creek and Blairmore Creek watersheds would compromise the survival and recovery of WSCT. DFO stated that authorizing the destruction of the critical habitat in the Gold Creek watershed would require robust scientific evidence that such destruction would not jeopardize the survival or recovery of the species. DFO stated that Benga's riparian quality classification system resulted in residual effects only for some medium- and high-quality habitat, and Benga's methodology for quantifying impacts did not acknowledge the ecological context and sensitivity of an isolated population of a species at risk with poor resiliency.

[1211] Several other participants raised similar concerns about the potential for the project to affect WSCT critical habitat. For example, the Timberwolf Wilderness Society stated, "A part of that critical habitat will be destroyed by Benga's mine, inevitably and unavoidably, according to Benga's own evidence. Neither Benga nor DFO can just invent new replacement critical habitat to offset that which will be destroyed, because it's not identified in the recovery strategy or action plan, and because there is no plan to replace the water removed" (CIAR 1346, PDF p. 54).

[1212] DFO stated that, as of the hearing, Benga had not characterized the full extent of critical habitat losses due to the project to reflect the updated 2019 Recovery Strategy-Action Plan. DFO confirmed that the predicted losses of critical habitat that Benga calculated in 2016 were considerably lower than the impacts that would be calculated using the updated 2019 Recovery Strategy-Action Plan. DFO suggested to Benga that an updated calculation of impacts on critical habitat was required to fully understand the impacts on WSCT habitat, as well as to assess proposed mitigation and offsetting measures. DFO recommended Benga undertake a detailed analysis of the ability of the riparian areas to support the features, functions, and attributes of critical habitat for Gold Creek, as well as Blairmore Creek, given its potential to support recovery objectives in the 2019 Recovery Strategy-Action Plan. Benga confirmed that it had not updated its estimates of project impacts on WSCT critical habitat since the 2019 Recovery Strategy-Action Plan was released.

[1213] In its final argument, Benga rejected DFO's assertion that it should have used the updated 2019 Recovery Strategy-Action Plan to update its aquatics assessment, accurately define the residual impacts of the project, and update the calculation of loss of critical habitat. Benga documented the changes in DFO staff over the course of the review process, and stated that "The current DFO staff assigned to the project had several earlier opportunities to advise Benga of their concerns [regarding updated critical habitat impacts]. The DFO issued IRs [information requests] to Benga on October 24, 2019, shortly before the final RS-AP [Recovery Strategy-Action Plan] for WSCT was issued in December. DFO witness Ms. Phalen prepared these IRs as technical assessor and noted in her oral evidence at the hearing that a draft version of the RS-AP for WSCT was available at that time. However, these IRs did not request that Benga update its critical habitat assessment" (CIAR 962, PDF pp. 101–102).

[1214] The information requests submitted by DFO during the review process did not explicitly instruct Benga to update its assessment of impacts on critical habitat after the release of the updated 2019 Recovery Strategy-Action Plan. However, Benga stated throughout the review process that it was aware of the importance of WSCT and their critical habitat, and it proposed offsetting the loss of critical habitat

to establish a sustainable population of WSCT in Gold Creek. Given that it had previously estimated project impacts to critical habitat, we believe that Benga was fully aware of the consequences of the updated 2019 Recovery Strategy-Action Plan.

[1215] Given Benga's awareness of the expanded definition of critical habitat within the project area in the updated 2019 Recovery Strategy-Action Plan, and the corresponding increase in critical habitat that the project will affect, it would have been helpful for Benga to have updated its calculation of project impacts on WSCT critical habitat prior to the hearing. An updated assessment of the project impacts on critical habitat would have helped us assess the significance of effects resulting from the proposed mine.

Habitat loss assessment from reductions in flows was inadequate

[1216] One primary pathway that Benga predicted would have residual effects on habitat was through changes in stream flows. We discussed the projected impacts of the project on flows in Gold and Blairmore Creeks in the chapter on surface water quantity and flow. To summarize, Benga evaluated the impacts of the project on surface water quantity with a hydrologic model using GoldSim, a graphical, object-oriented interface for carrying out spreadsheet calculations Benga used to define the relevant physical hydrologic processes. The model calculated monthly surface runoff volumes based on the annual precipitation, the average monthly runoff distribution, and runoff coefficients. It computed monthly precipitation by distributing the annual precipitation over the historical average monthly runoff percentage, and it computed daily precipitation by dividing the monthly precipitation equally over the number of days in each month. Benga's daily precipitation values, which informed its flow projections, were therefore based on a simple computation using the year-to-year average annual precipitation.

[1217] Benga's hydrology modelling predicted a small decrease in overall flows for Gold Creek, with monthly reductions of between 3 to 7 per cent up to a maximum of 10.4 per cent. Benga attributed the Gold Creek decrease in flows mainly to mine operations and diversion of selenium-enriched contact water from Gold Creek to Blairmore Creek. Benga stated that this "minor" reduction in flows would result in an overall reduction in habitat availability in Gold Creek (CIAR 876, PDF p. 193). Benga's estimated flow changes include surface flow, interflow, and base flow. Benga used the calculated changes in stream flow to determine the resulting change in area weighted suitability habitat, which we listed in the last section.

[1218] Under the average flow scenario for the project, Benga predicted that the changes in hydrology would result in the following changes in area-weighted suitability in Gold Creek: -27 m^2 of spawning/incubation habitat, -288 m^2 of adult holding habitat, -205 m^2 of juvenile rearing habitat, $+96 \text{ m}^2$ of fry rearing habitat, and -10 m^2 of overwintering habitat. In Blairmore Creek, Benga predicted that the changes in stream flow would result in the following changes to area-weighted suitability: $+18 \text{ m}^2$ of spawning/incubation habitat, $+192 \text{ m}^2$ of adult holding habitat, $+155 \text{ m}^2$ of juvenile rearing habitat, -121 m^2 of fry rearing habitat, and $+12 \text{ m}^2$ of overwintering habitat.

[1219] DFO identified considerable uncertainty with Benga's modelling due to the lack of incorporation of a representative range of monthly and seasonal flow variability and Benga's reliance on annual precipitation inputs and monthly distribution coefficients. DFO indicated the model has a high level of uncertainty on a monthly basis, particularly during low-flow conditions when WSCT are most susceptible. DFO identified several concerns with the GoldSim model that Benga used to calculate habitat losses resulting from changes in hydrology. DFO considered the simulations of future flow to be

highly uncertain, and the conclusions drawn from this analysis were therefore highly uncertain. They suggested that this modelling approach did not have the resolution to capture seasonal variation or assess impacts at the mesohabitat scale, which is what DFO recommended should be used to conduct fish habitat assessments.

[1220] Benga confirmed during the hearing that the project would result in a reduction in base flows in Gold Creek. Benga confirmed that this reduction would affect overwintering habitat in Gold Creek, specifically for smaller overwintering pools utilized during various life stages of WSCT. Although Benga characterized the likely impact as small, it did describe existing overwintering habitat in Gold Creek as limited. Benga conducted a separate groundwater modelling assessment to estimate specific changes in groundwater flow regimes. Benga did not explain how it integrated the groundwater and surface water model predictions into a single estimate of predicted changes in Gold Creek flows during low-flow periods when creek flows are dominated by base flow.

[1221] DFO stated that Benga evaluated the impacts of changes in flow using habitat suitability curves, but the analysis did not account for uncertainty, and Benga's monitoring plans did not demonstrate how to validate habitat suitability curves. DFO recommended that Benga define the low-flow (ecosystem baseflow) thresholds required to maintain habitat functionality, and that Benga describe how flow reductions below set thresholds will be mitigated, particularly under natural low-flow conditions.

[1222] DFO also stated that Benga only identified residual effects on habitat with a modelled change in area weighted suitability of 10 per cent or more. DFO suggested that, although Benga based this approach on the *Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada* (2013), Benga incorrectly interpreted this report in two ways. First, Benga suggested this report supports an allowable hydrologic alteration of 10 per cent of monthly flows. However, DFO submitted that the 10 per cent value refers to alterations in instantaneous flows. Applying a 10 per cent change to monthly flows would dampen the changes and their effects. Furthermore, DFO submitted that this value represents estimated thresholds at which impacts have a lower probability of causing effects, which is not synonymous with no residual effects. Second, Benga equated the 10 per cent change in instantaneous flow with a 10 per cent change in habitat area. DFO submitted that these metrics are not equivalent, and this decision introduced more dampening of potential changes in habitat. DFO would consider any loss in critical habitat area as a result of changes in flow a residual effect.

[1223] DFO also stated that the report cautioned that "the advice within this report is not necessarily recommended for direct application to intermittent, seasonal, or ephemeral streams or rivers." DFO reiterated that this may not be an appropriate threshold to apply due to the nature of these systems. DFO concluded that Benga's modelling approach represented a limited and insufficient framework for assessing the impacts on WSCT and its habitat. DFO stated that "impacts to WSCT due to changes in hydrology are subject to significant uncertainty and have likely been underestimated" (CIAR 1342, PDF p. 10).

[1224] The Timberwolf Wilderness Society's expert, Mr. D. Mayhood, stated that because Benga estimated the average annual decline in base flows in Gold Creek, the maximum instantaneous reductions in base flow throughout the year will exceed the predicted average declines. He suggested that these changes in instantaneous flows affect habitat available for WSCT. Mr. Mayhood was even more

concerned about instantaneous reductions in flows during the winter minimum flow period, which could result in some stream reaches with only interstitial flows, making the creek appear dry. He stated that the WSCT population in Gold Creek is already “vulnerable to existing low winter water flows” and “any reduction in winter flows” could be “expected to further reduce carrying capacity for Gold Creek’s WSCT by rendering parts of critical habitat unsuitable” (CIAR 907, PDF p. 18).

[1225] Benga indicated that it would endeavour to expose the differences in philosophy with respect to the models used in calculating changes in flows. However, during the hearing, Benga provided no additional evidence on this topic to respond to DFO’s concerns, nor did it cross-examine DFO on this issue. Benga also did not address DFO’s concerns in its closing arguments. In the surface water quantity and flow chapter, we discuss uncertainties in Benga’s modelling approach for predicting stream flows.

[1226] We agree with DFO’s criticism of Benga’s hydrology modelling, and find that Benga’s modelling and its projections of changes to monthly flows were inadequate to estimate impacts of the project on flows in Blairmore and Gold Creeks, particularly in periods of low flow, or to support its assessment of changes to area weighted suitability habitat. This lack of modelling detail increases the level of uncertainty in estimates of the project’s impacts on the habitat of WSCT in Blairmore Creek and Gold Creek. Benga compounded this uncertainty by failing to provide changes to instantaneous flows. We find that with the uncertainty and the potential for underestimating impacts on fish habitat, we do not have confidence in Benga’s assessment of alterations to flows and how this would impact WSCT critical habitat.

Contaminants released from the project could adversely affect WSCT

[1227] Habitat loss is not the only pathway for the project to potentially affect WSCT. As we discuss in the chapter on surface water quality, the project will release into Blairmore and Gold Creeks a variety of contaminants of potential concern that could affect WSCT.

Calcite

[1228] We briefly discuss the potential for calcite formation in the creeks downstream of the project in the surface water quality chapter, but we explore it in more detail here. Benga stated that calcite precipitation is an observed effect in creeks where contact waters containing dissolved calcium carbonate are released from the mine and equilibrate with the atmosphere. Equilibration results in off-gassing of carbon dioxide which, in turn, decreases acidity and allows calcite to precipitate.

[1229] Benga stated that contact water from the project could contain dissolved calcium carbonate under carbon dioxide partial pressures that exceed that of the atmosphere. As a result, calcite precipitation could occur as effluent water emerges from the saturated backfill zones and carbon dioxide off-gasses, which could affect WSCT habitat quantity and suitability. Benga also acknowledged this effect could be witnessed in runoff from the mine site that will not be managed as contact water. Calcite precipitation could occur as a result of the release of this runoff water from sedimentation ponds.

[1230] Benga stated that calcite precipitation could occur over several kilometres of streams, and result in cementation on the substrates of streambeds. The precipitation of calcite in Gold and Blairmore Creeks could reduce benthic invertebrate production by covering cobble and gravel beds, limiting the productivity of the benthic invertebrate habitat that provides the primary food source for WSCT.

The precipitation of calcite on WSCT spawning substrates could also limit the quantity and quality of spawning habitats.

[1231] Benga determined that baseline water chemistry in Gold and Blairmore Creeks included calcium and carbonate at concentrations that exceed the theoretical level at which calcite can precipitate. Benga stated that, because the natural waters appear to have no capacity to prevent calcite precipitation in streams by dilution, management of the potential for calcite precipitation needs to be considered for the project. We note that this suggests the potential currently exists for calcite precipitation in background conditions, and would only increase with the release of water from sedimentation ponds and saturated backfill zones. Benga confirmed that it is not aware of any instream treatments that can be applied to reverse calcite deposited on substrates, and areas of concretion are not reversible.

[1232] Given that baseline chemistry conditions required to precipitate calcite currently exist in Gold and Blairmore Creeks, Benga concluded the potential for calcite precipitation was low as its assessments did not identify any calcite precipitation in either creek. However, as discussed in the chapter on surface water quality, Benga predicted hardness levels would rise in Blairmore Creek as a result of the project. Benga confirmed the risk of instream calcite precipitation in Blairmore Creek rises with hardness.

[1233] Benga indicated that it would construct a cascade from the discharge point of the saturated backfill zone, over which effluent water would be allowed to flow. This would promote carbon dioxide off-gassing and atmospheric equilibration and reduce the potential for calcite precipitation. Beyond the cascade, Benga confirmed that it did not plan to implement any water treatment to relieve calcite precipitation. Instead, it would monitor effluent water chemistry to determine the likelihood of calcite precipitation, and visually monitor calcite in the downstream creeks in accordance with the draft aquatics monitoring plan. If the water chemistry changes to promote calcite precipitation, or if calcite is observed to be precipitating instream, Benga would then redirect water leaving the saturated backfill zone to the raw water pond, or recirculate it to the saturated backfill zone or a gravel-bed reactor for additional treatment. Should monitoring trends indicate additional mechanical treatment for specific water quality parameters is required, Benga would construct an appropriate water treatment plant.

[1234] Benga did not explain how recirculating effluent from the saturated backfill zone would reduce the risk of calcite formation downstream. We also note in the chapter on surface water quality that Benga's contingency plans for water treatment lack adequate detail and assessment. Trout Unlimited's expert, Ms. L. Peterson, noted that calcite deposition in streams affects habitat for fish that require loose, unconsolidated gravels. This applies to WSCT because the loss of unconsolidated gravels could result in catastrophic losses at all life stages of this species. The Livingstone Landowners Group's expert, Dr. G. McKenna, warned about the potential for calcite minerals to precipitate and cement in the streams, a problem that is hard to stop once it starts. The Ktunaxa Nation's expert, Mr. J. Sinclair, stated that, based on his experience in the Elk Valley, preventing calcite deposition in the first place is more cost-efficient and environmentally sensible than trying to remove calcite once it has been deposited.

[1235] DFO indicated that the effects of calcite precipitation on WSCT habitat are highly uncertain and potentially significant, given the isolated nature of the populations and the potential extent of downstream effects. DFO was of the view that the conceptual level of Benga's assessment of effects and mitigation leaves too much uncertainty. DFO stated that Benga's conclusion—that the potential for calcite

precipitation is low because no calcite precipitate was observed in Gold and Blairmore Creeks—is not well-supported, as neither creek currently receives water significantly affected by waste rock.

[1236] DFO stated that the potential for waste rock storage to result in calcite formation in WSCT habitat is underestimated. DFO indicated a comprehensive assessment of the potential effects and mitigation measures, including testing and validation, should be developed and proved effective. Without it, monitoring would only confirm that unaccounted for and potentially irreversible impacts on WSCT habitat has occurred. A significant length of time may pass before effects are evident. Any residual effects should be accounted for in the final assessment of impacts on WSCT, and required offsetting should be described in combination with other residual effects in the context of overall potential effects on WSCT survival and recovery.

[1237] DFO also stated that a comprehensive monitoring and adaptive management program would need to be developed and included in the aquatic monitoring plan and follow-up programs. The program would define thresholds and triggers for action to prevent effects beyond those predicted. DFO affirmed that the only effective method of preventing impacts from calcite is to avoid precipitation in fish-bearing waters.

[1238] When asked whether hardness or calcification could result in a cascading effect on Benga’s proposed site-specific water quality objective (discussed in the chapter on surface water quality), Benga’s expert, Mr. M. Davies, agreed that it could. This suggests that if Benga had to address calcification, it might need to reduce sulphates, which in turn would affect selenium levels.

[1239] Given that the baseline water chemistry in Blairmore Creek favours the formation of calcite prior to any mine-related influence, and that Benga acknowledges the project would increase hardness in Blairmore Creek, we find that calcite would likely form and cause harm to WSCT habitat in Blairmore Creek. The concretion of substrates would likely reduce benthic invertebrate productivity, habitat suitability, and spawning opportunities. The potential for calcite deposition in Gold Creek would be less likely.

[1240] While Benga provided a monitoring plan to identify calcite precipitation during the operation of the mine, it acknowledged that once precipitation was discovered, there is no known effective mitigation measure to remove areas of concretion. We therefore find that once calcite precipitated onto substrates in the creeks, it would remain in place. We do not have confidence that Benga’s assessment of this risk supports the population and distribution objectives in the 2019 Recovery Strategy-Action Plan.

Other contaminants

[1241] As noted in the chapter on surface water quality, we find that selenium released from the project is likely to cause significant adverse effects on surface water quality. By extension, this would have an adverse impact on WSCT. Although that discussion is not repeated here, we address that finding in the concluding section of this chapter.

[1242] Benga acknowledged that the project would result in large increases in sulphate concentrations and hardness levels in Blairmore Creek, compared with baseline measurements. In the surface water quality chapter, we noted that this increase in sulphate, along with increased hardness, may shift the community structure of algae, zooplankton, and benthic invertebrates and reduce habitat suitability for resident fish species, while increasing osmotic stress on aquatic species. The increased osmotic stress

resulting from increased sulphates and hardness, coupled with the other proposed changes in water quality, could weaken the resilience of aquatic species in Blairmore Creek.

[1243] Benga confirmed that the most sensitive life stage to increased sulphate levels was the egg/fry stage between late June and August. We note that this period corresponds to the timing of seasonal low flows following the spring freshet, which would result in less instream dilution of sulphate and hardness ions. Benga acknowledged that it had no plan to mitigate releases of sulphates to, or hardness levels in, Blairmore Creek.

[1244] DFO advised during the hearing that the *Fisheries Act* prohibits the deposition of substances deleterious to fish into fish-bearing waters unless authorized by federal regulations, and it pointed out that this prohibition would apply to the project. DFO indicated that they had been supporting the development of the Coal Mining Effluent Regulations that would establish allowable limits for contaminant concentrations in effluent from coal mines. But this regulation is not finalized and not yet in force. We discuss this regulation and its application to the project in the chapter on surface water quality.

[1245] In the surface water quality chapter we find the combined project effects on Blairmore Creek increase the risks to surface water quality, and by extension WSCT and its habitat. Benga has not adequately assessed these risks or planned to mitigate them. We are not confident that Benga's proposed mitigation measures would avoid significant adverse impacts on WSCT.

[1246] Bull trout are another native species found in the lower portions of the Crowsnest River, below Lundbreck Falls, and are present in the Oldman Reservoir. Bull trout are classified as threatened under Alberta's *Wildlife Act* and *SARA*. Benga did not assess any potential effects on bull trout as a result of the project. Nor did Benga consider bull trout to be a valued component in the EIA. While we received little information on bull trout during the review, some participants at the hearing noted that important bull trout habitat can be found below Lundbreck Falls in the Crowsnest River. Some participants at the hearing also expressed concern that bull trout populations would be further compromised by the project.

[1247] Potential effects on bull trout and their critical habitat downstream in the Crowsnest River or the Oldman Reservoir could result from predicted changes in water quality resulting from the project. As noted in the chapter on surface water quality, we find that project-related selenium bioaccumulation in egg/ovary tissues of fish inhabiting the Oldman Reservoir, including bull trout, may occur as a result of selenium loadings from the project. However, we do not have enough evidence to fully quantify the risk to this species.

Other pathways of effects could affect WSCT and their habitat

[1248] As discussed earlier, Benga identified a number of other pathways of effects that could affect WSCT and their habitat. In this section, we explore three such pathways: thermal regulation in the streams, food supply for WSCT, and blasting.

Instream thermal regulation

[1249] Benga modelled water temperature for Gold and Blairmore Creeks over the lifespan of the project from pre-construction to post-closure (2017 to 2099) to determine how, during each phase of the mine, maximum monthly changes in forecasted flow could affect key life stages of WSCT. It calibrated the model during baseline conditions by collecting continuous water temperature and hydrological data throughout Gold and Blairmore Creeks, as well as representative meteorological data, and calibrating as necessary until predicted and measured stream temperatures were in reasonable agreement.

[1250] Benga estimated future changes in water temperature by taking the difference between these baseline temperature data, and predicted water temperature using estimated flow changes for each phase of the mine. It forecast these flow changes at specified model nodes on Blairmore and Gold Creeks, and then modelled the hydraulic changes necessary to calculate the changes in both area weighted suitability habitat and water temperature. To determine how predicted changes in water temperature may affect each life stage of WSCT, Benga compared predicted changes in water temperature relative to observed water temperatures against literature-based optimal temperature ranges for each life stage.

[1251] In the Eighth Addendum, Benga stated that the predicted changes in temperature are based on these hydraulic changes alone, and that it did not explicitly model any spatial and temporal variability of water temperature along Gold and Blairmore Creeks that would arise from individual water management activities (such as releases from sedimentation ponds). However, in the Tenth Addendum, Benga contradicted this statement when it stated that “the model does account for the discharge contributions from the project’s water management infrastructure developments; consequently, providing a reasonable prediction of temperature fluctuations” (CIAR 251, Package 5, PDF p. 122).

[1252] DFO commented on Benga’s use of stream flows as the primary predictor of temperature changes instream. While they agreed this was a valid variable affecting stream temperatures, DFO noted that other relevant variables, such as the loss of riparian habitat and upland vegetation and the influence of sedimentation ponds, were not included in the predictive model, despite Benga’s acknowledgement that they can alter instream temperature. DFO recommended that Benga update its model and its residual effects assessment. DFO pointed out that Benga did not identify the temperature at which mitigation measures would be implemented, or describe which mitigation measures could adjust stream temperatures, given that the cause could result from multiple factors over a large spatial scale.

[1253] The Coalition’s expert, Dr. J. Fennell, indicated that under various climate change scenarios, temperature exceedances in Blairmore Creek above the incipient lethal limit could occur more frequently due to warmer ambient temperatures, prolonged heat waves and drought periods, and a reduction in stream flows resulting from the mine development. These increases in temperature could create thermal barriers or areas of water temperatures above the incipient lethal limit and affect dissolved oxygen concentrations, creating a cumulative effect on WSCT.

[1254] Benga acknowledged that the reduction in base flow predicted as a result of the project may affect overwintering habitat by increasing the freezing of important overwintering habitat, or by increasing the formation of frazil ice. Benga stated that stream temperatures in overwintering habitats should be monitored due to potential changes in base flow and the resulting impacts on ice formation as a result of changes in stream temperature.

[1255] We agree that the use of stream flows as the primary, or only, predictor of instream temperature changes does not adequately assess the range of potential project impacts on stream temperatures. Benga's lack of clarity on whether individual water management activities were explicitly modelled to determine spatial and temporal variability does not allow us to accurately assess this potential impact on WSCT habitat. Stream temperatures are a significant factor in determining suitable habitat for WSCT, as the species has a narrow tolerance range for instream temperatures. An increased stream temperature resulting from loss of riparian habitat, increased runoff, and sedimentation from mining activities and the reduction in stream flows may result in synergistic impacts on WSCT, reducing the resiliency of populations in both Gold and Blairmore Creeks. We find that Benga's assessment of changes in stream temperatures introduces uncertainty about potential project impacts on WSCT habitat suitability in Gold and Blairmore Creeks.

Sediment transport and food supply

[1256] Benga indicated that site preparation, surface water management and erosion control, open-pit development, and/or waste rock placement activities could alter sediment supply and transport and basin sediment yield. These effects, in turn, could threaten WSCT habitat quantity and suitability. Benga acknowledged that the mine footprint will remove tributaries to both Gold and Blairmore Creeks and may influence sediment inputs to downstream habitats, and Benga assessed this as a valid pathway of effect. Benga characterized these predicted "imprinting" interactions in its riparian and aquatic footprint assessment, and included them in the draft fisheries offsetting plan.

[1257] Benga stated that it continues to evaluate the mine plan and opportunities to reduce the riparian and aquatic imprinting interactions. However, Benga stated that the findings from its fluvial geomorphology assessment indicate the likelihood and extent of altering the quantity and suitability of physical habitat are negligible. Benga stated that no detectable residual effects on fish habitat due to modifications in fluvial geomorphological processes (e.g., sediment mobility, bed load movement) are expected throughout the mine life.

[1258] Benga stated that a Gold Creek tributary would be lost, and three tributaries would be partially altered, by mine activities. It also noted that the primary tributaries that feed both Gold and Blairmore Creeks are sourced on the opposite sides of each watershed to the mine (i.e., Blairmore Creek's main tributary flows from the west and Gold Creek's main tributaries flow from the east). The flow and sediment contributions from these tributaries will not interact with mining activities.

[1259] Benga submitted that in both watersheds, mine activities will only alter a very small portion of the area of each creek, relative to the length of all the channels in each drainage basin. Benga stated that, although the tributary habitat losses that will occur as a result of the project will affect macroinvertebrate communities and may alter the biomass of invertebrate drift in localized areas of both Gold and Blairmore Creeks, the contribution of the affected areas relative to the total invertebrate biomass within each mainstem watercourse is small in comparison with the total invertebrate supply of biomass from all reaches and/or other tributaries based on drainage area.

[1260] According to DFO, Benga's incremental effects assessment did not include the potential impacts associated with changes in sediment supply. DFO stated that, although sediment sources were inventoried in the existing conditions assessment, Benga did not analyze or discuss the potential impacts of reduced

sediment supply on channel morphology or, correspondingly, fish habitat. Benga's assessment did not adequately evaluate how potential changes to the flow regime will affect sediment types that have been documented as preferential habitat for WSCT. For example, the location of mature fish during the spawning period and associated habitat assessments were only reported for one year.

[1261] DFO recommended that Benga incorporate hydrological predictions into the sediment transport analysis and use daily flow data to evaluate potential impacts on the magnitude and frequency of sediment transport for the entire flow regime. The analysis should assess potential impacts on channel-maintenance flows and the magnitude, frequency, and duration of spawning-gravel transport, and assess potential effects on channel morphology and sediment transport in post-closure conditions. DFO suggested that these impacts need to be assessed in greater detail to determine the project's potential environmental effects. Benga concluded that DFO was implying that Gold and Blairmore Creeks would not receive upstream sediment to replenish spawning habitat. Benga disagreed with this statement, and argued that both creeks would continue to receive upstream sediment throughout the project's lifetime.

[1262] Benga provided some supporting studies that indicate that headwater tributaries do not provide a significant proportion of invertebrate drift. It stated that reductions in tributary habitat as a result of the mine development will cause no change in invertebrate productivity or drift. Benga contended that, because food does not drift far, the majority of aquatic or riparian habitat upstream of the fish-frequented portion of the system to be lost does not convey food drift to the fish-frequented portions. Based on this information, Benga concluded that any loss in food drift would be immeasurable relative to the local invertebrate production. Benga stated that any residual effects to the macroinvertebrate community resulting from impacts on the riparian area from the development of the mine would be mitigated through additional offsetting.

[1263] We note that, while additional offsetting would address the loss of physical habitat, it would not ensure that any loss in bioenergetics would be replaced. Macroinvertebrates are the main food for WSCT, and any reduction in their availability could affect the sustainability of resident populations.

[1264] DFO stated that juvenile and adult WSCT rely heavily on invertebrate prey, which are supplied by riparian vegetation and sufficiently high water flow. DFO stated that invertebrate drift sampling locations conducted by Benga failed to align with key locations that would allow a before-and-after, control-impact study to gauge the accuracy of effect predictions (e.g., habitat that would be lost downstream of tributaries). DFO found that the scientific literature presented by Benga does not support the conclusion that Benga reached. DFO stated that Benga's prediction of a loss of food drift contribution is likely a residual effect.

[1265] To limit the impacts on habitat productivity of WSCT, Benga committed to several measures to mitigate changes in the species' food supply. Benga would maintain an undisturbed riparian buffer zone, generally 100 m wide, from the mainstems of Blairmore and Gold Creeks, and a 30 m setback from associated tributaries. Benga would implement a progressive reclamation plan to expedite revegetation, reforestation, and end land uses to provide overhanging cover and shade for watercourses. Benga committed to implementing an approved fisheries offsetting plan, pending project approval and final consultation with Indigenous groups and DFO. Benga would finalize the draft aquatic monitoring plan using the most current information available regarding mitigation, monitoring, and potential adaptive

management options. The plan would include bioenergetics monitoring, which would focus on quantifying the food energy provided to fish and fish conditions.

[1266] Given the critical nature of upstream sediment supply to maintaining productive habitats that support various WSCT life stages, we find that Benga's assessment of fluvial geomorphology leaves uncertainties as to the extent of project-related impacts on sediment supply arising from the loss of tributary habitats. We agree with DFO's assessment that Benga only considered potential impacts associated with alterations to part of the hydrologic cycle, and did not assess potential impacts associated with changes in sediment supply. While we agree with Benga that Gold and Blairmore Creeks will continue to receive invertebrate drift from upstream areas, the extent of project impacts on this food supply is uncertain. Given the sensitivity of WSCT and their habitats, and the need to take a precautionary approach, this uncertainty leads us to conclude that alterations to upstream sediment supplies would likely result in a residual effect on WSCT.

[1267] Benga presented evidence that invertebrate drift is limited to the immediate areas downstream from where it originated. Therefore, we find that the impacts on invertebrate drift would likely be localized and largely reversible once reclamation of riparian areas was completed. Nevertheless, the loss of riparian and tributary habitats is likely to result in a reduction in overall productivity in both Gold and Blairmore Creeks and residual adverse impacts on WSCT.

Blasting

[1268] Benga indicated that it would use explosives that can create instantaneous pressure changes in fish swim bladders. It acknowledged that blasts generate both seismic and surface waves that can have varying physiological impacts on fish, and that vibrations from the detonation of explosives could damage incubating fish eggs. Benga committed to developing and using a blasting protocol that would meet the Guidelines for the use of explosives in or near Canadian Fisheries Waters (Wright and Hopky 1998). Benga stated that these 1998 blasting guidelines are typically followed in projects near freshwater when determining how to mitigate the risks of land-based blasting effects. Benga stated that DFO's pathways of effects guidance for blasting applies the 1998 blasting guidelines, and maintains that the Wright and Hopky analysis is defensible.

[1269] Benga committed to a number of specific measures to mitigate the effects of explosives on fish. These included:

- no explosive charge would be detonated near fish habitat that is likely to produce an instantaneous pressure change greater than 100 kiloPascals in the swim bladder of a fish;
- no explosive charge would be detonated that is likely to produce an excessive peak particle velocity in a spawning bed during the period of egg incubation;
- explosive weight charge would be limited to one charge per discrete explosion;
- if multiple charges were required, time-delay detonators would be used to reduce the overall detonation to a series of discrete explosions; and
- ground vibration monitoring, using specifically designed instruments, of all blasting activities would be conducted when an explosives charge is used within 300 meters of fish habitat.

[1270] Benga predicted that by implementing these measures, blasting activities would cause no detectable changes in WSCT relative abundance. The Métis Nation Alberta – Region 3 requested that measures be taken to ensure that vibration and noise due to explosives in the vicinity of fish-bearing waters will not disturb aquatic habitat or fish.

[1271] DFO stated that Benga’s approach to predicting and mitigating effects on WSCT is insufficient. DFO indicated that the setback distance provided in the guidelines “closely approximates the theoretical lethal range within which 50 per cent of the fish may be killed or injured” (CIAR 542, PDF p. 245). Given the sensitivity of the populations in proximity of the mine, any mortality resulting from the use of explosives would affect the overall population. DFO noted that it does not currently accept the 1998 blasting guidelines as a code of practice, and additional research has occurred since the publication of this document. DFO stated that the limits proposed by Benga do not exclude the possibility of lethal harm. In the context of habitat conditions (e.g., rocky substrate) at the proposed mine site, and the presence of fish with small body sizes, the mitigation measures proposed by Benga are not sufficiently protective.

[1272] DFO stated that while the 1998 blasting guidelines may be appropriate in certain applications, it recommends that a more robust and site-specific mitigation and monitoring plan is necessary to adequately consider the species sensitivity and the potential for non-lethal injury, considering the protected status of WSCT. In addition, DFO recommended that Benga carry out site-specific assessments considering the prohibitions under both the *Fisheries Act* and *SARA* to determine the appropriate level of mitigation required when using explosives as part of the mine development.

[1273] Given the geological conditions, and the close proximity between the creeks and the locations where blasting will occur, we find that the use of explosives as proposed may increase the risk of residual effects that would harm WSCT from blasting. If Benga were to develop site-specific mitigation measures based on the most recent literature, and implement an appropriate monitoring plan to address the risks to WSCT, we accept that the explosives could be used safely. However, Benga did not develop site-specific mitigation measures or present a monitoring plan that would address the risks posed to WSCT populations, which introduces uncertainty and poses a risk to WSCT populations in Gold and Blairmore Creeks.

Effectiveness of Benga’s proposed offset measures is uncertain

[1274] Benga acknowledged that the project would reduce aquatic habitat in the LSA, including some critical habitat for WSCT. To compensate, it proposed to create more habitat than would be lost, consistent with DFO’s offsetting requirements under the *Fisheries Act*.

[1275] Benga developed its draft fisheries offset plan and offsetting effectiveness monitoring plan in consultation with DFO, the Agency, AER, and AEP, and in consideration of both the federal and provincial recovery plans. Benga’s fisheries offsetting plan proposed four approaches to offsetting:

- Creating additional overwintering habitat in upper Gold and Blairmore Creeks, which Benga identified as limiting in each system (five proposed sites in Gold Creek and six in Blairmore Creek).
- Re-establishing connectivity through the mainstem of Gold Creek by rechannelling braided sections near the historic town of Lille, where flows become subsurface and create a seasonal barrier to migration.

- Enhancing degraded riparian areas, focused on improving productivity and water quality.
- Conducting genetic studies of WSCT populations in Gold and Blairmore Creeks to inform the physical habitat creation projects, better understand the structure and stability of each population, and determine the status of rainbow trout hybridization in Blairmore Creek and the genetic diversity due to habitat fragmentation in both populations. This work comprises complementary measures under the previous version of the *Fisheries Act*, which allows up to 10 per cent of the offsetting measures to be directed toward data collection.

[1276] Benga also identified potential contingency measures should the offsetting projects described above fail to offset the impacts of the project. These measures would include tributary enhancement of critical habitat in lower Morin Creek, focusing on improving habitat for juvenile rearing and improving water quality being affected by off-road vehicle use and cattle access. Another measure would be a suppression program in lower Gold Creek that would reduce competition from non-native brook trout. Benga contended that habitat-specific stressors could be minimized through well-engineered interventions in Gold Creek to re-establish damaged channels and build more overwintering pools. Benga asserted that if no measures were undertaken, the existing WSCT population would likely disappear over time.

[1277] Benga stated that the availability of adequate overwintering habitat would promote WSCT overwintering survival. The key features of this habitat are low-velocity areas of deep pools, complex woody debris, and interstitial cover. Benga suggested that the upper reaches of Gold and Blairmore Creeks have few deep pools that provide this habitat. The creation of additional pool habitat in Gold Creek would provide both overwintering and secondary summer rearing habitats. Benga stated that it had identified 11 candidate sites for creation and enhancement of overwintering pools on Blairmore and Gold Creeks. Benga's design for overwintering pools is based on the features that exist in overwintering habitat already used by WSCT in these creeks, as well as the findings from research studies in similar systems. These sites would be transformed into deep pools by narrowing the channel, excavation, and directing the flow with boulders and large woody debris.

[1278] Benga proposed an offsetting measure to re-establish flows in segments of Gold Creek where flows have become diffuse due to historical flooding and anthropogenic alterations. Benga expected that restructuring of those segments would take one year to complete and that stream flow would be improved permanently by the next season. Benga was aware of the updated 2019 Recovery Strategy-Action Plan, and stated that it would continue to consult and operate under the oversight of provincial and federal regulators to ensure appropriate measures were taken to improve the future outlook for WSCT.

[1279] DFO stated that the scale and scope of Benga's offsetting plan does not provide confidence that the impacts resulting from the development, operation, and closure of the project will be adequately offset. In the context of this project specifically, DFO stated that Benga has a legislative requirement under the *Fisheries Act* as it relates to offsetting and a legislative requirement under *SARA* pertaining to offsetting, and avoiding jeopardizing the survival or recovery of the species. Given the sensitive nature of WSCT, DFO indicated that it must put a high emphasis on reducing uncertainty and ensuring adequate offsetting is applied, if it were to consider authorizing harm to listed species and their critical habitats. DFO stated that there were insufficient data to indicate that a section of braided stream channel in Gold Creek poses a barrier to WSCT. Nor is there sufficient data to support the proposal that

realigning the braided channel to a single channel is sustainable in the long term, due to natural sediment-transport dynamics.

[1280] The Coalition stated that seasonal dry channels are not a significant limiting factor for WSCT and occur on many streams. These channels are not “dry” but simply lack surface flow, and because they are seasonal they do not preclude movement of trout at other times. The Coalition noted that Benga’s offsetting plan did not detail how it would “correct” these seasonally dry channels. The Coalition noted that Benga provided no evidence that the intermittent seasonal barrier is limiting WSCT abundance or persistence in Gold Creek. They stated that Gold Creek is open most of the time in most years, and trout persist upstream and downstream of intermittently separated sections. The Coalition observed that WSCT engage in longer-range movements during the spring freshet, when the creek is free-flowing, and are relatively sedentary the rest of the year.

[1281] CPAWS stated that a lack of overwintering pools is not a limiting factor for the WSCT population in Gold Creek, and that Benga’s habitat offsetting plan is neither necessary nor helpful for the WSCT. The Ktunaxa Nation’s expert, Mr. C. Burns, noted that overwintering pools are known to be dynamic, and fish recruitment to the pools is affected by many factors. In the absence of a more developed offsetting plan, there is a risk that the overwintering pools created by Benga could “act as a sink and actually could result in increased overwintering mortality by trapping certain fish in the wrong type of environment” (CIAR 1336, PDF p. 10).

[1282] The Coalition stated that Benga’s selection of sites for artificial overwintering pools, and the techniques planned for their construction, indicate the pools will not be successful in creating permanent features useful to WSCT. These sites will be subject to bed-load movement, infilling, and channel shifts, and would not provide lasting habitat offsets beyond the life of the mine.

[1283] The Coalition also agreed that Benga did not present any evidence that overwintering pool habitat is limiting WSCT in Gold Creek. The Coalition cited an MSc thesis by Benson, which was partially funded by Benga, that suggests such habitat is not limiting in Gold Creek, and based on Benson’s overwintering study, juvenile WSCT prefer to overwinter among boulders and cobbles. The Coalition indicated that overwintering pools appear to be relatively abundant in Gold Creek, and this is one of the reasons why Gold Creek has maintained a relatively large population, in contrast to most other WSCT streams in Alberta.

[1284] In addition, the Coalition stated that Benga presented no evidence that artificially constructed pools would function as winter refuge, with sufficient upwelling to reduce frazil ice, or persist beyond the next freshet. The Coalition concluded that it is not a viable offsetting proposal.

[1285] DFO stated that there are uncertainties with how the mine would affect the fluvial geomorphic processes in the creeks during the construction, operation, and closure phases of the mine. They stated that Benga’s limited assessment of these fluvial geomorphic processes means that there is insufficient data to confirm whether deeper overwintering pools would be sustainable in the long term. DFO added that significant uncertainty remains around whether proposed offsetting measures would be functional and persist indefinitely to offset residual effects.

[1286] The Wildlife Society's expert, Dr. S. Elmeligi, indicated that habitat protection measures proposed by Benga would not allow maintenance of WSCT populations in streams adjacent to mining operations and would lead to significant negative impacts on those populations, including extirpation. In addition, she stated the proposed mitigation plans were inadequate to compensate for the impacts of mountain-top removal and were largely unworkable in streams adjacent to mining operations.

[1287] DFO stated that to be certain that mitigation measures were effective, Benga would need to model populations on Gold Creek and Blairmore Creek separately, and identify links between project impacts and population rates, including life stage-specific impacts. For DFO to consider authorizing the project, including making a section 73 determination under *SARA*, Benga would need to mitigate impacts. For impacts remaining after mitigation, Benga would need to implement offsetting measures that population models indicated with high certainty would result in a positive net effect.

[1288] Different regulatory considerations apply to Gold Creek and Blairmore Creek. Although fish in both systems are considered highly sensitive with low resilience to harm under the *Fisheries Act*, Gold Creek fish and fish habitat are further protected in specific ways under *SARA*. DFO indicated that Benga would need to differentiate among the impacts on each stream, and clearly define how impacts on Gold Creek fish and fish habitat are being offset (including life stage-specific effects), and whether the final outcomes of the offset measures align with the goals identified in the 2019 Recovery Strategy-Action Plan.

[1289] DFO expressed concern that the detailed fisheries offsetting plan did not demonstrate how the proposed offsetting would meet the population and distribution objectives for WSCT (as stated in the 2019 Recovery Strategy-Action Plan) and not jeopardize the survival and recovery of this species. As the offsetting measures were proposed in existing critical habitat, they have the potential to harm WSCT, which are protected under *SARA*. Although the ultimate outcome of the measures may have benefits at some life stages, other life stages could suffer from either the undertaking of the offsetting work or the outcome.

[1290] DFO described a number of ways in which Benga's offsetting plan failed to sufficiently assess the baseline conditions of WSCT habitat, the full extent of impacts including the cumulative effects, and the effectiveness of the mitigation and offsetting measures. Benga's quantification of offsetting habitat was therefore deemed inadequate. DFO would require Benga implement additional offsetting once all residual effects were quantified in order to consider issuing regulatory approvals under the *Fisheries Act* and *SARA*.

[1291] DFO noted that a period of time would pass between the loss of habitat and the offsetting measures becoming fully functional. Due to the small population sizes of WSCT and limited habitat area in both Gold and Blairmore Creeks, this lag time would likely jeopardize the survival and recovery of these populations. Offsets may also fail to work as planned, resulting in lasting and irreversible impacts. Overall, DFO concluded that there is no empirical basis to assume the proposed offsetting plan will be effective.

[1292] DFO stated that offsetting should be constructed and proven effective prior to realization of project effects on habitat, to support a determination that the survival and recovery of WSCT would not be jeopardized, which is a section 73 precondition of *SARA* that must be met prior to issuing a permit. DFO clarified that acquisition of the information outlined in its recommendations would not guarantee issuance of a *SARA* permit, but would facilitate the collection of information to support the regulatory decision-making process.

[1293] Benga indicated during the hearing that it would not be feasible to implement the offsetting measures—and then monitor for several years to show that the measures were effective—before developing the mine.

[1294] Benga provided a list of approved projects that were permitted within critical habitats of various species, pursuant to sections 73 and 74 of *SARA*. The examples included:

- replacement of an electrical supply line in Banff National Park, involving the likelihood of damage or removal of whitebark pine;
- activities related to the construction and initial (five year) operation of a light rail transit project in Ottawa, Ontario, with a likelihood of direct impacts on the Great Lakes/St. Lawrence population of Blanding's turtle, and the little brown bat, northern long-eared bat, tri-colored bat, and butternut;
- infill of 522 m² of habitat for the stabilization of the banks of Lee Creek, Alberta, with potential impact on bull trout and rocky mountain sculpin;
- remedial works to bridges located on Savanna Creek and the Livingston River, Alberta, with potential impacts on WSCT;
- permanent shoreline infilling of approximately 100 m² of critical fish habitat in Goat Creek, Alberta, with potential impacts on WSCT; and
- the restoration of degraded sites along Lynx Creek and Hidden Creek, Alberta, aimed at benefitting WSCT.

[1295] Benga suggested that DFO's policy regarding permits issued under section 73 of *SARA* is consistent with Benga's proposed impacts, mitigation measures, and offsets concerning WSCT habitat.

[1296] Benga confirmed that accurately monitoring populations in Gold Creek without causing undue stress on the population would be difficult. The limited options pertaining to fish sampling due to the sensitive nature of WSCT and the restrictions inherent in a federal *SARA* permit and a provincial fish research licence results in an area of uncertainty for monitoring the effectiveness of offsetting measures. Benga suggested that a robust before-and-after, control-impact approach to assessment is not feasible in Gold Creek because handling fish as part of regular sampling techniques is unachievable. This would limit the accuracy of any fish population assessments and prevent an accurate analysis of the gains provided by the offsetting measures. Benga acknowledged that it may not be able to definitively show that offsetting achieved the proposed benefits to the Gold Creek WSCT population.

[1297] DFO disagreed with Benga's assessment that offsetting would have a positive effect on WSCT and support recovery of the species beyond the current baseline. Based on the offsetting plan's conceptual nature, technical gaps, and misalignment with DFO's policies, DFO's opinion was that the goal of conservation and protection of fish and fish habitat, particularly WSCT, would not be achieved. The concepts currently proposed require substantial additional analysis to satisfy the offsetting policy and ensure viability. Alternatively, DFO suggested that redesigning the project to reduce impacts on fish and their habitat could reduce the risk and uncertainty associated with the decision its minister would be required to make when considering whether to issue an authorization under the *Fisheries Act* and *SARA*.

[1298] Finally, shortly before the hearing and again in its final argument, DFO submitted that, based on the information available to date, it is unlikely that *SARA* subsection 73(3) preconditions can be met for the project.

[1299] The evidence concerning Benga's proposed habitat offsetting measures raises a number of key points:

- The recently updated 2019 Recovery Strategy-Action Plan sets out new requirements for the calculation of WSCT critical habitat that could be affected by the project. Benga had ample opportunity to calculate and submit the new critical habitat that would need to be offset, and this calculation is important to inform an assessment of the feasibility of its proposed offsetting approach. It failed to do so.
- Benga did not adequately support its assertion that two of its main offsetting measures— construction of new overwintering pools in Gold Creek and reconnecting the upstream and downstream habitats in Gold Creek by removing the seasonal barrier near Lille—would be sustainable, or effectively improve the habitat for WSCT, or were limiting factors for WSCT in Gold Creek in the first place. By extension, there is considerable uncertainty about whether these offsetting measures would benefit the Gold Creek WSCT population and offset the impacts of the project. In fact, implementing these offset measures in critical WSCT habitat in Gold Creek would pose a short-term risk of harm to these fish, which would be prohibited under *SARA*.
- Implementing a successful monitoring program to evaluate the effectiveness of these proposed offsetting measures would be challenging due to the sensitivity and protected status of WSCT, and would take years following implementation of the measures to yield clear results.

[1300] We find that Benga has not demonstrated that the proposed habitat offsetting program, which constitutes its primary attempt to address residual effects on WSCT habitat, would mitigate project impacts on WSCT habitat.

[1301] We note that DFO has clearly indicated that offsetting measures should be constructed and proven effective prior to project impacts occurring on WSCT habitat. This will support a determination that the survival and recovery of WSCT will not be jeopardized. DFO has stated that this is a precondition that must be met prior to issuing a permit under section 73 of *SARA*, which we understand is a requirement for the project to proceed. We also note that Benga has rejected this approach as untenable. Given the sensitivity of the species and habitat in question, we understand DFO's position on this matter. However, we cannot base our decisions on what DFO or its minister may or may not decide in future

regulatory applications. For our purposes, we must be persuaded on a balance of probabilities that Benga's proposed offsetting plan is technically feasible and likely to be effective. We are not persuaded this is the case.

[1302] As for the examples that Benga provided of other projects that have received *SARA* section 73 permits, Benga did not provide sufficient information about the magnitude and scope of those projects for us to evaluate how similar they are to this project. We are left to assume that if those permits were issued by DFO, then DFO must have concluded that those projects were unlikely to jeopardize the survival or recovery of the *SARA*-listed species affected by each project. This does not offer sufficient guidance for our assessment of the potential residual effects that Benga's project may pose to the populations of WSCT in Gold or Blairmore Creeks.

Aquatics monitoring plan would not support timely adaptive management

[1303] Benga identified that residual effects of the project could affect the valued components of water quality and WSCT. Benga presented a draft aquatics monitoring plan for the project in the Eleventh Addendum. Its objective was to verify the project's predicted effects on the receiving environment and to WSCT, and potential project effects on stream flows, water quality, sediment quality, and fish and fish habitat during operations, closure, and early post-closure phases. Benga suggested that the aquatics monitoring plan would allow it to verify predictions of residual environmental effects made in the EIA, and to confirm whether mitigation measures have achieved desired outcomes. The aquatics monitoring plan was essential to determining whether the proposed mitigation measures or monitoring methodologies would need to be modified or adapted if the project proceeded.

[1304] Benga's goal for WSCT in the aquatics monitoring plan was to monitor the long-term persistence and sustainability of WSCT in Gold and Blairmore Creeks. The data collected as part of this monitoring would be combined with data from other monitoring programs (including the proposed fisheries offsetting plan) to generate a better understanding of WSCT population status. Benga indicated that if monitoring and evaluation of mitigation effectiveness revealed that adverse environmental effects were greater than predicted, Benga would determine whether these effects result in changes to the conclusions presented in the effects assessment. If changes were confirmed, Benga would evaluate the need for revised mitigation actions and management practices.

[1305] The draft aquatics monitoring plan proposed monitoring water quality quarterly, benthic algae and invertebrate biomass and tissue content every three years, and fish health every three years. Monitoring would include both reference and potentially affected locations. Additional monitoring could also be conducted should triggers or limits within the receiving environment be exceeded.

[1306] The aquatics monitoring plan included calcite precipitation monitoring to verify the effectiveness of calcite mitigation efforts. Calcite precipitation monitoring would document the extent of calcite deposition and the degree to which deposition has occurred, and would characterize the depositions in Blairmore and Gold Creek. Benga stated that its proposed monitoring approach is based largely on the calcite monitoring plan developed for the *Elk Valley Water Quality Plan*. Benga stated that Teck successfully implemented this calcite monitoring plan for five years, and Benga considered its approach would sufficiently mitigate concerns related to calcite.

[1307] Benga stated in the hearing that it would need to initiate the aquatics monitoring plan immediately to allow sufficient time to establish an accurate baseline to be used to validate the effects assessments, and then implement timely adaptive management should predicted effects prove inaccurate. Benga also confirmed the need to immediately implement the aquatics monitoring plan to establish baseline conditions and verify the selenium-sulphate uptake relationship, which would be used to refine its proposed site-specific water quality objective for selenium.

[1308] Benga acknowledged there are limitations to tissue sampling of WSCT, given their protected status. Benga proposed to focus tissue sampling on monitoring project-related impacts on resident rainbow trout, instead of WSCT, in Blairmore Creek. However, Benga was unable to provide an estimate of the availability of rainbow trout for sampling. Benga provided historical sampling data in the EIA that indicated that only one rainbow trout and two rainbow trout–WSCT hybrids were captured above the permanent barrier on Blairmore Creek. If a stable self-sustaining population of rainbow trout is not present above the permanent barrier, this would preclude Benga from conducting tissue sampling to monitor for contamination and potential toxicological effects on resident WSCT.

[1309] Benga indicated that while there are similarities between introduced rainbow trout and WSCT, samples from both species would need to be taken to make comparisons between tissue contamination in the two species. For Benga to accurately predict tissue concentrations of various contaminants, direct tissue sampling of WSCT would need to be undertaken and a baseline established between various tissue-sampling techniques before any non-lethal tissue sampling options would be viable.

[1310] Benga stated that it would not monitor the impacts of reduced base flow on specific overwintering pools, but instead would monitor Gold Creek at the reach scale to detect potential changes.

[1311] The draft aquatics monitoring plan does not extend to the Oldman Reservoir. Benga stated that it would commit to monitoring selenium in the Oldman Reservoir. Benga stated that water quality monitoring in the reservoir would be conducted either by Benga or a third party funded by Benga. This monitoring would collect baseline data prior to mine construction.

[1312] DFO suggested that extensive sampling of WSCT distribution and abundance, tissue contaminant concentrations, and invertebrate densities are required both spatially and temporally to effectively establish baseline conditions and monitor for project effects, along with ongoing sampling of water flow and quality (e.g., temperature, dissolved oxygen, contaminants) at a similar sampling regime. It stated that individual project effects could not be considered in isolation, but that cumulative effects need to be considered. DFO identified outstanding concerns for many of the potential pathways of effects that could affect the population of WSCT in Gold and Blairmore Creeks, as the effects may be irreversible by the time monitoring reveals discernible impacts. DFO stated that the large 95 per cent confidence interval in population estimates could mask impacts on the population without these impacts becoming detectable.

[1313] DFO noted that a high degree of variability between fish survey methods and stream reaches reduces confidence that the method can provide sufficiently early detection of population-level impacts on WSCT. Due to the highly variable nature of biological data, similar concerns exist for endpoints related to food supply and fish condition (bioenergetics monitoring).

[1314] DFO noted that the aquatics monitoring plan provides adaptive management options, but without enough detail to offer confidence that irreversible changes can be avoided. DFO indicated that not all endpoints have a specific trigger value that would initiate adaptive management, and the aquatics monitoring plan lacks detailed mitigation options and an assessment of their feasibility should these triggers be exceeded. DFO stated that specific thresholds need to be established and specific plans of action for mitigation and offsetting need to be in place should project impacts extend beyond thresholds.

[1315] DFO noted that offsetting is not an appropriate adaptive management technique because of factors considered when determining the adequacy of an offsetting plan. Regardless of whether it is appropriate to issue an authorization under section 35 of the *Fisheries Act* with *SARA* conditions, DFO must consider the magnitude of impacts and how they may affect local populations. In the case of genetically pure and near-pure WSCT, additional offsetting would be considered a last resort and require a full reassessment of the risks associated with authorizing additional harm.

[1316] DFO stated that the proposed monitoring required to verify predictions and effectiveness of mitigation, including offsetting, is itself a risk to WSCT due to their limited population size. Sampling to support monitoring of population endpoints, aquatic effects monitoring endpoints, and bioenergetics endpoints may require sampling that contravenes *SARA*, including handling and tissue sampling. This prevents robust monitoring and contingencies from ameliorating uncertainties because the monitoring itself may affect the population.

[1317] Benga suggested that DFO's positions were inappropriate at this late stage of the regulatory process, given the depth of consultation that has already occurred and Benga's detailed responses to DFO's questions and concerns during the review process, dating back to 2016. Benga agreed with DFO that additional details will be required after the current review process concludes, and through ongoing verification of predictions during the regulatory phase. Benga indicated this is normal and reflective of the progressive nature of the regulatory system for projects of this nature in Canada. Benga expected that the final details of the aquatics monitoring plan would be developed in close consultation with DFO and other agencies, once there is a decision that the project is in the public interest. Only then, as per regulatory and industry practice, and in consultation with the relevant regulatory agencies, would all environmental monitoring plans be finalized.

[1318] The Timberwolf Wilderness Society expressed concern about the proposed use of adaptive management that Benga included in its draft aquatics monitoring plan. They found that the approach relies on discovering a problem has occurred when the appropriate goal is preventing the problem from occurring in the first place. Mr. A. Garbutt stated that the precautionary principle should be applied, given that impacts of the mine would likely not be observable for years and would take multiple years to reverse, if reversing them were even possible.

[1319] The Ktunaxa Nation's expert, Mr. C. Burns, noted that, while the proposed aquatics monitoring plan did attempt to provide greater clarity, many of the specifics are largely omitted and left for development at a future date. The Ktunaxa indicated that the lack of sufficient baseline data has serious implications for the proponent's ability to detect change (if any) and for the overall mine construction plan. Multiple years of baseline data are required to develop a statistically robust aquatics monitoring plan, which must be factored into the overall mine construction plan.

[1320] The Ktunaxa Nation further expressed concerns with deferring plans to a later date, specifically for sulphate and calcite management. They indicated that experience in the Elk Valley suggests preventing calcite deposition would be less expensive. This is supported by Teck’s statements that removing calcite from streambeds using antiscalants does not work. Benga confirmed during the hearing that the removal of calcite from streambeds would be difficult.

[1321] CPAWS stated it was not clear that the WSCT populations in Blairmore and Gold Creek are resilient enough to be as sampled and monitored as frequently as they would need to be to make monitoring useful for adaptive management. Careful consideration must be given to ensuring that monitoring protocols do not harm the WSCT populations. CPAWS further stated that the approach Benga proposed is an ad hoc reaction to problems that arise and constitutes “hoping that someone else will find a solution to the project’s environmental problems” (CIAR 1347, PDF p. 12).

[1322] We find that, for many pathways of effects from the project to the valued components of WSCT and surface water quality, Benga’s proposed sampling schedule and adaptive management process would make responding to impacts slow and challenging. By the time Benga observed and confirmed an effect, then implemented mitigation measures, irreversible damage to the aquatic ecosystem could have already occurred. We further find that it will be difficult for Benga to accurately monitor WSCT in a manner that does not adversely affect the population. The uncertainty in the size of the WSCT population will also make it challenging to detect changes in a timely manner to intervene with corrective measures if necessary.

[1323] The sensitivity of the species in question, and the additional protections afforded under *SARA*, reinforces the need to adopt a precautionary approach, and for us to have confidence in the efficacy of Benga’s predictions and mitigations. Benga was aware of the sensitive nature of the aquatic ecosystem surrounding the project, and should have presented us with an aquatics monitoring plan that provided the level of detail, and triggers for implementing adaptive management actions, that would reduce the uncertainty and risk associated with the project.

The project poses unacceptably high risks to WSCT and aquatic habitat

[1324] Benga presented the results of its evaluation of the significance of residual effects on fish and aquatic habitat in its First Addendum and EIA Consultant Report 6. Benga considered the effects of changes to habitat and changes in flow regime. For all potential effects to fish and aquatic habitat, Benga found the residual effects were not significant.

Benga’s assessment of residual effects on fish and aquatic habitat

[1325] Benga assessed the direct effects of the project on the loss of aquatic or riparian fish habitat in the local study area as moderate in magnitude, local in extent, long-term in duration (before offset measures become functional) in duration, continuous in frequency, and reversible in the long-term (after offset measures become functional).

[1326] Benga assessed the effects of the project on flows resulting in alteration of aquatic habitat in Gold Creek as moderate in magnitude, local in extend, extended in duration, continuous in frequency and reversible in the long-term (after offset measures become functional).

[1327] Benga stated that, although appropriate best management practices and other mitigation measures would be applied, the placement of waste rock piles, pit excavation, construction of water management features, and execution and operation of on-site water management would result in a permanent loss of WSCT habitat in the Gold Creek watershed. Benga predicted no net change in the abundance of WSCT. This prediction was based on the success and effectiveness of project mitigation and offsetting options aimed to counterbalance and exceed any predicted loss of WSCT tributary habitat or habitat altered as a result of changes in hydrology in Gold or Blairmore Creeks. Benga acknowledged that the habitat would be removed or altered, and the productivity contributions provided specifically by those tributary habitats would be lost. But Benga indicated that these losses would be reversed and additional gains exceeding the losses will be realized once the offsetting plan is finalized, implemented, and deemed functionally effective.

[1328] As we discussed in the surface water quality chapter, Benga did not consider that selenium would affect WSCT because it assumed that its proposed mitigation measures would be effective, and its proposed site-specific water quality objective for selenium would be protective of WSCT. It did not consider selenium to cause a residual adverse significant effect on WSCT.

[1329] With the uncertainty in Benga's approach to the assessment, we believe there is a high likelihood of impacts on habitat that would not be mitigated or compensated for, and because this includes critical habitat for a threatened species, the magnitude of these effects is high. The extent of these impacts exceeds the local scale, because the impacts involve a subpopulation of WSCT that is one of a small number remaining in the province with (potentially) a reasonable chance at recovery. As for Benga's finding of reversibility, the risk of extirpation of the local subpopulation would not be reversible.

[1330] We find that Benga's conclusions regarding the significance of residual effects on fish and aquatic habitat are unconvincing. The effectiveness of Benga's proposed habitat offsetting measures, which are its main proposed measure to mitigate habitat loss, is associated with a high degree of uncertainty. We disagree with Benga's significance determination for several reasons. These include our finding that Benga likely underestimated project effects, the uncertainties regarding the effectiveness of mitigation, the sensitivity of the threatened species, and the difficulty associated with monitoring the effects of the project. We are also not confident in the likelihood of the success of Benga's future offsetting measures if the project were to proceed. Finally, we disagree with Benga's assertion that selenium will have no adverse effect on WSCT. We discuss this in detail in the chapter on surface water quality.

Our assessment of the significance of residual effects on fish and aquatic habitat

[1331] We accept Benga's use of WSCT as the key valued component for fish and aquatic habitat. WSCT is a threatened species that has experienced many historical influences on its habitat over the decades. The proposed project could threaten an important remaining subpopulation of this species in Gold Creek, one of the ten remaining subpopulations in Alberta (outside of national parks) with the best chance to survive and recover in the long term.

[1332] Uncertainty remains regarding the potential impacts of all pathways of effects on fish and aquatic habitat identified by Benga. At key points in the analysis of the pathway of effects, Benga made optimistic assumptions that were not well supported by evidence. Moreover, its adaptive management

approach did not contain enough detail to give us confidence that Benga would be able to manage the effects on WSCT if its predictions were incorrect. If Benga's predictions did turn out to be incorrect, it might be too late to avoid impacts on WSCT. This does not give us confidence that significant adverse effects of this project on WSCT can be avoided.

[1333] Throughout this chapter, we identify our concerns and findings about Benga's assessment. We summarize some of our main findings below:

- WSCT are listed as threatened under both the provincial *Wildlife Act* and *SARA*. The project would affect federally protected critical habitat in Gold Creek, as well as habitat in Blairmore Creek, which the 2019 Recovery Strategy-Action Plan for this species identifies as important.
- Recent population estimates for this species in these streams are cause for concern, and highlighted the need for us to have confidence that Benga's analysis and proposed measures would avoid negative effects on these fish and their habitat.
- Benga did not adequately assess the amount of critical habitat the project would affect, in accordance with the 2019 Recovery Strategy-Action Plan, which was important to fully assess the potential impacts of the project.
- Benga's hydrology modelling failed to provide sufficiently detailed estimates of the impacts of the project on flows in Blairmore and Gold Creeks, particularly in periods of low flow, and did not provide changes to instantaneous flows. This increased the level of uncertainty in estimating the project's impacts on the habitat of WSCT in these streams.
- Selenium releases from the project into these streams would likely cause significant adverse effects on water quality, which by extension would affect WSCT. Benga did not adequately justify its assertion that its proposed mitigation measures would prevent selenium concentrations from reaching concentrations that could pose a risk to WSCT. It also did not adequately justify its assertion that its proposed site-specific water quality objective would be protective of WSCT. We discuss these findings in detail in the surface water quality chapter.
- Calcite is likely to form and cause harm to WSCT habitat in Blairmore Creek. The concretion of substrates was likely to cause a reduction in benthic invertebrate productivity, and reduce habitat suitability and availability for spawning. Once calcite precipitates onto substrates in the creeks, it remains in place because there are no proven treatments to remove instream calcite.
- Benga's inadequate assessment of both changes in stream temperatures and in food supply and sediment transport increased uncertainty about the project's potential effects on habitat suitability in Gold and Blairmore Creeks.
- Benga proposed a draft offsetting plan with a number of measures that it suggested would compensate for losses of habitat and, on balance, improve the available habitat for WSCT. We found that Benga did not adequately demonstrate that the proposed habitat offsetting program, which was its main mitigation measure for addressing residual effects to WSCT habitat, would successfully mitigate project impacts on this habitat. Nor were we convinced that the offsetting plan was technically feasible or likely to be effective.

[1334] Based on the evidence and findings discussed in this chapter, we assess the residual effects of the project on WSCT and its aquatic habitat to be as follows:

- **Magnitude:** high. The project will result in a loss of critical habitat, and we are not confident in the effectiveness of the proposed offsetting measures. Contaminants released from the project, particularly selenium, are likely to have significant adverse effects on water quality that will harm WSCT. The project as proposed is likely to jeopardize the recovery of WSCT in Gold Creek, and will result in impacts on Blairmore Creek that will jeopardize the ability of this population to support the recovery objectives in the 2019 Recovery Strategy-Action Plan.
- **Geographic extent:** regional in one sense, provincial in another sense. The project would have the highest level of direct impacts on WSCT in Gold and Blairmore Creeks, but direct impacts arising from selenium loading could occur as far downstream as the Oldman Reservoir. This suggests a regional geographic impact. However, the loss of one of the remaining populations of WSCT in Alberta would jeopardize the recovery of all provincial populations, due to the limited number of individuals available to repopulate depleted populations. Most populations cannot lose individuals to restocking without those populations being imperiled.
- **Frequency:** some effects continuous, some effects periodic. Impacts on water quality are continuous, alteration of flows is continuous, loss of critical habitat is continuous until offsetting is proven effective, the potential for calcite precipitation is continuous until permanent management is implemented, impacts on sediment supply are continuous, changes to instream temperatures are continuous, and the effects of blasting are periodic.
- **Duration:** persistent. The effects would be permanent if the local population is extirpated. Other effects could have extremely long-term impacts on the population, considering our lack of confidence in the proposed offsetting measures. Residual effects on water quality, stream flows, and sediment transport are likely.
- **Reversibility:** some effects are irreversible, some reversible in the medium term (unless the local subpopulation is extirpated). Loss of WSCT populations is irreversible, changes to stream flows and sediment transport are irreversible, calcite precipitation is irreversible, changes to water quality and temperature are reversible in the long-term, and changes to critical habitat are reversible in the medium term.
- **Ecological and social context:** negative. WSCT in the project area are listed as threatened under *SARA* and the provincial *Wildlife Act*.

[1335] We conclude that the project is likely to cause significant, adverse effects on WSCT and their aquatic habitat. We have high confidence in our assessment.

[1336] While Benga's assessment focused on WSCT, changes in water quality and loss of habitat would have implications for other fish species and aquatic organisms in the streams and rivers downstream of the project, including bull trout, which are listed as threatened under Schedule 1 of *SARA*. While Benga and other participants provided limited information on these matters, bioaccumulation of selenium released from the project could occur in fish tissues in the Oldman Reservoir. Based on the limited

information available to us, we conclude that the project has the potential to adversely affect bull trout and other fish species. We are unable to characterize the residual effects related to bioaccumulation of selenium on bull trout and other fish species in the downstream environment, nor are we able to determine the significance of these effects.

Cumulative effects

[1337] Benga stated that historic mining, timber operations, recreational use, the existing dam on Gold Creek, ranching, and climate change have contributed to ongoing adverse effects on WSCT and these effects are expected to persist. Benga stated that the project's residual effects are localized to the WSCT population in the LSA and are predicted to interact with the effects from other activities in the area. It stated that its fisheries offsetting plan is an opportunity to benefit WSCT. Benga stated that the residual effects from the project in combination with past and present projects in the Gold Creek and Blairmore Creek watersheds would be considered a positive outcome for the protection of WSCT, and that any predicted residual effects are anticipated to be not significant.

[1338] Benga noted that both Gold Creek and Blairmore Creek have been subjected to anthropogenic activities that have shaped the current state of WSCT populations in both systems, and the residual effects from the project are not expected to cause cumulative irreversible changes at the population level or decrease resilience of WSCT populations within the LSA or RSA. Benga stated that, for the purposes of characterizing cumulative effects, the analysis and conclusions for WSCT would be representative for the salmonoid species, including bull trout. Benga stated that bull trout once occurred in tributaries above and below Lundbreck Falls but are now restricted to the Crowsnest River below the falls, as a result of overharvesting, habitat loss, and construction of the Oldman Dam.

[1339] DFO stated that the currently defined critical habitat for WSCT is only partial, and the identified extent is not capable of supporting the species' population and distribution objectives. DFO suggested that any loss of critical habitat would impede efforts to expand or recover the populations in Alberta. DFO identified Gold Creek as one of ten subpopulations with enough individuals to be considered viable.

[1340] DFO noted that whirling disease was overlooked as a potential threat that could interact with the project, and that cutthroat trout are particularly susceptible to whirling disease. DFO referred to evidence supplied by the province of Alberta in 2019 suggesting rainbow trout populations in the Crowsnest River are declining. High levels of the whirling disease parasite were found in the Crowsnest River, and clinical signs and elevated mortality in young-of-year rainbow trout. Blairmore and Gold Creek subpopulations are directly adjacent and connected to the Crowsnest River, which puts them at higher risk.

[1341] DFO stated that various project impacts are likely to generate cumulative effects, and previous activities may result in degraded conditions that may be compounded by the project. DFO stated that the project's long timeframe requires considering the influence of climate change and other proposed mining activities on the state of the watersheds and WSCT populations.

[1342] DFO stated that Benga's cumulative effects assessment has no quantitative basis. The assessment carries forward—and compounds—assumptions, data gaps, and uncertainties regarding residual effects of the secondary linkages for WSCT, the effects of which are likely underestimated. DFO stated this results in the removal of these secondary linkages from the final determination of residual effects of the project

on WSCT. DFO indicated that the assessment of residual effects is the basis for the cumulative effects assessment, and the elimination of residual effects on secondary linkages to WSCT introduces and compounds uncertainty in the cumulative effects assessment. DFO was of the view that Benga's characterization of the potential cumulative effects on WSCT was likely inaccurate and the effects underestimated.

[1343] DFO recommended that Benga undertake a quantitative cumulative effects assessment. This should include consideration of the status of WSCT; refined residual effects of the project; appropriate consideration for other potential stressors including whirling disease, timber operations, recreational use, grazing, and climate change; and reasonable predictions of Benga's ability to effectively mitigate impacts in combination with other stressors.

[1344] The Coalition stated that recent studies show that the population of WSCT in Gold Creek has only a 74 per cent probability of long-term persistence, and that mining within the southeastern slopes within the footprint of the current operations will cause a 31 to 70 per cent decline in abundance of WSCT over the next three generations. The Coalition stated that Benga's analysis of the cumulative impacts of the project on WSCT is flawed and underrepresents the true cumulative impact on long-term viability of WSCT within the project's footprint. The Coalition noted that WSCT are currently vulnerable to existing land uses, which are beyond the range of natural variation within which these native trout evolved and adapted to. They stated that the project would put WSCT at even greater risk.

[1345] The Coalition's expert, Dr. J. Post (who is also the COSEWIC co-chair for the Freshwater Fishes Specialist subcommittee), stated in his evidence that the EIA ignores the cumulative effects of multiple local impacts and uncertainties associated with these impacts. Minor changes can be expected to flows, sediments, temperature, riparian structures, and contaminants when overlain by predicted climate change, which is predicted to increase spring flooding, late summer droughts, and summer temperatures. Each of these impacts was considered in isolation and none was assessed at each individual life stage of WSCT. Fish population dynamics and modelling suggest that these impacts are synergistic. Without a model to assess the cumulative effects of these impacts on the demographic rates, which is growth and survival through all life stages, the quantitative impact on the population of WSCT from the evidence on the record is uncertain.

[1346] The Coalition stated that, because population processes are synergistic and cumulative, the WSCT population loss would certainly be larger than that associated with each of the individual life stages in the instream flow analysis. They added that, if temperature increases, if the frequency of droughts increases, and if terrestrial and benthic invertebrates decline—all as the habitat area shrinks due to declines in instream flow—the cumulative impacts discussed in the application would certainly underrepresent the true cumulative impact of mine development on the long-term viability of WSCT. The Coalition indicated that a reasonable analysis of cumulative effects of impacts must incorporate all threats; it must model their synergies and incorporate uncertainties into all of these processes. According to the Coalition, this application provided none of these approaches in the EIA or in the evidence presented during the hearing.

[1347] Trout Unlimited noted that the proposed project is not the only threat to water quality, fish habitat, and fish communities in the region. Forestry, oil and gas, recreation, species introductions, and climate change act synergistically and have a cumulative impact. Trout Unlimited noted that whirling disease appears to be well established in the Crowsnest River, having caused population-level effects on rainbow trout.

[1348] The Wildlife Society noted that it worked with ALCES in 2020 to produce a cumulative effects assessment of the southeastern slopes of the Rocky Mountains. The results showed that, with increasing human population and land pressure, a healthy watershed environment cannot be maintained if current and projected land uses are continued. They stated that overlapping land uses present substantial risks to bull trout and WSCT in the southeastern slopes, and recommended increased protection of the western portion of the area to preserve native trout populations. Benga stated that the ALCES study area was regional, outside the scope of our review, and did not focus on the project.

[1349] The Shuswap Indian Band noted that recent water quality and contamination issues in the region have led to a drastic decline in cutthroat trout, a species important to them, further compounding the impacts on their community.

[1350] We find that the existing effects on WSCT from industrial development and other activities have left the species vulnerable to any additional adverse effects. We understand that WSCT have suffered extensive habitat loss and now occupy a small portion of their historical natural range. We acknowledge that hybridization with other species and overharvesting have also contributed to declines in WSCT populations. We agree with the Coalition's conclusions that Benga's assessment of cumulative effects underrepresents the actual cumulative impact on the long-term viability of WSCT populations in Gold and Blairmore Creeks.

[1351] We assess the cumulative effects of the project, along with previous and other reasonably anticipated impacts on WSCT and its aquatic habitat, to be as follows:

- **Magnitude:** high. The cumulative effects will jeopardize recovery of WSCT due to the combined effects of critical habitat loss, changes in stream flows, alteration of water quality (particularly through increased selenium concentrations), reduced habitat suitability, likely precipitation of calcite, reduction in sediment supply, and changes in stream temperatures. These changes are cumulative and synergistic and are likely to cause a detectable change (and potentially extirpation) in WSCT populations in Gold and Blairmore Creeks beyond natural variation, given the known sensitivities of WSCT.
- **Geographic extent:** provincial. While most effects are local or regional, the cumulative effects are likely to jeopardize recovery of WSCT at the provincial scale, and result in the local reduction or extirpation of WSCT populations in Gold and Blairmore Creek.
- **Frequency:** continuous. Cumulative impacts on water quality, alteration of flows, impacts on sediment supply, and changes to instream temperatures are all continuous and cumulatively likely to permanently alter habitat suitability in Gold and Blairmore Creeks, jeopardizing the recovery of WSCT populations.

- **Duration:** persistent. Cumulative impacts on water quality, alteration of flows, impacts on sediment supply, and changes to instream temperatures will persist after the closure and reclamation of the mine, permanently altering habitat suitability in Gold and Blairmore Creeks and jeopardizing recovery of WSCT populations.
- **Reversibility:** irreversible. Cumulative impacts on water quality, alteration of flows, impacts on sediment supply, and changes to instream temperatures are likely to be irreversible in a meaningful timeframe for the recovery of WSCT in Gold and Blairmore Creeks, jeopardizing the recovery of WSCT populations. We consider this effect irreversible given the timeframe required for conditions to return to background (decades) and the Gold and Blairmore Creek populations of WSCT being on the low-end of long-term population viability.
- **Ecological and social context:** negative. WSCT in the project area are listed as threatened under *SARA* and the provincial *Wildlife Act*.

[1352] The existing conditions represent a significant cumulative adverse environmental effect on WSCT. We do not expect Benga's offsetting efforts to fully mitigate the project's effects on WSCT and we expect that residual project effects will exacerbate existing effects. While Benga's cumulative effects assessment focused on WSCT, project impacts would combine with existing impacts from previous and reasonably anticipated future activities to cause changes in water quality and loss of habitat for other fish species and aquatic organisms in the streams and rivers downstream of the project, including bull trout.

[1353] Benga and other participants provided little information on these matters. Based on the limited information available to us, we conclude that the project has the potential to contribute to adverse cumulative effects on bull trout and other fish species, although it appears unlikely that the project would make a substantial contribution to these cumulative effects.

[1354] We find that the project's multiple local residual impacts, along with the uncertainty associated with Benga's assessment and proposed mitigation, in combination with past, present, and reasonably foreseeable activities, is likely to cause significant, adverse cumulative effects to WSCT and its aquatic habitat.

15. Terrain and Soils

Benga's baseline assessment for terrain and soils was reasonable

[1355] The LSA for the terrain and soils baseline study was limited to those lands within the proposed mine development areas that the project would be expected to disturb. These areas total 1520.7 ha.

The project's RSA for terrain and soils encompasses the project footprint, the mine permit boundary, and some additional areas, encompassing 4549.8 ha in total. Benga stated the area selected as the RSA was sufficient to evaluate the cumulative effects from direct disturbance of terrain and soils due to other industrial operations within this selected area. The baseline soil survey was conducted to establish the thickness of soil layers, reclamation suitability, erosion risk potential, soil sensitivity to acidification, and forest land capability.

[1356] The baseline soil survey met soil survey intensity level 2 of the terms of reference and the *Guide to Preparing Environmental Impact Assessment Reports in Alberta*. Benga inspected 230 sites over 1520.7 of the LSA. Most were accessible by road, trails, or other cut lines. One inspection was conducted for every 6.6 ha, and 407 sites were inspected over 4549.8 ha of the RSA, or one per 11.2 ha. To confirm soil classification, Benga sampled at least one soil horizon or layer from 24 of the soil inspection sites. Benga also sampled 26 soil profiles.

[1357] Benga produced baseline soil and terrain maps at a scale of 1:15 000. Benga identified 38 soil series and variants and organized them into 21 soil models representing common soil patterns in the RSA and LSA. Benga recognized 27 terrain types, or landform models, large enough to map at a scale of 1:15 000. Slope classes identified within the LSA and RSA were estimated using a global positioning system analysis of available LiDAR imagery, digital elevation models, and field inspection data.

[1358] The baseline soil survey included soil sampling and analysis to evaluate soil sensitivity for acidification from atmospheric deposition from the project. No potential acid input isopleths contained values that triggered critical, target or monitoring load exceedances for the soils within the LSA or RSA. Therefore, Benga did not include soil sensitivity for acidification in the impact assessment.

[1359] Benga characterized the overburden in 176 samples from seven drill-hole locations collected during geotechnical, geochemical, and hydrogeological investigations. Benga used the analytical data to rate the overburden following the *Soil Quality Criteria Relative to Disturbance and Reclamation Guidelines*, as specified for the eastern slopes region of Alberta (Soil Quality Criteria Working Group 1987).

[1360] The M.D. of Ranchland expressed concern that Benga had not assessed the potential effects of dust from coal mining (acidification) on local grazing lands that are vital to the ranching industry. Benga stated that the low potential for acid input in the baseline and project development scenarios resulted in no anticipated direct effect on plants and only indirect possible effects on the soil. The thresholds for soils were not reached in any assessment scenario; subsequently, no impact on vegetation is expected.

[1361] We find that Benga carried out the terrain and soils baseline survey in accordance with provincial guidance and the EIA terms of reference. One limitation that we noted, which is common among baseline soil surveys, is the skewed distribution of inspection sites toward accessible routes along roads and cut lines. Given the size of the LSA relative to the RSA, without any future disturbance in the area, 33.4 per cent of the RSA would be disturbed by the mine.

Soil salvage will not occur on steep slopes

[1362] According to Benga, 1102.0 ha of the project's 1520.7 ha footprint has salvageable upland surface soil and salvageable organic soil present. The remaining area of the project footprint was previously disturbed (235.9 ha, soil model miscellaneous disturbed lands) or had slopes in excess of 27 degrees, where salvage of topsoil would be unsafe.

[1363] Benga acknowledged that it is extremely important to salvage the upland surface soil resource in all available areas to ensure it has enough material to complete the proposed reclamation. Benga indicated no additional soil data would be collected prior to operations. Benga would rely on the soils inventory completed for the EIA to guide soil salvage operations. The soils inventory provided useful information on the amount of soil present in the areas. Soil salvage operations would be monitored by personnel trained in soil salvage techniques.

[1364] The goal of a soil conservation program is to ensure the availability of sufficient volumes of suitable reclamation material. This means having enough reclamation material to support the self-sustaining vegetation communities required to achieve the planned end land uses. Benga would be expected to track the reclamation material inventory throughout the project, and refine and update its progress toward the reclamation material balance in operating plans and reports.

[1365] We acknowledge the logistical and safety constraints, such as steep slopes, involved in soil salvage. We also recognize that these constraints may affect Benga's ability to salvage enough soil to meet the reclamation material balance. The project's reclamation material balance is discussed in the chapter on conservation, reclamation, and closure. We observe that much of the area in which soil will not be salvaged due to steep slopes overlaps areas with whitebark pine and the rough fescue grasslands community of the foothills. If that soil is not salvaged, the seedbank for whitebark pine and foothills rough fescue grasslands community would be lost.

Soils are subject to a high risk of water and wind erosion

[1366] Benga indicated soil could be lost from erosion during soil salvage, soil storage, and after soil replacement. Wind or water erosion could affect soil profiles and distribution of soils in the landscape. The erosion risk to surface soils would be greatest during soil salvage and soil replacement operations. Benga's erosion risk assessment provided erosion ratings for baseline conditions. The assessment also estimated erosion potential for, or risks posed to, reclamation material during soil salvage and replacement. Benga did not assign erosion risk ratings to non-soil units, disturbed lands, or open water totalling 17.7 per cent of the project footprint.

Water erosion

[1367] Benga estimated the rate of water erosion using the *Revised Universal Soil Loss Equation for Application in Canada* (Wall et al. 2002). Baseline conditions represented vegetated conditions where the risk of water erosion risk was very low. Benga stated that upland surface soil on steep slopes that are recently reclaimed with no mitigation would be at severe risk of water erosion. Benga estimated the area at severe risk to be 1185.0 ha, or 77.9 per cent of the LSA. When mitigation is implemented after reclamation, the area with soil at severe risk would be reduced to 0.4 per cent. Mitigation measures included adding mulch or tackifier for soil stabilization until vegetation establishment and limiting slope length.

[1368] We prepared Table 15-1 to summarize the data from Benga's baseline soil survey and impact assessment for soil map unit extents and the assigned water erosion risk rating for upland surface soil for each soil map unit. While not significant, we note that the discrepancy in the extent of severe water erosion rating between Benga's text and those calculated in Tables 15-1 and 15-2 has no obvious explanation.

Table 15-1: Water erosion risk ratings for upland surface soil

Rating	Upland surface soil recently reclaimed, no mitigation (% of LSA)	Upland surface soil recently reclaimed, mitigation implemented (% of LSA)
Very low	3.3	6.5
Low	0	16.8
Moderate	0	45.9
High	0	12.8
Severe	79.1	0.4
Not Rated	17.7	17.7

[1369] Upland subsoil was evaluated for water erosion risk when bare, which refers to when upland surface soil has been removed at salvage or not yet replaced at reclamation. Upland subsoil at severe risk accounted for 79.1 per cent of the LSA. According to Benga, when mitigation is implemented by adding mulch or tackifier for soil stabilization, no areas would be at severe risk for water erosion. Similarly, we prepared Table 15-2 to summarize data from Benga's baseline soil survey and impact assessment for soil map unit extents. For each soil map unit, Benga assigned a water erosion risk rating for subsoil.

Table 15-2: Water erosion risk ratings for subsoil

Rating	Exposed subsoil, no mitigation (% of LSA)	Subsoil, mitigation implemented (% of LSA)
Very low	3.3	3.9
Low	0	9.4
Moderate	0	58.8
High	0	10.3
Severe	79.1	0
Not rated	17.7	17.7

Wind erosion

[1370] Wind erosion risk ratings were modified from the *Wind Erosion Risk, Alberta* (Coote and Pettapiece 1989), Alberta Agriculture (1985), and United States Department of Agriculture (2014). The wind erosion rating at baseline condition was very low to negligible for all soil models due to vegetation cover. The wind erosion assessment ratings assume all the vegetation has been removed, leaving the bare soil exposed. Benga estimated 640.5 ha, or 42.1 per cent of the upland surface soil in the LSA, were at a high risk of wind erosion.

Wind erosion risk ratings

[1371] Table 15-3 was prepared to summarize Benga's baseline soil survey and impact assessment for soil map unit extents. Benga assigned a wind erosion risk rating for upland surface soil and subsoil for each soil map unit.

Table 15-3: Wind erosion risk ratings

Rating	Upland surface soil, bare (% of LSA)	Subsoil (% of LSA)
Low	1.2	1.0
Moderate	10.7	10.0
Moderate-high	28.4	24.3
High	42.1	47.2
Not rated	17.7	17.7

Sources: Coote and Pettapiece (1989), Alberta Agriculture (1985), United States Department of Agriculture (2014).

[1372] Benga stated that erosion will occur on the new landscape and some erosion of replaced reclamation material is expected on steep and long slopes. Benga suggested that the loss and deposition of soil due to erosion would add diversity and produce a more natural soil landscape. Benga indicated it would implement soil erosion control measures to minimize loss of soil materials from wind or water erosion during activities associated with surface soil salvage, storage, and reclamation.

[1373] Benga's proposed mitigations for soil erosion included

- locating reclamation material stockpiles in strategic locations to minimize exposure to wind or water,
- seeding reclamation material stockpiles with a non-invasive and weed-free seed mix that establishes quickly,
- employing erosion control materials (mats, netting, mulches, and straw) to reduce soil surface exposure and reseeding reclaimed landscapes with quick-establishing species, and
- using non-invasive cover crop to minimize the length of time bare soil is exposed to potential wind and water erosion.

[1374] During the hearing, Benga confirmed that the primary method of erosion control would be seeding and stabilization through vegetation. Benga indicated that a reasonable germination time after seeding was two to three weeks. Benga was asked about the challenges of using native versus non-native vegetation. Benga indicated native vegetation tends to be slower to germinate and grows more slowly than agronomic seed mixes. Consequently, agronomic species offer advantages for quick stabilization and

erosion control. To encourage ecological succession, a seed mix that balances rapid soil stabilization and long-term stability should be chosen. Benga proposed using adaptive management to evaluate seed mixes and modify them if improvements were needed. But it provided no specific examples of how adaptive management would be applied in this context.

[1375] Benga indicated a full growing season would be necessary to allow for sufficient grass growth to help prevent erosion. In response to a question about how long it would take until the soil stockpiles would be seeded, Benga indicated it could take a month or two for the stockpile to be ready for seeding. In some cases, seeding could be deferred until the start of the growing season. Benga acknowledged the need to be conscious of the erosion potential for the reclaimed sites, and indicated that mitigation is absolutely necessary.

[1376] The Livingstone Landowners Group questioned Benga about the lack of detail related to drainage in the conservation and reclamation plan. Benga explained that the drainage plan is general and that drainage features would be developed at a later stage. Benga added that erosion is a natural process and that some erosion would occur on the reclaimed landscape, especially in the early stages. But the mitigation measures will minimize erosion possibility and potential.

Participant concerns about water and wind erosion

[1377] The Oldman Watershed Council stated the project would be located in an area with shallow soils and steep mountain terrain. The council said many previous attempts at reclamation had failed because ground cover could not even be established. The council found it difficult to see how, if soil can't be kept on the land, adequate ground cover could be established to control erosion or how ecological functions could be restored. The extended timeline and large scale of this coal project would make the risk higher compared with other types of land uses.

[1378] The M.D. of Ranchland was encouraged by Benga's proposed use of rapid revegetation of reclaimed areas and soil stockpiles as a primary method to control erosion. But they indicated that Benga would not be able to revegetate the area with desired species in a short timespan. They expressed concern that some erosion will occur regardless of control measures, and that soil disturbed by erosion would contribute to future weed outbreaks. Revegetated areas would be at risk of erosion during early stages of revegetation, resulting in favoured germination conditions for both seeds stored in the seed bank and seeds invading from elsewhere.

[1379] The Ktunaxa Nation expressed concern that water and wind soil-erosion ratings have the potential to be high to severe if vegetation does not establish rapidly. And this may become an increasing problem with more severe summer droughts as a result of climate change.

[1380] Mr. McIntyre, a local resident, expressed concern about the potential for high winds to cause erosion and affect reclamation success. Mr. McIntyre showed photographs of the TC Energy pipeline to the east of the project area, apparently many years after reclamation efforts had been undertaken, with no vegetation growth. When asked if he could explain the differences between the challenging reclamation of the TC Energy pipeline, and the apparent successful reclamation examples given by the Coal Association of Canada, he responded, "There's probably a long answer, but the short answer is regular hurricane-force winds."

[1381] The Livingstone Landowner Group expressed concern with the method Benga used to estimate water erosion potential. The group's expert, Dr. McKenna, said that the revised universal soil loss equation, which Benga used to estimate the rate of water erosion, is more applicable to sheet flow erosion than gully erosion, and that gully erosion is a much more common and important erosional mechanism for waste rock dumps. The group acknowledged that some level of erosion is inevitable. They submitted that the almost complete absence of surface water drainage design is a major deficiency in Benga's conservation and reclamation plan. They submitted that it is clear that erosion would present a significant challenge to reclamation at Grassy Mountain, and that Benga failed to demonstrate it can address that challenge.

[1382] A number of participants, including Ms. Field, Mr. Des Moulins, Mr. McIntyre, and Mr. S. Marty of the Livingstone Landowners Group, commented on the frequency of high winds in the Crowsnest Pass and expressed concerns about the potential for increased dust due to mining operations.

[1383] The majority of soils, after disturbance and prior to the establishment of an effective vegetation cover following reclamation, are subject to moderately high to high risks of wind erosion and high to severe risks of water erosion. We find that the timing and effectiveness of measures to control erosion and to establish an effective vegetation cover following disturbance are therefore critical.

[1384] We agree with the Livingstone Landowners Group that the *Revised Universal Soil Loss Equation for Application in Canada* (Wall et al. 2002) has limitations for predicting the average soil loss by water erosion. As per page 4 of the document, "... the USLE and its revised version provide simple and reasonably accurate methods for which there is no better alternative available at the present time." The document goes on to state, "USLE/RUSLE only predicts the amount of soil loss that results from sheet or rill erosion on a single slope and does not account for additional soil losses that might occur from gully, wind or tillage erosion, nor does it calculate sediment yield." Some of the assumptions used in Benga's water erosion assessment are questionable. The use of soil map units in the reclaimed landscape may not represent the soil of reclaimed areas, as the replaced soil would be coming from the reclamation stockpile.

[1385] Benga assumed mitigation activities on recently reclaimed landscapes included a mulch or tackifier added for slope stabilization until vegetation establishment. However, at the hearing, Benga indicated that revegetation is the primary erosion control method and it may take up to a year for vegetation to become established and to effectively control erosion. We are uncertain why, when questioned about erosion risk at the hearing, Benga did not emphasize other mitigation measures proposed in the application, such as use of erosion control mats, netting, mulches, and straw, or provide additional details and examples to support its confidence in its ability to minimize erosion.

[1386] Benga did not provide examples of effective erosion control in a setting similar to that of the project. We do not have confidence in Benga's assertions about the efficacy of erosion control, specifically erosion control seed germination time and success due to the climatic conditions at the site, such as the short growing season and moisture limitations. It was also unclear if Benga intended to use native or agronomic seeds for erosion control. We note the use of the term "non-invasive seed mix" does not necessarily mean native seed.

[1387] We agree with the Livingstone Landowners Group that proper design of surface water drainage is important for minimizing water erosion. We also agree that more detail about surface water drainage design would help us assess the potential for water erosion and the effectiveness of the proposed mitigation. We expect a level of detail sufficient to understand how the water will be collected, controlled, and managed.

Soil salvage and handling will affect soil quality

[1388] Benga stated that disturbance of the soil profile may affect soil quality. Soil would potentially be chemically and physically altered due to activities associated with salvage, handling, storage, and replacement. Using best management practices, Benga proposed to salvage upland surface soil and sufficient subsoil and suitable overburden materials. Benga stated that appropriate soil salvage activities, subject to technical and safety considerations, would ensure the maximum achievable volumes of surface soil materials for placement.

[1389] As the upland areas have thin leaf litter and A (topsoil) horizons; Benga proposed to salvage a part or all of the B (subsoil) horizon to meet the reclamation materials balance requirements. Benga confirmed that deep organic material will be stored with upland surface soil. Benga indicated it would not conduct additional soil surveys before salvaging, but confirmed that it would monitor soils during operations.

[1390] Benga proposed only one stockpile location. The proposed location is adjacent to and south of the coal-handling and processing plant area. Benga acknowledged that stockpiling salvaged soil materials during construction of the project, in both the short term and long term, could result in soil erosion and affect soil productivity. Benga indicated the surface soil material would be located in accessible and retrievable areas, stored in a manner that minimizes material loss or degradation of quality, and seeded with a non-invasive, weed-free mix of seeds that establish quickly. Benga also indicated that temporary stockpiles could be placed on backfilled areas as the mine progresses to minimize haul distances. During the hearing, Benga suggested temporary stockpiles would be selectively located in small depressions or draws that would be out of the wind.

[1391] We recognize that operational challenges from operator error, equipment limitations, weather, and operating schedules may prevent Benga from salvaging all material as planned. Salvage during wet, windy, and frozen conditions has the potential to affect soil quality. In mining, these risks always exist. However, the landscape and topography at Grassy Mountain makes it even more challenging, given the thin soils, severe risk of wind and water erosion, and accessibility constraints caused by the nature of the terrain and slope.

[1392] Benga is proposing to do one-lift salvage of reclamation material. At mountain mines, salvage of reclamation material is challenging, as topsoil is often thin or absent. The combined depth of leaf litter and A horizons is commonly 10 to 15 cm, which would make salvaging in two lifts operationally difficult. We therefore find Benga's proposed one-lift salvage approach to be reasonable. Benga did not consistently analyze soil nutrients in the horizons for any soil profile. Therefore, it is difficult to understand the nitrogen and carbon concentration differences between topsoil and subsoil. Benga also did not discuss how overstripping may affect the seedbank.

[1393] Benga is currently proposing only one stockpile location. Our primary concerns with this approach are the potential impacts on the quality of reclamation material (the size of stockpile and the length of time the soil will remain in the stockpile) and the haul distances between the stockpile and reclamation areas toward the end of mine life. It is operationally and financially unlikely that only one soil stockpile will be created for the mine. Benga acknowledged the possibility of creating temporary stockpiles during soil salvage. Temporary stockpiles, while sometimes operationally necessary, are not ideal as they are typically not as secure as permanent stockpiles and require re-handling of reclamation material.

The suitability of soils on the project could pose significant challenges for reclamation

[1394] Benga determined reclamation suitability for soil models based on pH, salinity (electrical conductivity), sodicity (sodium adsorption ratio), saturation percentage, coarse fragments, soil texture, consistency, and calcium carbonate equivalent. The assessment followed the *Soil Quality Criteria Relative to Disturbance and Reclamation* guidelines, as specified for the eastern slopes region of Alberta (Soil Quality Criteria Working Group 1987) and used rating categories of good, fair, poor, and unsuitable. The A horizon was mostly fair to poor reclamation suitability, with coarse fragment content and slightly alkaline soil pH the most common limitations. The B horizon ranged from good to poor suitability, with coarse fragment content, high saturation percentage, and slightly alkaline soil pH as limitations. One soil model was rated as unsuitable due to very high coarse fragment content. The C (weathered, unconsolidated material) and BC (transition) horizons ranged from mostly fair to poor reclamation suitability, with coarse fragment content, high saturation percentage, and slightly alkaline soil pH as limitations. Five soil models were rated as unsuitable due to very high coarse fragment content. Benga did not consider the coarse fragment content a barrier to the establishment of a forested ecosystem.

[1395] The limited chemical analysis provided by Benga supports the claim that the pH, electrical conductivity, and sodium adsorption ratio do not appear to differ significantly between the topsoil (A) horizons and the subsoil (B and C) horizons. Physical characteristics, soil texture, also appear to be similar. Benga rated the suitability of overburden material using the *Soil Quality Criteria Relative to Disturbance and Reclamation* guidelines as specified for the eastern slopes of Alberta (Soil Quality Criteria Working Group 1987) as it could be part of the lower rooting zone. Benga indicated that the main limiting parameters for the overburden based on the analytical data were pH and sodium adsorption ratio. Benga's overburden assessment concluded that the majority of the bedrock overburden is a suitable rooting medium for reclamation.

[1396] During mining, the overburden would be removed and placed in external dumps, or in the mined-out pit. The overburden material will be recontoured to a maximum slope angle of 23 degrees. Benga indicated a soil management plan will ensure unsuitable overburden materials are not present in the rooting zone. Suitable overburden will not be separately salvaged, as Benga assumed management of material would be such that a suitable overburden cap would not be required. Benga planned to assess the vegetation response to evaluate the reclaimed rooting zone.

[1397] The Livingstone Landowners Group questioned Benga's claims about the reclamation suitability of soil. Benga replied that soil suitability calculations indicate that the soils would be of the same quality as what currently exists on the natural landscape. Benga added that the quality would not be deteriorated

or altered as a result of its activities, and in some instances it would be improved. But the group noted that a large majority of the project site has poor reclamation suitability, and Benga's plan was to use only materials salvaged onsite from the A and B horizons for reclamation. The group submitted that Benga's reclamation plan did not seriously grapple with the underlying challenge presented by the poor suitability of the reclamation material.

[1398] We note that fair material (as defined by the *Soil Quality Criteria Relative to Disturbance and Reclamation* guidelines) is usable as reclamation material with proper planning and sound management. But material with poor reclamation suitability requires careful planning and strictly controlled management. We agree with the Livingstone Landowners Group that Benga did not give adequate attention to the limitations of fair, and of poor quality, soil.

[1399] The recontouring of landforms during reclamation will result in terrain units differing from baseline conditions, and could cause unsuitable overburden materials to potentially be introduced into the reclaimed soil profile. Prior to final recontouring, materials with adverse chemistry need to be placed at depth and out of the rooting zone. Adverse chemistry in the rooting zone can affect vegetation growth and health and influence the vegetation that can occupy the site.

[1400] We find that Benga's evaluation of soils was limited. We note that while Benga reported drilling seven holes and taking overburden samples, Benga provided analytical data and reclamation suitability ratings for samples from only the three most southern locations.

Soil diversity will decrease but is expected to increase over time following reclamation

[1401] Benga confirmed that in identifying and assessing soil biodiversity—a valued component—it did not consider project effects on the biological diversity within soils related to the variability among living organisms in the soil. In its experience, Benga said that effects on soil biodiversity were not commonly evaluated in EIAs and would be difficult to do. The impact assessment for soils instead considered soil diversity. Benga's assessment considered the effects of the project on the spatial distribution of soil patterns and potential changes in soil diversity and ecological integrity after disturbance. Benga stated that common soils in the LSA and RSA include brunisols, regosols, luvisols, and chernozems in upland and mid-slope positions, gleysols in transitional areas, and shallow to deep organic soils in poorly drained level landscapes.

[1402] Benga's baseline soil survey provided distributions for the 43 soil map units in the LSA and RSA as well as disturbed lands and open water. Benga organized the soils into 21 soil models that represented common patterns found in the RSA and the LSA. Based on soil information for the LSA and RSA, Benga did not identify any uncommon soil profiles or patterns in the proposed disturbance area of the LSA and RSA.

[1403] Soil profiles would be disturbed as a result of soil salvage. Permanent loss is expected for organic soil map units MTF20 and DNL1, which cover approximately 18.9 ha, or 1.2 per cent of the LSA and 0.4 per cent of the RSA. During the hearing, Benga confirmed that it is not salvaging and separating soil based on moisture conditions. However, Benga said there may be an opportunity to selectively place soils during direct placement to increase diversity.

[1404] For upland and wetland reclamation, Benga proposed to place varying thicknesses of reclamation material with an average target of 20 cm to help create diversity in the reclaimed landscape. Benga stated that reclaimed soil-landscape patterns will be more homogenous than baseline conditions because reconstruction of the inherent variability associated with natural soil profiles is not possible. Benga stated that soil handling and storage will result in some diversity of the replaced soil on the reclaimed landscape, and it will not be uniform across the project. Soil diversity may decrease initially, but as the reclaimed soil profiles develop, diversity will increase.

[1405] Ecological integrity with respect to soil and landscapes is related to the vegetation communities and resulting habitats that form as a result of the relationship between soil and landscape patterns and corresponding moisture and nutrient regimes. Benga considered removal of the soil profile from the landscape and eventual replacement to be a disturbance above normal background conditions, one that would cause a detectable change in ecological parameters beyond the range of natural variability.

[1406] The Livingstone Landowners Group said that the current design appears to be limited to a promise to salvage all A and B horizons from the mining footprint, except in steep terrain. Material would then be distributed evenly across the reclaimed landscape to a single layer 20 cm deep, with minor roughening, regardless of target ecosite, slope, aspect, elevation, or net percolation objectives. The group suggested Benga revisit the cover design by paying more attention to the soil prescriptions, providing clarity on the salvage of overburden, and explaining how the cover prescriptions will satisfy ecosystem targets.

[1407] The Coalition stated that the plant communities—and the topography and soils on which whitebark pine, limber pine, and other rare or at-risk plants thrive today—will change dramatically. Meanwhile, Benga’s assurances that the closure landscape will support diverse communities hinge on “hedge words” such as “may support diverse communities.” The Coalition added that a number of references note that whitebark pine favours weakly developed soils, and that making the landscape more homogeneous does not inspire confidence about potential success.

[1408] The Ktunaxa Nation stated that it was important that monitoring soil profiles and diversity (i.e., soil microorganisms, mycorrhizal fungi, and nutrients) be undertaken to ensure the necessary building blocks for reclamation are present and the assumed timeframe for recovery is met. Otherwise, compensation in the form of offsetting would be required if soil recovery was not occurring on the trajectory expected for effective revegetation. Ktunaxa asked for a commitment from Benga for ongoing monitoring of the soil profile, soil diversity, and constituents (e.g., soil micro- and macroorganisms, mycorrhizal fungi, and nutrients) to ensure soil recovery and to inform reclamation options, the potential for revegetation success, and the need for further mitigations.

[1409] We find that Benga’s proposed soil salvage and handling operations would not recreate the soil profiles and diversity that exist prior to disturbance. The disturbance of the soil profile will mix the A and B horizons, which would dilute and mix nutrients. Soil structure that had developed would be lost. Stockpiling of the material would further reduce variability by narrowing the differences in the chemical, biological, and physical characteristics of soil profiles. Seedbanks would be diluted and possibly lost during soil stockpiling.

[1410] We acknowledge that the salvaging and stockpiling of soils does not mean the material will not function as a growth medium when placed during reclamation. We accept that the soil profiles created during reclamation will develop over time to be more varied across the mine site. We note that, while Benga provided average soil placement depths, it did not provide soil prescriptions. We agree with the Livingstone Landowners Group that more attention to soil prescriptions would create more diversity during reclamation.

The project will result in permanent changes to the natural variability and complexity of the terrain

[1411] The project area is defined by steep mountainous terrain. The elevation of the proposed mine permit boundary ranges from 1460 m near Blairmore Creek and west of the coal-handling and processing plant to 2100 m at the top of Grassy Mountain. Reclamation cross-sections provided by Benga illustrate the original and closure topography of the project area. We prepared Table 15-4 using figures provided by Benga to summarize expected changes in topography for the rock disposal areas and end pit lake.

Table 15-4: Elevation changes from original topography (m above sea level).

	South rock disposal area	Central rock disposal area	North rock disposal area	End-pit lake
Original topography	1580	1540	1710	2060
Reclaimed disposal profile / final pit profile	1720	1740	2000	1600 ^a
Difference in elevation	140	200	290	-460

^a The end-pit lake was expected to have a final water level of 1700 m. The 1600 m represents the bottom of the pit.

[1412] Benga stated that the effect of the terrain on the distribution of vegetation and on the assessment of project effects is strong. Vegetation changes are dramatic and generally driven by slope steepness, slope position, and aspect. After vegetation is removed and topsoil is salvaged, rock overlying the coal seams will be drilled, blasted, and excavated by mining shovels. The overburden rock will be loaded into haul trucks and transported to designated disposal areas. The resulting proposed mine pit, which follows the ridgeline of Grassy Mountain, will be approximately 6 km long and up to 1.8 km wide. The maximum pit depth is approximately 430 m at the north-central area of the pit.

[1413] The project development and reclamation process will establish new landforms, including the reclaimed pit and rock disposal areas, reclaimed end-pit lake, and highwall feature. The rock disposal areas will be progressively recontoured and reclaimed. The end-pit lake will be developed in the northeast portion of the mine. The end-pit lake will have a final water level of 1700 m with a maximum depth of 105 m and a surface area of 18.4 ha. A portion of the highwall along the north end of the pit will be left standing. The length of this highwall will be 2050 m, with a maximum height of 330 m above the end-pit lake level. The overall area of the highwall will be 42 ha. The resulting high wall and end pit will be on Crown land.

[1414] Various terrain types will be removed as a result of project development. After mining and reclamation of the project, there will be a permanent loss of organic landforms and a reduction in extreme slopes in the upland terrain. The reclaimed landscape will be reduced to a maximum slope angle of 23 degrees, except the highwall, which would have overall slopes of 55 degrees to 60 degrees. Benga

indicted during cross-examination by the Livingstone Landowners Group that the maximum slopes could be up to 27 degrees and would be decided during the detailed design of the reclamation topography.

[1415] Benga stated that reclamation of the project would create aspects and slope length similar to those of the existing upland terrain. Ridges, plateaus separated by terraces, valleys, and steep single-slope inclines would be created. However, Benga indicated that the natural variability and complexity of the existing terrain within the LSA will not be duplicated by creation of recontoured landscapes. Benga acknowledged that the end landscape will be different but argued that, if it does its reclamation job right, the landscape after closure will be interesting and productive. Benga suggested concerns over erosion, vegetation establishment, and safety are relevant to creating steeper slopes during reclamation.

[1416] The size and location of the highwall and end-pit lake are a function of the mine plan and are located in the last part of the pit to be mined. Benga acknowledged that the steep slope of the highwall poses a potential risk to public safety. But it suggested the risks are comparable to those faced by anyone hiking or scrambling in the mountains. Benga noted that the highwall will include horizontal safety benches across its face and that these areas also provide a place where vegetation, such as pine trees, could be established.

[1417] Benga considered options for the design of the highwall. A key limitation for backfilling against the highwall is the lack of material available as mining concludes. Benga considered knocking down the slope angle of the highwall or removing some of the safety benches. But it decided there is more benefit to the highwall and benches in the closure landscape than partially sloped benches. Benga used slope to evaluate alteration of terrain, as slope is measurable. Table 15-5 is Benga's comparison of pre-mining and reclaimed terrain at closure that was presented in the conservation and reclamation plan. We calculated the change from pre-disturbance to the post-reclamation per cent and added it to the table. The data are illustrated graphically in Figure 15-1.

Table 15-5: Comparison of pre-mining and reclaimed terrain at closure

Slope class	Slope (%)	Approximate slope (degrees)	Pre-disturbance (ha)	Pre-disturbance (%)	Post-reclamation (ha)	Post-reclamation (%)	Change from pre-disturbance to post-reclamation (%)
1	0-0.5	0	3	0.17	232	15.24	+15.07
2	>0.5-2	0.3-1.1	13	0.84	104	6.83	+5.99
3	>2-5	>1.1-3	51	3.35	77	5.04	+1.69
4	>5-10	>3-5	68	4.45	95	6.24	+1.79
5	>10-15	>5-8.5	139	9.16	88	5.80	-3.36
6	>15-30	>8.5-16.5	338	22.21	798	52.50	+30.29
7	>30-45	>16.5-24	360	23.66	67	4.38	-19.28
8	>45-70	>24-35	441	28.98	53	3.49	-25.49
9	>70-100	>35-45	109	7.18	7	0.48	-6.70
Total			1,520.7	100.00	1,520.7	100	

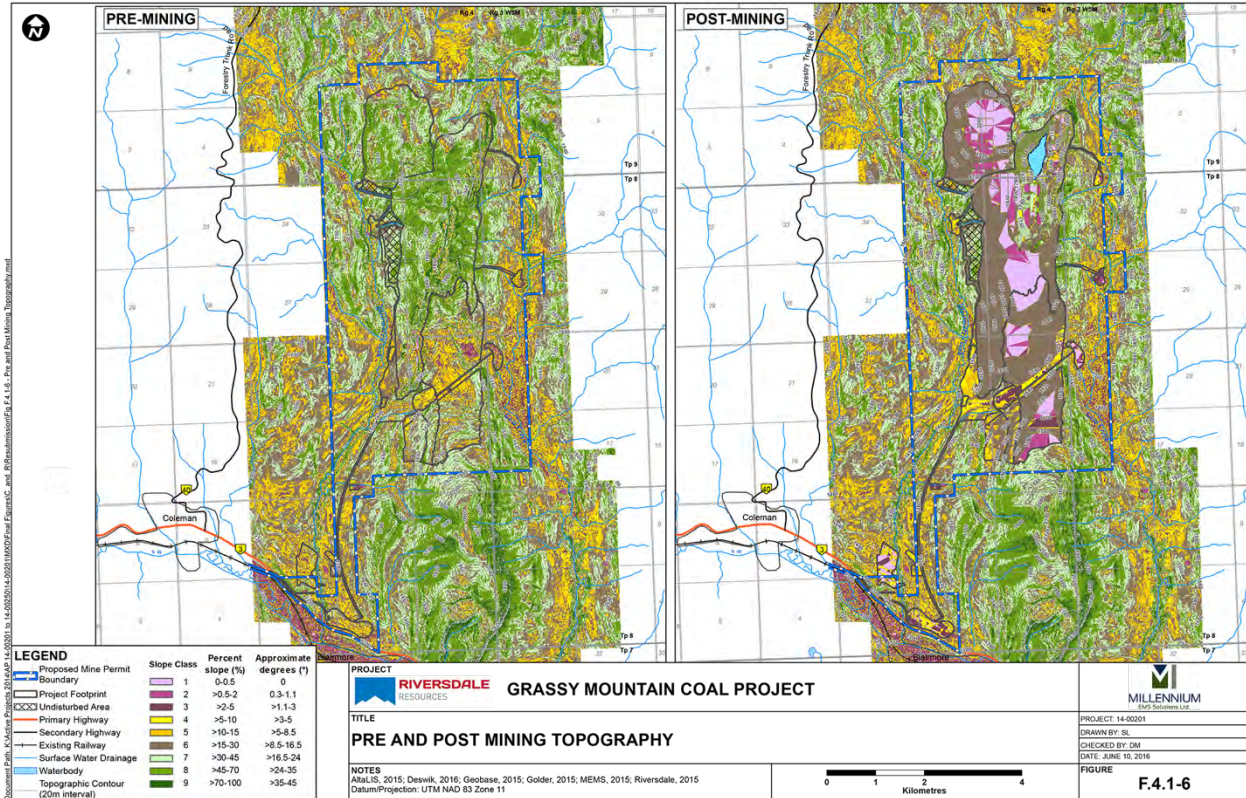


Figure 15-1. Pre- and post-mining topography. Source: CIAR 251, Package 2, Figure F.4.1-6, PDF p. 228.

[1418] The Livingstone Landowners Group said that, while Benga promised aesthetics in the reclaimed landscape, it provided little supporting information. The group noted that most mines use visualization techniques to explain to staff, regulators, and local communities the vision for the mine’s reclamation. These techniques show what the mine will look like from various points on the site and offsite before mining, during mining, after reclamation is complete, and in the long term. They noted that such information was not provided by Benga. The information in the EIA was limited to text, maps, and cross-sections.

[1419] The M.D of Ranchland expressed concern about the visual impacts of the project, including open cuts, pits, roads, landslides and spoil piles. The Coalition questioned the implications of Benga’s assessment of terrain. The Coalition noted that there will be a significant (86 per cent) reduction in slopes greater than 30 per cent over the entire mine area. They stated that it is doubtful and unproven whether Benga can grow equivalent quantities of whitebark pine on a significantly more homogenous and much gentler post-mining landscape.

[1420] The project would result in changes to the topography and landscape of Grassy Mountain, including a reduction in elevation along the summit ridge, an increase in low (less than 2 degrees) and moderate (15 to 30 degrees) slopes and a decrease in slopes of more than 30 degrees. We recognize that the alteration is more than a change in slope. Changes in elevation and slope have implications for the ability to re-establish certain species (such as whitebark pine) and ecosite types found in the subalpine natural region, such as ecosites d (spruce/heather; mesic/poor) and f (thimbleberry; subhygric/rich) in the closure landscape. However, Benga’s assessment of the alteration of terrain was limited to changes in

slope and did not discuss the relevance of changes in local and regional landscape aesthetics and future use resulting from landscape disturbances created by the project. We agree that a visual representation of the reclaimed landscape from different viewpoints would have helped understand the changes to terrain as result of the project.

[1421] We note that for operators to receive a reclamation certificate, a highwall must be safe and be abandoned as per *AER Manual 017* (May 2019). Operators should have a clear understanding of how highwalls and end-pit lakes fit into the closure landscape, including public use, recreation and wildlife objectives. We accept that the highwall and end-pit lake are artifacts of mining, but Benga provided limited analysis and discussion of the implications of these features in the closure landscape or their integration into the surrounding landscape. The end-pit lake is discussed in more detail in the chapter on surface water quality.

The project is not likely to result in significant adverse effects on terrain and soils

[1422] Benga used the following valued components to evaluate potential environmental impacts on terrain and soils associated with the project:

- soil quality (includes impacts on soil disturbance, erosion, soil burial, and accidental releases)
- soil biodiversity
- alteration of terrain
- landscape capability (impact on potential capability of reclaimed soil and landscapes compared with baseline conditions)

[1423] Benga found no significant effects on terrain or soils. Benga's determination was based largely on the local extent of the impacts, and the assumption that soil salvage, handling, progressive reclamation, and monitoring and mitigation would result in successful reclamation. We note that Benga's assessment of significance was not based on quantitative measures. Benga did not set criteria for magnitude or impact ratings, and it is unclear how Benga arrived at its assignments.

[1424] We do not agree with Benga's rating that project contributions to alteration of terrain would be neutral. The removal of extreme terrain and organic landforms from the project footprint, and changes in distribution of slope classes, are adverse effects. This is due to the potential of changes in terrain to affect the re-establishment of certain ecosite and vegetation types, and the increase in low slopes and inclusion of a highwall. The closure landscape will be distinguishable from the surrounding natural terrain. We consider the effect to be adverse and moderate in magnitude, but not significant.

[1425] We do not agree that the duration for erosion effects is short. While specific erosion events may be brief, erosion is possible for life of the project, and possibly beyond, and a more suitable duration is long. We also do not agree the magnitude of the impact on soil biodiversity and ecological integrity is low. Soil profiles will not be replicated during reclamation and the lack of consideration for soil prescriptions could affect the re-establishment and diversity of vegetation. We consider the magnitude to be moderate. We conclude that the effects on terrain and soils are adverse but not likely to be significant, largely based on the local areal extent. We have a high degree of confidence in our assessment.

Table 15-6. Panel's assessment of summary of residual effects and significance determinations

Indicator	Geographic extent	Duration	Frequency	Reversibility	Magnitude of impact	Ecological and sociological context	Significance
Soil quality and profile disturbance	Local	Persistent	Continuous	Reversible in long term	Moderate	Initially adverse, neutral long-term	Not significant
Soil quality and erosion	Local	Long	Occasional with highest risk during soil salvage and placement	Irreversible	Initially moderate, decrease to low over time	Negative	Not significant
Accidental releases	Local	Medium: may occur as one-time release, or as cumulative releases over longer periods of time	Occasional	Reversible shortly after operations cease	Low	Neutral	Not significant
Soil biodiversity and ecological integrity	Local	Persistent	Continuous	Partially reversible; effects diminish as profiles develop over time	Moderate	Negative	Not significant
Alteration of terrain	Local	Persistent	Continuous	Irreversible	High	Negative	Not significant
Reclaimed overburden materials	Local	Persistent	Continuous	Reversible in the long term	Low	Neutral	Not significant
Land capability	Local	Long or persistent	Continuous	Reversible in the long term	Moderate for changes to terrain type, low for delay in achieving land capability	Neutral	Not significant

The project is not likely to contribute to significant adverse cumulative effects on terrain and soils

[1426] Benga determined that no other planned or reasonably foreseeable projects or activities would interact with soil valued components within the RSA used for the soil assessment. Therefore, the planned development (cumulative effects assessment) case for soils was equivalent to the application case. Benga estimated that 8.2 per cent (372.6 ha) of the RSA was disturbed from past or existing activities. As the LSA represents more than 30 per cent of the RSA, the magnitude of the project effect in the RSA would be large. However, this is a function of how the LSA and RSA are defined.

[1427] With regards to soil quality, Benga expected that existing and potential future developments within the RSA that disturb the soil will be required to conserve soil and complete reclamation. This is required by current regulatory and operating requirements. Benga expected the resulting environmental

effects on soil erosion for the planned development case to be equivalent to the application case. Benga indicated that no change in soil diversity or ecological integrity with respect to soil types and landscape patterns is expected from a regional perspective, and that the cumulative effect of the project was not expected to be significant.

[1428] We agree with Benga's assessment that, because no other projects within the RSA are likely to interact with the project's soils and terrain, the project is not likely to contribute to adverse cumulative effects on soils and terrain.

16. Vegetation and Wetlands

Benga's approach to assessing effects on vegetation and wetlands was acceptable

[1429] Benga assessed the potential environmental effects of the project on vegetation and wetlands resources in the region. To do so, it selected the following key indicators or valued components:

- vegetation communities (ecosite phases)
- rare plants, rare plant communities and rare plant potential (including whitebark and limber pine)
- rangeland resources (including foothills rough fescue)
- forest resources
- old-growth forests
- species associated with traditional ecological knowledge
- wetlands
- biodiversity (species, community and landscape diversity)

[1430] Benga also assessed noxious vegetation, potential acid input, and nitrogen deposition.

[1431] The baseline studies and effects assessment on vegetation resources were conducted in an LSA covering 4797.6 ha and an RSA of 284 024.8 ha. The project footprint is 1521 ha. The LSA encompasses the Montane and Subalpine Subregions of the Rocky Mountain Natural Region of Alberta, with the former occupying most of the footprint. Vegetation communities in the Montane and Subalpine Subregions within the LSA were characterized by mapping and field surveys. Field surveys did not target noxious weeds and other non-native plant species. This information was obtained from lists of species collected for the general vegetation and wetlands field surveys. Benga reported that, in addition to naturally occurring land units, the LSA contained 763.9 ha of previously disturbed areas, including 274.2 ha within the project footprint.

[1432] Approximately 47 800 ha, or 17 per cent, of the RSA is within the province of British Columbia. Vegetation communities in the RSA were characterized by mapping using remote satellite imagery. Benga did not obtain forest harvesting data, traditional ecological knowledge vegetation data, or rare plant databases for the portion of the RSA outside Alberta.

[1433] Information on the assessment of the effects of potential acid input and nitrogen deposition on vegetation and wetlands was obtained from data collected for the air effects valued component. Information on noxious weeds was collected during field surveys of vegetation and wetlands.

[1434] We find that Benga's field data collection followed acceptable standards for vegetation surveys in Alberta. Given that Benga's field surveys did not target noxious weeds and other non-native plant species, we find that Benga's understanding of baseline conditions related to the presence of noxious weeds and other non-native plant species is likely incomplete.

The project will disturb a diverse and specialized landscape

[1435] Benga confirmed that the construction, operation, and closure of the project would remove all vegetation species and ecosite phases in the project footprint. This includes rough fescue communities and other ecosite phases that each make up less than 1 per cent of the LSA. Benga noted that the LSA is dominated by upland communities, which comprise 3662.6 ha in the Montane and Subalpine areas of the LSA. The upland communities include 27 upland ecosite phases (17 in the Montane Subregion and 10 in the Subalpine) that represent approximately 76 per cent of the LSA. Lowland communities, such as wetlands and aquatic ecosystems, occupy 1 per cent of the LSA. The remainder of the LSA consists of non-forested upland vegetation (7.7 per cent) and previously disturbed land (16 per cent).

[1436] Benga reported that 11 ecosite phases within the LSA had limited distribution (those occupying less than 1 per cent of the LSA); six in the Montane Subregion and five in the Subalpine. Benga reported three non-forested land classes occupying less than 1 per cent of the LSA. From baseline case to application case, upland ecosite phases in the LSA decline by 21.7 per cent (1039.5 ha) due to land clearing and soil disturbance. This includes a loss of 518.8 ha of upland ecosite phases in the Montane Subregion and 523.9 ha of upland ecosite phases in the Subalpine Subregion. Non-forested land declines by 4.1 per cent (195.6 ha) in the LSA.

[1437] Within the subalpine Natural Subregion of the LSA, the white spruce (*Picea glauca*)-dominated d1 (spruce/heather Se), whitebark pine–dominated e2 (false azalea [*Rhododendron menziesii*], grouse-berry [*Vaccinium scoparium*] Pw) and Douglas fir (*Pseudotsuga menziesii*)-dominated e4 (false azalea – grouse-berry Fa) ecosite phases will decline by 100 per cent, 98.3 per cent, and 89.5 per cent respectively. The d1 ecosite phase will be completely lost from the Subalpine Subregion of the LSA as a result of the project. This ecosite phase does not occur naturally in the Montane Subregion.

[1438] Ecosite phases disturbed during project construction will be reclaimed to four broad vegetated ecological units (closed conifer forest, grassland open forest, mixed forest, and treed wetland) as well as open water and barren land. Benga expected that, in 65 years or more, revegetated areas would resemble targeted early-succession vegetation communities. Benga stated that 274 ha of existing anthropogenic disturbance would be reclaimed at closure to equivalent land capability.

[1439] Benga stated that progressive reclamation during project operations and final reclamation after the end of mine life will achieve the goal of attaining equivalent land capability and re-establishing the variety of predisturbance species and plant communities. Native plant species would be used for revegetation during progressive reclamation. Specifically, Benga planned to implement progressive reclamation to mitigate disturbance of vegetation communities by

- establishing vegetation communities that are locally and regionally limited in distribution,
- preserving adjacent vegetation communities by limiting disturbance to areas required for development,
- using direct placement practices to ensure propagules in the salvaged soil are transferred to areas that are immediately ready for reclamation,
- planting multiple layers of vegetation to improve biodiversity,

- using certified native seed mixes, and
- consulting with Indigenous communities regarding revegetation plans.

[1440] Benga's proposed reclamation plans are discussed in further detail in the conservation, reclamation, and closure chapter. Benga was of the view that following reclamation, the project would have a neutral effect on vegetation communities.

[1441] The project would disturb a highly diverse and specialized landscape. This area contains plant communities that have evolved over time to make small but important contributions to local and regional biodiversity. We note that previously disturbed land accounts for only 274 ha (approximately 18 per cent) of the project footprint. The remainder hosts well-established plant communities. We disagree with Benga's conclusion that the environmental effect from the loss of plant communities will be neutral or that vegetation communities will be subject to no residual effects after mitigation.

[1442] The vegetation communities within the project footprint include 17 and 10 forested ecosite phases in the Montane and Subalpine Subregions, respectively, four non-forested communities, and two naturally non-vegetated areas. These areas will be reclaimed to only four broad vegetated ecological units that are defined by the dominant and co-dominant tree species as well as open water, barren land, and anthropogenic units. We find that Benga's plan to reclaim just these four broad vegetation classes is not sufficient to compensate for the loss of 27 upland ecosite phases.

[1443] Moreover, it is unclear when existing ecosite phases would be restored on the reclaimed landscape. While 65 or so years may be sufficient to establish early successional communities, it will not be sufficient to achieve equivalency in the diversity of species and communities found at baseline given the harsh climate of the Rocky Mountains, where plant development is slow. As discussed in the conservation, reclamation, and closure chapter, Benga's plan to place a uniform depth of reclamation soil across the project footprint without accounting for differences in soil moisture retention and terrain characteristics (slope, aspect, elevation) may result in unsuccessful outcomes.

[1444] The project is in an area that is strongly influenced by Cordilleran climates and elevation, aspect, and substrate. While not as extreme as the Alpine Subregion, where tree growth is uncommon, the growing season in the Subalpine and Montane Subregions is relatively brief, and revegetation success and attainment of climax vegetation communities on the reclaimed landscape may be prolonged.

[1445] We find that the effects on upland ecosite phases will be moderate in magnitude and local in extent. We recognize that Benga is relying on natural succession following reclamation to support its claim that ecosite phases will return with a complement of species and vegetation communities equivalent to those of the surrounding areas or conditions similar to those present at baseline. While some communities may eventually become re-established, it will likely take more than 100 years to achieve equivalency. As a result, we find that adverse residual effects on vegetation communities in the LSA will remain far into the far future.

The project will result in the loss of rare plants and rare plant communities

[1446] Benga's assessment of project effects on rare plants and rare plant communities was based on the number of rare plants found in each ecosite phase in the LSA, the rare plant potential of each ecosite phase, and the number and extent of rare plant communities. Benga stated that the rare plant community potential in the LSA was determined by considering rare plant communities historically reported near the project in the provincial database, reviewing available literature, and through professional judgement.

[1447] Benga identified 41 provincially rare species (14 vascular plants, 16 mosses and liverworts, and 11 lichens) in the LSA during field surveys. Two species identified in the LSA, the whitebark pine and the limber pine, are designated as endangered by COSEWIC. Since June 20, 2012, whitebark pine populations in Alberta and British Columbia have been listed as endangered under *SARA*.

[1448] The construction and operation of the project would remove all vegetation, including rare plants, from the project footprint. Benga reported that 11 of the 14 rare vascular plant species in the LSA would experience declines, and that four of the rare vascular plant species in the project footprint were not located outside the project footprint; these four species would be eliminated from the LSA. Benga also reported that nine of the 16 rare moss and liverwort species would be affected, while three of the rare species that occur only in the project development area would be eliminated from the terrestrial LSA.

[1449] Within the LSA, Benga reported 1199 ha in the Subalpine and 119 ha in the Montane among ecosite phases with high rare plant potential. Ecosite phases with moderate rare plant potential covered 383 ha and 1761.7 ha in the Subalpine and Montane Subregions of the LSA.

[1450] According to Benga, project construction and development will affect 465 ha (39 per cent) and 18 ha (15 per cent) of ecosite phases with high rare plant potential in the Subalpine and Montane Natural Subregions, respectively. At the same time, ecosite phases with moderate rare plant potential will decrease by 24.3 per cent (93.1 ha) and 29.1 per cent (512 ha) in the Subalpine and Montane Subregions, respectively. The effects on rare plant community potential are the greatest in the Subalpine Subregion. From baseline to application case, the extent of the LSA with high rare plant community potential declines by 61.2 per cent (103.6 ha) and 30.5 per cent (63.4 ha) in the Subalpine and Montane Subregions, respectively.

[1451] Benga indicated that—wherever possible—it would mitigate effects on rare plant species by leaving them undisturbed. Benga's mitigation plan primarily focuses on whitebark pine and rough fescue communities, for which detailed mitigation plans were included. Benga stated that mitigation measures for vegetation communities would be applicable to rare plants. The conservation, reclamation, and closure chapter contains further details on Benga's plans for reclamation and our analysis of its reclamation and closure plans.

[1452] Benga proposed the following mitigation measures for effects on rare plants and rare plant communities:

- Consider propagule relocation and collection for seven vascular plants found in the project footprint.
- Consider avoidance of populations of whitebark pine as a criterion for ongoing mine footprint planning and adhere to provincial recovery plans for whitebark and limber pine.

- Collect cones from pine trees within the footprint that are healthy and free of disease.
- Try to introduce blister rust-resistant strains of whitebark pine during reclamation phases following federal and provincial guidelines.
- Minimize project disturbance and avoid fescue where possible through mine planning.
- Identify potential areas on hill crests and southern aspects suitable for transplanting native fescue.

[1453] Benga concluded that the project will result in the loss of some rare plants, as they would be removed during clearing and mining and there is no assurance that they will return after reclamation. Benga concluded that project effects on rare plants and rare plant communities resulting from the construction and operation of the project would not be significant following reclamation. Benga said it expected that natural ingress of species will improve biodiversity and, over time, see the return of rare plants impacted by the project. Ultimately, reclamation is the primary means of mitigating the loss of vegetation in the project footprint.

[1454] We find that Benga's assumption of successful reclamation cannot be extended to include rare species. Rare plants may be limited to just a few individuals in an area or jurisdiction, or they may be restricted to a narrow geographic range as a result of slope, aspect, climatic condition, or the presence of a plant or animal species that plays a role in its survival (such as the Clark's nutcracker [*Nucifraga columbiana*] for whitebark pine). Although recovery plans can contribute to the survival or resurgence of a plant species that is becoming increasingly rare or on the verge of extinction, some species such as lichens and mosses only expand their range through habitat protection. In addition, lichens often require specialized habitats such as rocky outcrops, cliffs, tree logs, and the bark and branches of trees in forest stands in later successional stages.

[1455] Rare plants occupy highly specialized niches that are often difficult to replicate on reconstructed landscapes. Benga's reclamation plan targets broad vegetation communities that comprise fewer ecological units (six compared with the 27 ecosite phases [communities] mapped in the footprint at baseline). Therefore, we find that impacts on rare plants will persist despite reclamation. Fewer niches than exist at baseline will be available in the reclaimed landscape.

[1456] Benga has suggested minimizing the extent of the project footprint or avoiding rare plants and whitebark pine in the footprint. However, the project design has been optimized to enable maximum coal recovery and rock disposal. Consequently, we find it unlikely that changes to the footprint would be sufficient to allow Benga to avoid existing vegetation communities within the project footprint, or even in the vicinity of the footprint. In addition, the expected change in topography, including slope, aspect, and the overall elevation of the reclaimed landscape, may not be suitable for some current vegetation.

[1457] While no specific studies link rare lichens to individual tree species, some species are found in mature to old-growth forest stands as hanging lichens, on decomposing tree logs, or on exposed rock faces that would be removed during construction. An area lacking the specific combination of environmental and biological conditions to allow rare plants to establish and survive may be devoid of many rare plants for periods that could exceed 200 years.

[1458] We find that, after reclamation, there are likely to be residual effects of moderate magnitude on rare plants and rare plant communities within the LSA. While all rare plants within the project footprint will be removed, most rare plant species and communities will remain in the LSA. The residual effects are likely to persist for more than 100 years after closure. We suspect most rare species may never return.

The project will remove a large number of whitebark pine

[1459] Our terms of reference require us to consider the effects of the project on species listed under *SARA*, as well as their critical habitat. We are also required to identify measures to avoid or lessen those effects, and monitor them, in a manner consistent with applicable recovery strategies or action plans. The whitebark pine is listed as endangered under *SARA* and Alberta's *Wildlife Act*. The *Alberta Whitebark Pine Recovery Plan 2013-2018* was published in January 2014. In October 2017, ECCC released a proposed *Federal Recovery Strategy for the Whitebark Pine* for consultation. As noted by CPAWS and other participants, the proposed recovery strategy was never finalized.

[1460] The whitebark pine is a long-lived, five-needled pine with large closed cones that is found in many forested ecosystems, primarily in upper Montane and Subalpine Regions. In Canada, populations occur in British Columbia and Alberta. Whitebark pine is a keystone species considered essential to ecosystem function on many alpine and subalpine sites.

[1461] Benga said that the project would result in the removal of an estimated 208 ha of whitebark pine and open grassland areas containing a sparse whitebark pine canopy within the project footprint. Benga estimated that the project would remove approximately 21 000 whitebark pine trees and noted that this was likely a conservative overestimate. Benga stated that the project would have an overall positive contribution for whitebark pine, with the establishment of disease-resistant trees on the reclaimed landscape and the creation of additional habitat through reclamation of historical mine areas.

[1462] ECCC agreed with Benga that mining activities would result in the mortality of whitebark pine trees in the project footprint, and concluded that there would be environmental risks to whitebark pine. ECCC concluded that the mine would affect local whitebark pine populations for 30 years or more.

[1463] The Coalition raised concerns regarding Benga's assessment methodology and conclusions. They were of the view that Benga underestimated the numbers of whitebark pine in the project footprint and failed to identify the full extent of the distribution of whitebark pine that would be removed by the project. The Coalition's expert, Mr. C. Wallis, conducted a field survey near the north edge of the proposed rock disposal area and found 107 whitebark pine trees previously not accounted for by Benga, 87 of which were within the project footprint. Benga later confirmed that there were whitebark pine in that area. The Coalition argued that the elimination of tens of thousands of individual whitebark pine trees to develop a coal mine was at odds with the whitebark pine recovery strategy's goals and strategies of reducing the direct mortality of trees and the conservation of genetic resources. The Coalition noted that the whitebark pine recovery plan provided guidance to protect known high-value trees that are both cone-bearing and blister rust-resistant.

[1464] Many participants raised concerns about the loss of whitebark pine. Some noted the importance of whitebark pine to local inhabitants and local wildlife, specifically Clark's nutcracker and grizzly bears. For example, the whitebark pine is a species of cultural importance to the Ktunaxa Nation. Mr. McIntyre,

a local resident and forest scientist, stated that he has been involved in the mapping and protection of limber and whitebark pine in Alberta. He noted that the species were of special interest to many people from all walks of life, and that some trees were “maybe more than 1000 years of age.” The Wildlife Society noted that whitebark pine seeds were considered an important food source for grizzly bears.

[1465] At the hearing, the Coalition noted that the 2017 proposed federal recovery strategy identified critical habitat within the project footprint area. The Coalition submitted communication between ECCC and Benga in 2018 indicating that a reassessment of critical habitat was being undertaken. The revised 2018 map of the project area, provided by ECCC to Benga, shows no critical habitat within the project footprint area. ECCC indicated to Benga in 2018 that this was the “current proposed thinking for critical habitat.” However, ECCC confirmed at the hearing that maps showing the occurrences of high-density and mature whitebark pine trees in the project area are still valid.

[1466] The Coalition argued that critical habitat for the whitebark pine still existed within the project area because the area contains high-density, mature whitebark pine stands that meet the criteria set out in the recovery strategy. The Coalition also noted that the lack of identification of critical habitat did not mean that the presence of whitebark pine within the project area was not relevant. ECCC agreed with this statement. In its final argument, Benga noted that there was no critical habitat for the whitebark pine in the project footprint area, based on ECCC’s information. Benga also noted that the *SARA* prohibitions protecting critical habitat only apply to critical habitat on federal lands, of which there is none in the project area.

[1467] ECCC did not provide any updates or conclusions in their hearing submission on the specific location of critical habitat within the project area, or on the effects of the project on any future identification of critical habitat. ECCC also did not indicate which of the critical habitat proposals should be considered during our analysis, or provide any indication as to when the recovery plan was likely to be finalized.

[1468] Participants debated whether the project area is, or should be, considered critical habitat. However, the critical habitat identified in the 2017 *Recovery Strategy*, and the other draft maps presented, remains “proposed” and has not been finalized. Although the 90-day timeline for identification of critical habitat (as specified in *SARA*) has long since passed, it is uncertain whether the high-density stands of mature whitebark pines in the project area will be considered critical habitat.

[1469] In its final argument, the Coalition argued that *SARA* prohibitions should apply to provincial Crown lands due to commitments made under the *Accord for the Protection of Species at Risk* by the federal, provincial, and territorial ministers. As noted by the Coalition, the accord commits federal and provincial ministers to develop complementary legislation and programs that protect species at risk throughout Canada. This includes immediate legal protection for endangered species and the habitat of endangered species, and recovery strategies within one year that address the identified threats to the species and their habitats. The accord also requires these two levels of government to undertake multi-jurisdictional cooperation for the protection of species that cross borders. This is achieved through the development and implementation of recovery strategies that consider the needs of species at risk as part of environmental assessment processes.

[1470] ECCC noted that, because the project is on provincial lands, *SARA* prohibitions do not apply to the terrestrial species at risk in the project area. Benga agreed, noting ECCC's comments on the matter.

[1471] As there is no critical habitat delineated in a final recovery strategy for whitebark pine, we base our analysis of the effects of the project on whitebark pine on the precautionary approach discussed in the chapter on the panel approach to determining the significance of effects. Specifically, we consider the project footprint an area with a high density of whitebark pine trees that are cone-producing and potentially important to the survival and recovery of the species. But it is not an area of critical habitat. In addition, we carry out our analysis irrespective of the jurisdiction of the land, as our terms of reference require us to consider the effects of the project on species listed under *SARA*, regardless of where they are located.

[1472] We find that, while Benga may have undercounted the number of whitebark pine in the project footprint, that number is likely negligible compared with the total number of whitebark pine counted (21 000). With that in mind, removal of 21 000 whitebark pine, a listed endangered species, represents a large number of trees. While we acknowledge that Benga has committed to planting three whitebark pine seedlings for every whitebark pine removed as a mitigation measure, we are not confident Benga will be able to restore whitebark pine through reclamation. The reasons for our lack of confidence are discussed in the next section.

Successful re-establishment of whitebark pine is uncertain

[1473] Benga indicated that the goal of its reclamation plan was to develop maintenance-free and self-sustaining lands. Benga stated that its specific objective for whitebark pine was to re-establish a community of white pine blister rust-resistant trees that would conserve the genetic diversity of the original population during the reclamation phase of the project. Benga stated that its whitebark pine mitigation plan was intended to adhere to the mitigation approaches outlined in the *Alberta Whitebark Pine Recovery Plan* and the proposed *Federal Recovery Strategy for the Whitebark Pine*.

The objectives are

- reduce direct mortality,
- develop and introduce blister rust-resistant strains of whitebark pine,
- conserve genetic diversity, and
- manage habitat and natural regeneration

[1474] Benga proposed the following mitigation measures:

1. Reduce direct mortality by minimizing the project footprint to avoid populations of whitebark pine where possible.
2. Introduce blister-rust resistant strains of white pine during reclamation phases.
3. Conserve genetic diversity by collecting cones from whitebark pine trees, within the disturbance footprint, that are healthy and free of disease after harvesting is completed.

4. Manage habitat and natural regeneration by planting through
 - a. identification of high light, low competition sites,
 - b. planting in pure stands or patches to avoid competition from other trees,
 - c. avoidance of potential swales and frost pockets,
 - d. creation of microsites for seedling establishment (rocks, stumps, or other coarse woody debris),
 - e. use of recommended spacing to avoid interspecies competition, and
 - f. preferentially planting seedlings in the fall to avoid hot dry summer conditions.

[1475] Benga also committed to the following measures:

- Identify all whitebark pine in advance of clearing the project footprint.
- Participate in the provincial recovery program.
- Make seeds available to support the Alberta Whitebark Pine Recovery Plan.
- Continue to participate in the Crown of the Continent Ecosystem High Five Working Group.
- Salvage all whitebark pine, unless it is unsafe to do so due to steep and or unstable terrain.
- Engage qualified professional contractors to undertake the safe collection of healthy whitebark pine cones.
- Plant 63 000 whitebark pine seedlings; three times the conservative pre-disturbance number of trees. Benga assumed a 50 to 90 per cent survival rate for the seedlings.
- Initiate planting trials once suitable reclaimed habitat is available.
- Consult with and involve nearby First Nations in the development of the final closure and reclamation plans as the project moves into design and construction.
- Develop an Indigenous monitoring program with nearby First Nations that includes monitoring of closure and reclamation results and adaptation of plans as required to improve performance.

[1476] Benga stated that the reclaimed lands would feature regionally compatible landforms and vegetation patterns that were ecologically functional and successional. It said the goal of the reclamation plan would be to develop lands that were maintenance-free and self-sustaining. Benga stated that it was confident that its mitigation measures and reclamation activities would be successful and that the project would ultimately have a positive effect on the population of whitebark pine.

[1477] In its response to our information request, Benga provided examples of whitebark pine revegetation projects in Canada and the U.S., where the general success rate ranged from 55 to 90 per cent. Although Benga provided five examples, three were trials that had just begun or would soon begin and cannot yet be considered successful revegetation. We also note that, while the other examples provide early indication of successful revegetation, no study is more than eight years old. We note that the

number of planted whitebark pine seedlings ranged from 373 to 24 460, much fewer than the planned 63 000 seedlings Benga expects to plant.

[1478] The Coalition stated that Benga’s proposed reclamation plan continued to pose “significant risks” that had not been sufficiently addressed. The Coalition indicated it was “doubtful and unproven that Benga can successfully grow equivalent quantities of whitebark pine on a significantly more homogenous, much more gentle post-mine landscape” (CIAR 1339, PDF p. 78).

[1479] The Ktunaxa expressed concern regarding Benga’s ability to successfully restore whitebark pine and noted that in their experience, restoration projects have met with mixed success and that long-term monitoring would be needed. The Ktunaxa also noted that the assessment of “not significant” for whitebark pine and other rare plants was based on little or no supporting evidence for reclamation success. As such, they lacked a precautionary approach. The Livingstone Landowners Group noted that re-establishment of whitebark pine stands may represent a high-risk commitment, in that it is unlikely the commitment can be met and that these risks appear to be underrepresented in Benga’s assessment.

[1480] We heard differing views about the current health of the whitebark pine population in the project area. In its 2016 EIA, Benga stated that whitebark pine within the LSA appeared relatively healthy, although Benga noted that some trees had branches with no needles, and some trees had died. However, at the hearing, Benga’s expert witness stated that, as of 2019, the trees in many of the locations that were previously documented by Benga were dying or already dead, and many of the survivors were not bearing cones that year. Benga’s expert witness went on to state that the more mature trees were clearly unhealthy, and that in fact none of the trees appeared to be genuinely healthy. Benga’s expert witness clarified that the health issues related to whitebark pine in the project area appeared to be consistent with white pine blister rust.

[1481] The Coalition’s expert witness, who conducted a field survey in 2020, stated that most of the whitebark pine that were viewed during the field survey were healthy, although only a small number of blister rust–infected trees in the more closed forest were observed. The Coalition’s expert witness noted that the trees on the steeper, more open slopes were apparently still healthy. Given this conflicting evidence, the current health of the whitebark pine in the project area is not clear. However, if the whitebark pine in the project area are, as Benga suggests, unhealthy, this raises questions about the feasibility of Benga’s plan to harvest seeds from healthy trees for reclamation purposes.

[1482] Benga committed to introducing white pine blister rust–resistant strains of whitebark pine during the reclamation phase of the project, noting that the provincial recovery strategy included criteria for identifying disease-resistant trees as well as establishing greenhouses to germinate resistant seedlings for future reintroduction. In its EIA, Benga explained that it would collect seeds from healthy and disease-free whitebark pine trees harvested from within the project footprint area to conserve genetic diversity, in accordance with the objectives of the *Alberta Whitebark Pine Recovery Plan* and the proposed *Federal Recovery Strategy for the Whitebark Pine*.

[1483] At the hearing, Benga explained that it would take seven years to determine if a source tree had genetic resistance to white pine blister rust. Benga noted that it would have to carry out a more detailed health survey on the whitebark pine in the project footprint to find a tree that appeared to be healthy and

was of cone-bearing age for testing. Benga noted that there were trees available that were known, or suspected, to be genetically resistant and producing cones for seedling production in planting projects, alluding to the recent planting of “10 million seedlings.” However, no other information was presented regarding the potential stock crop.

[1484] Benga further explained that seedlings from whitebark pine trees outside the project footprint area may need to be sourced, noting that Benga owned considerable land in the area. No information about these whitebark pine trees was presented. Benga further noted that it would look to other suppliers of seeds to help with the replanting effort, if necessary. Benga stated that it was confident that it could get the required seedlings, as it was currently working with “the recovery team and other whitebark pine organizations,” but acknowledged that it would take planning (CIAR 842, PDF p. 49).

[1485] Given these statements, it is not clear if the whitebark pine in the project footprint area will provide sufficiently healthy and rust-resistant seeds to meet Benga’s commitment to plant 63 000 seedlings during reclamation. If seeds from blister rust-resistant strains of whitebark pine were sourced from other locations owned by Benga, or from other suppliers, it is not clear how Benga’s commitments to conserving genetic diversity by harvesting from the project footprint will be met. If Benga sourced its seeds from just a few known resistant trees, genetic diversity may be lost. This raises questions about the feasibility of Benga’s reclamation plans for whitebark pine, adding to the uncertainty of the reclamation plan’s chances of achieving its goals of introducing blister rust-resistant strains of whitebark pine and conserving the genetic diversity of the whitebark pine in the project footprint.

[1486] Clark’s nutcracker, a bird native to the forests of southwestern Canada and the western U.S., has a close relationship with whitebark pine. Due to this relationship, Benga was asked to provide a description of the effects of the project on Clark’s nutcracker to understand the indirect effects on the re-establishment of whitebark pine. The effects of the project on Clark’s nutcracker are discussed in more detail in the wildlife chapter.

[1487] Benga explained that the whitebark pine is an obligate mutualist (one that cannot survive without another species) that germinates almost exclusively from seed caches left by Clark’s nutcrackers. Clark’s nutcracker is considered a keystone species because of the pivotal role it plays in seed dispersal and forest regeneration for a number of conifer species, including the whitebark pine, and is almost exclusively responsible for the distribution of whitebark pine across the landscape. Benga noted that, as whitebark pine stands are damaged, seed caching by Clark’s nutcrackers was expected to play a vital role in re-establishing or rejuvenating these communities. Clark’s nutcrackers are considered vital for maintaining genetic diversity of whitebark pine within and between populations.

[1488] Benga noted that the project would displace Clark’s nutcrackers from the project area for up to 60 to 80 years after the replanting of whitebark pine, at which point sizeable cone production was expected to begin. Benga acknowledged some uncertainty as to the extent to which displaced Clark’s nutcrackers would be able to forage in alternate habitats. However, the Coalition’s expert, Mr. Wallis, argued that it would take 125 to 250 years for whitebark pine to attain sufficient canopy volume and produce enough cones for Clark’s nutcrackers.

[1489] Benga’s wildlife expert, Mr. J. Kansas, explained that Clark’s nutcracker would become important to whitebark pine once the trees start producing seeds for the birds to harvest and cache, noting that Clark’s nutcrackers would come from the outer western edge of the RSA, from “the north end and work their magic that way” (CIAR 931, PDF p. 25).

[1490] The presence of Clark’s nutcrackers in the reclaimed landscape is critical to the long-term perpetuation of the whitebark pine in the reclaimed landscape. Considering the importance of Clark’s nutcrackers to the germination, distribution, and genetic diversity of whitebark pine, it is unclear if Benga can meet its goal of establishing a maintenance-free and self-sustaining population of whitebark pine if Clark’s nutcrackers are not present. We are not confident in Benga’s predictions that Clark’s nutcrackers will return to the project area given the time lag of approximately 100 years between initial removal of whitebark pine from the site and maturity of replanted saplings.

[1491] The potential effects of climate change on reclamation success are discussed in the conservation, reclamation, and closure chapter. In Benga’s view, the anticipated effects of climate change on the fire regime would likely be greatest on individual species abundance. As such, Benga estimated a moderately reduced confidence in reclamation efforts involving specific species reestablishment. Benga noted a moderate reduction in its confidence in successfully re-establishing whitebark pine, largely due to uncertainty in the future forest fire regime associated with climate change. Nevertheless, Benga went on to note that its confidence in the revegetation techniques used for reclamation remained high, and natural recovery, seeding, fertilization, tree and shrub plantings, and transplantation should be carried out as expected.

[1492] The Coalition expressed concerns regarding the predicted impacts of climate change on seedling re-establishment, including for whitebark pine. The Coalition noted that “the potential impacts on vegetation will be even more uncertain on disturbed lands than in native habitats where there is the full complement of soil mycorrhizae, soil structure, vegetation structure, and species diversity (flora and fauna) that will support greater resilience in the face of climate change than on disturbed sites” (CIAR 553, PDF p. 271).

[1493] ECCC did not express any views on the potential effects of climate change on Benga’s proposed reclamation plans for whitebark pine, but recommended that Benga monitor and apply adaptive management to ensure seedling success.

[1494] We find that the successful restoration of whitebark pine in the project footprint is not assured. While the project will remove an estimated 21 000 whitebark pine from the project footprint, Benga did not present any examples of successful reclamation of whitebark pine species to maturity. We note that none of the examples of whitebark pine restoration provided by Benga involve large areas or stands that are more than 12 years old. Successful whitebark pine reclamation, while being researched, has not yet been proven. We are not aware of any examples of mines in Alberta where whitebark pine has been established or included in reclamation plans. Instead, the revegetation plans at other coal mines have targeted commercial forestry species, such as lodgepole pine, white spruce, and firs.

[1495] Benga’s proposal to plant three whitebark pine seedlings for every whitebark pine removed by the project is a reasonable attempt to compensate for the fact that not all seedlings would be expected to survive to maturity. But the successful seedlings would likely not become mature cone-bearing trees for more than 80 years. Additionally, it is uncertain whether Clark’s nutcracker, which is critical to the long-term survival of whitebark pine in the reclaimed landscape, would return to the project area after a prolonged absence. Consequently, it will not be possible to gauge the success of Benga’s whitebark pine restoration efforts for more than 80 years, and possibly as long as 125 to 250 years, after restoration is initiated.

[1496] As we discuss in the conservation, reclamation, and closure chapter, almost all the whitebark pine in the LSA was found within the Subalpine Region. While some whitebark pine can be found scattered across the Montane Subregion at lower elevations with gentle slopes, whitebark pine thrives on the steep slopes and harsh environments of the Rocky Mountain Subalpine Subregion. Given the reduction in steep terrain that will occur as a result of the project (discussed further in the terrain and soils chapter) and Benga’s plans to target Montane Subregion–type vegetation communities in the closure landscape, it is uncertain whether the landscape will support the re-establishment of whitebark pine.

[1497] We consider the project effects on whitebark pine to be adverse, high in magnitude, regional, and potentially irreversible. A careful and precautionary approach to our assessment for this species is required. Such an approach is made necessary by the uncertainties associated with Benga’s ability to successfully restore whitebark pine that is resistant to white pine blister rust, the extended time required to demonstrate that restoration has been effective, and the status of whitebark pine as an endangered species under Canada’s *SARA* and Alberta’s *Wildlife Act*.

[1498] We recognize there is no approved federal recovery strategy for whitebark pine at this time, and therefore critical habitat for whitebark pine has not been formally identified. We also recognize that the effects would not occur on federal lands as the project is located on privately owned and provincial Crown lands. All whitebark pine within the project footprint would be removed. In the most optimistic case, it would not be restored for more than 80 years and possibly much longer. This means project effects would be persistent and extend long after the project’s closure phase. In the worst case—restoration is not successful—project effects would be irreversible. Given whitebark pine’s listing under *SARA* and the *Wildlife Act*, we find the ecological and social context of project effects to be negative as the species is expected to decline due to several pressures. We consider the effects to be significant and likely.

The project will remove limber pine

[1499] Limber pine is designated as endangered under Alberta’s *Wildlife Act*, which led to the publication of the *Alberta Limber Pine Recovery Plan 2014-2019* in September 2014. Limber pine was federally designated as endangered by COSEWIC in November 2014, and it is currently under consideration for listing under *SARA*. No federal recovery strategy has been prepared. Benga noted that limber pine was globally secure, while the whitebark pine was not.

[1500] Benga stated that mapping of the LSA revealed no large stands of limber pine, although “a few” individual limber pine trees were found throughout the project footprint during the aerial and ground survey. Benga noted that limber pine were sometimes difficult to distinguish from whitebark pine. Benga estimated that construction and operation of the project would remove roughly 1000 limber pine trees.

[1501] Similar to the whitebark pine mitigation plan, Benga’s limber pine mitigation plan would include mitigation measures developed with objectives and approaches outlined in the *Alberta Limber Pine Recovery Plan*. Many of the features of the plan are the same, as the issues faced by both species are similar, including reduction in direct mortality, development and introduction of white pine blister rust-resistant strains, conservation of genetic diversity, and management of habitat and natural regeneration. Benga also committed to making seeds available to support the *Alberta Limber Pine Recovery Plan*.

[1502] Benga noted that suitable post-mining habitat for limber pine would, in most cases, accommodate whitebark pine. Benga did not specify how many limber pine seedlings it would plant. But it explained that, due to the whitebark pine’s greater vulnerability and more limited range, whitebark pine would be planted preferentially over limber pine. Benga also explained that, until specific guidance for planting limber pine is available, recommendations for whitebark pine would be used.

[1503] Re-establishment of limber pine will likely face challenges similar to those associated with whitebark pine, particularly in the absence of specific planting recommendations. As was the case for whitebark pine, Benga has provided little evidence that it will be able to establish blister rust-resistant limber pine. The only trial that Benga discussed (the Shell Canada Waterton limber pine trial) had a 56 per cent survival rate for seeds planted. However, no information was provided on the number of seedlings planted or how long the trial had been going on. It is therefore difficult to draw conclusions from this trial. We find that there will be an adverse residual effect on limber pine, but we do not have sufficient information about the number of limber pine in the project area and the LSA to determine the significance of project effects.

Grasslands dominated by rough fescue will be permanently removed from the project footprint

[1504] Benga’s assessment of rangeland resources focused on rough fescue grassland communities. Foothills rough fescue is a densely tufted bunchgrass that grows with other native grasses, forbs, and shrubs in the Montane and Foothills Subregions of Alberta in response to specific ecological conditions. Several areas of foothills rough fescue grassland community were mapped within the LSA. Areas of foothills rough fescue within the project footprint are protected by a provincial protective notation under the *Public Lands Act*.

[1505] The Coalition’s expert, Mr. Wallis, noted the importance of native grasslands to maintaining biodiversity and their context within the *South Saskatchewan Regional Plan*, which identifies the value of keeping areas of native grassland intact. Ms. S. Frank of the Oldman Watershed Council stated that the montane grasslands and native subalpine grasslands, including rough fescue grasslands, are valued for their carbon storage capacity, livestock forage, and wildlife habitat. But they are extremely difficult to reclaim.

[1506] Benga identified two rangeland communities within the LSA: the rough fescue–Idaho fescue–Parry oatgrass grassland community in the b1 ecosite phase (Montane Subregion) and the rough fescue–sedge (HG) grassland community. In addition to the site-wide surveys for vegetation and wetlands, Benga conducted rangeland health assessments at five locations within the LSA. Benga reported 155.0 ha of rough fescue–Idaho fescue–Parry oatgrass grassland and 165.9 ha of rough fescue–sedge community within the LSA.

[1507] In 2016, Benga conducted a reconnaissance survey to delineate rangeland plant community types within the project footprint that were previously mapped as forest types but contained foothills rough fescue as a dominant or co-dominant grass. This includes 3.4 ha where rough fescue was the dominant range grass, 18.2 ha where it grew as a co-dominant population, and 197.3 ha where it appeared as small, scattered patches within sparse open-canopy stands of whitebark pine. Benga reported the project will affect 163.8 ha in the project footprint, where foothills rough fescue is the dominant grass. The area affected represents 51 per cent of the 320.9 ha of foothills rough fescue present at baseline in the LSA.

[1508] Benga proposed two measures to mitigate the effects on rangeland resources. Through mine planning, Benga would aim where possible to minimize project disturbance and avoid fescue. And it would identify potential areas on hill crests and southern aspects suitable for transplanting native fescue. Benga also proposed the following mitigation measures specific to rough fescue:

- Construct, or undertake assessments and surveys, during the dormant period for rough fescue (August to March).
- Avoid soil disturbance by minimizing topsoil stripping and grading; utilizing existing trails; and potentially implement a seed collection and propagation plan and/or direct placement of sod.

[1509] Benga proposed seeding foothills rough fescue on rough areas of the proposed golf course.

[1510] While acknowledging the inherent difficulties associated with reclaiming fescue grasslands, Benga claimed that adaptive management would make reclamation efforts successful. We discuss Benga's plans for reclamation of rough fescue communities in the conservation, reclamation, and closure chapter. We conclude that we are not confident that rough fescue grasslands will be successfully reclaimed as there are no examples of successful rough fescue grassland reclamation in the Montane Subregion. Considering the effects of the project on rough fescue communities, and our views on the unlikely success of reclamation, we find that, even with mitigation, the project will result in residual adverse effects on rough fescue grasslands disturbed during construction and operation of the project.

[1511] Although Benga indicated that it will plant rough fescue on the golf course, we do not consider this to be an appropriate mitigation measure for the loss of the foothills rough fescue community. The value of the community arises from more than a single grass species; it comes from the fact that rough fescue grows in association with other native grasses, forbs, and shrubs as a vegetation community that is wildlife habitat with value as a protected ecological community.

[1512] We find that project effects on rough fescue–dominated grasslands will be high in magnitude, local in extent, persistent, and irreversible. The high magnitude considers the limited distribution and 51 per cent loss of fescue grasslands predicted for the LSA. We consider the ecological and social context

to be negative due to the limited area of rough fescue grasslands available in the LSA, the emphasis in the *SSRP* on keeping native grasslands intact, and the provincial protective notations in place for these grasslands under the *PLA*. We find that the effects are significant and likely.

The project will result in the removal of productive and old-growth forests

[1513] Lodgepole pine and Engelmann spruce (*Picea engelmannii*) are the leading trees by composition and available volume used for commercial timber in the region. Benga's plan to mitigate the effects on forest resources, specifically commercial forests that will be disturbed during clearing, is to salvage all merchantable timber prior to disturbance and collect locally available cones for use in progressive reclamation. Benga used the Alberta Vegetation Inventory to determine the potential timber productivity rating of each forest stand. Four timber classes were used: good, medium, fair, and unproductive. Desirable stands for commercial forestry operations include those rated as good, medium, or fair. Non-forested and anthropogenic areas were not rated for timber productivity.

[1514] Within the LSA, Benga reported 3987 ha (83.1 per cent) of baseline forested land. Coniferous and coniferous-leading stands dominated the LSA, with lodgepole pine being the most abundant coniferous species. Forest resources are directly affected by removal during construction and operation of the project and indirectly by loss of site productivity. The application case predicts declines of 77.6 per cent (202.1 ha), 72.8 per cent (1963.9 ha), and 65.4 per cent (648.1 ha) in good, medium, and fair timber productivity, respectively, in the LSA. Benga stated that the conservation and reclamation plans include species that primarily target the restoration of ecological communities. No specific information was provided on which species will contribute to commercial forestry in the closure landscape.

[1515] Within the LSA at baseline, Benga reported 167.7 ha of old-growth forest, representing 3.5 per cent of the LSA. Benga stated that none of the mapped ecosite phases have a high potential to support old-growth forests. Most of the forested areas within the LSA are predominantly young or mature stands. Benga said that the potential for forest stands in the LSA to reach old-growth status was generally low because of the intensity of timber harvesting at the landscape level.

[1516] The application case predicts a 16.3 per cent (27.4 ha) decline in old-growth stands relative to the baseline. Benga assigned an old-growth forest category to forest stands that are greater than 100 years of age, greater than 110 years, and greater than 140 years for deciduous or mixed stands, pine-dominated stands, and coniferous stands, respectively. Coniferous stands contain less than 20 per cent pine. Benga stated that the project would reduce the area with moderate potential to support old-growth forests by 28.5 per cent (1042.8 ha). At closure, 140.3 ha of old-growth forests will remain in the LSA.

[1517] Benga stated that mitigation measures for old-growth forest will include planting species capable of achieving old-growth conditions and preserving adjacent vegetation communities by minimizing the area required for construction and operation of the project. Benga did not note the type of trees that may succeed to old-growth stands that would be disturbed during the construction and operation of the project.

[1518] Benga acknowledged that the project will incrementally contribute to a loss of old-growth forests in the region. Benga stated that the predicted declines of mature and old-growth forest constitute a high magnitude change for the base, application, and planned development cases.

[1519] We note that the total area of good, medium, and fair timber productivity Benga predicted in the application case will be lost in the LSA exceeds the actual area of the project footprint. How Benga came up with these numbers is unclear. We further note that not all of the project area would be productive for commercial timber due to historical disturbance within the project footprint and LSA. However, we accept that all productive commercial forest will be lost within the footprint. Benga has committed to restoring ecological communities, and has proposed measures to salvage all available merchantable timber prior to disturbance that will mitigate this loss. We are uncertain if Benga has a plan to re-establish commercial forests. However, given that commercial forests will remain available in the LSA and RSA, we find that any effects on commercial forests would be low in magnitude, local in extent, long-to-persistent in duration, and reversible in the long term.

[1520] While all old-growth forest will be removed from the project footprint, we consider this a moderate-magnitude effect as it involves only 16.3 per cent of the old-growth area in the LSA, and old-growth forest will remain available in the LSA. The long periods (more than 100 years) required for old-growth forests to become re-established after reclamation, coupled with the potential for slow vegetation reestablishment within the Rocky Mountain Region, mean the effects on old-growth forest will persist beyond project closure, and we consider them reversible only in the far future (more than 100 years). We therefore find that the effects on old-growth forest are adverse but not significant.

The project will result in the removal of species important to Indigenous peoples

[1521] Benga compiled a list of vegetation species used by Indigenous groups based on consultation with Treaty 7 First Nations and a review of traditional ecological knowledge reports. The lists were compared with species identified during Benga's field surveys and then tabulated. The potential for ecosite phases to support traditional-use species was ranked as very high, high, moderate, or low based on the number of traditional-use species in each ecosite phase.

[1522] Within the LSA, the application case predicts a loss of 1042.8 ha (28.5 per cent) of ecosite phases that support traditional-use species, including a loss of 102.4 ha (27.3 per cent) of very high or high potential traditional ecological knowledge areas in the Montane and 0.8 ha (100 per cent) in the Subalpine Subregions, respectively.

[1523] Benga provided the following mitigation measures for effects on traditional use species:

- Benga will provide opportunities for members of Indigenous communities to identify and collect suitable lodgepole pine for traditional use ceremonies on lands owned by Benga. Lodgepole pine collection will occur before vegetation clearing and soil salvage.
- Traditional-use vegetation species identified through consultation with the Indigenous communities to be established include: lodgepole pine, prickly rose, ground juniper, willows, aspen and balsam poplars, saskatoon berries, thimbleberries, bearberries, dwarf birch, subalpine fir, and dogwoods.
- The conservation and reclamation plan will utilize native vegetation species and not include agronomic invasive species such as clovers, timothy, meadow brome grass, and other grasses and forbs that occur as weeds in cultivated areas. Agronomic species would only be used as a temporary cover crop until native seed can be established.

- The conservation and reclamation plan will utilize locally collected seeds to preserve the legacy of species and of place, where practicable.
- Benga has and will continue to consult with Indigenous groups on the conservation and reclamation plan. Wherever possible, the plan will include the use of traditionally important species and incorporate end land use decisions made in consultation with Indigenous groups.

[1524] Benga submitted that the reclaimed land will support a range of communities with capabilities equivalent to those of the surrounding lands that existed prior to development. It noted that, following closure, the reclaimed terrain and soils will support a range of native plant communities that will in turn support traditional uses. Benga acknowledged that not only the existence of these species, but their location, may be important in the cases of some traditional use species. It also acknowledged that the project would cause the loss of certain species at important locations. But Benga concluded that the project will have a neutral effect with respect to traditional use species and communities.

[1525] While the project will result in the loss of plant species important to Indigenous peoples within the project footprint, we find that Benga's proposed measures to restore the traditional plant potential of the project area are reasonable. Benga has identified plant species important to Indigenous communities and has committed to including these species in its planting prescriptions during reclamation. Further, Benga has committed to ongoing engagement with Indigenous communities during its reclamation planning and implementation. These measures are expected to increase the probability that reclamation will include and result in the restoration of vegetation species important to traditional uses.

[1526] We find that there will be a moderate magnitude loss of areas of traditional plant potential during the construction and operations phases of the project within the LSA; however, most traditional plant species will remain available within the LSA. The residual effects on traditional plant potential in the LSA will be local in extent, long in duration, and reversible in the long term, after reclamation. The effects will not be significant.

The project will remove most organic wetlands mapped in the LSA

[1527] Wetlands cover just 0.4 per cent (16.9 ha) of the LSA. The most common wetland class is shrubby open fen (11.2 ha), which is a peatland. Treed swamps cover 4.8 ha while open water and marsh wetlands cover 0.5 and 0.4 ha of the LSA, respectively. Within the LSA, the application case predicts a 57.2 per cent (9.7 ha) decline in the wetlands mapped in the LSA, including an 85 per cent decline (9.6 ha) in shrubby open fens in the project footprint.

[1528] At closure, Benga predicted 4.8 ha of treed swamps would remain in the LSA. Benga proposed restoring 18.2 ha of treed wetlands in the sedimentation ponds, surge ponds associated with selenium management facilities, and littoral zones of the end-pit lake. This is discussed in the chapter on conservation, reclamation and closure. Benga stated that, while the overall project effects on wetlands for the application case are low, reclamation of the surge ponds and littoral area of the end-pit lake will result in a net increase in wetland area within the LSA.

[1529] Benga proposed the following mitigation measures for wetlands lost due to construction and operation of the project:

- Mineral wetlands (non–peat forming wetlands with less than 40 per cent organic matter content) will be constructed in areas used as surge ponds and in the fringes of the end-pit lake where a littoral zone less than 2 m deep will be established to meet wetland requirements.
- Benga “will implement wetland construction best practices to maintain the hydrologic regime of mineral soil wetlands” through its reclamation and conservation plan.
- Vegetation species appropriate to wetlands conditions will be used in plantings.

[1530] Based on its proposed mitigation measures, Benga concluded there would be no residual adverse effects to wetlands.

[1531] We recognize that wetlands make up less than 1 per cent of the LSA and the effects on wetlands from the project will therefore be limited. However, while the extent of wetlands to be disturbed is low, 99 per cent of wetland area that will be removed from the LSA are peatlands. As discussed in the conservation, reclamation, and closure chapter, the loss of peatlands cannot be mitigated through reclamation because there are no proven methods to do so. Additionally, because wetlands are uncommon in the LSA, they may have increased importance for some species, such as amphibians, and would contribute to biodiversity.

[1532] We do not agree with Benga’s assessment that there will be no residual adverse effects due to its plans to reclaim sedimentation ponds, surge ponds, and the littoral zone of the end-pit lake to wetlands. We are uncertain if the surge ponds will be successfully reclaimed to functioning wetlands once management of selenium is no longer required. Because the timeline for selenium management is unknown, it is also unknown when the surge ponds will be available for reclamation to treed wetlands and whether Benga will be available to complete this reclamation. The lack of timely reclamation of the surge ponds means that the majority of the reclaimed treed wetlands may never be monitored to determine if reclamation outcomes were achieved. We therefore find that Benga’s claim of a positive contribution to wetlands in the LSA is not well supported.

[1533] We find that project effects to wetlands will be adverse and moderate in magnitude, local in extent, continuous, and persist into the closure period and potentially beyond. We accept that some wetlands may be created in the closure landscape and therefore some effects on wetlands may be reversible in the future; however, because reclamation of peatlands is not currently possible, the effects on peatlands would be irreversible. We find that the effects on wetlands are not likely to be significant. To the extent that wetlands provide habitat for amphibian species at risk, we provide our conclusions on the significance to these species in the wildlife section.

The project will result in an extended loss of biodiversity within the LSA

[1534] Benga assessed the project’s impact on biodiversity at three levels: species, community, and landscape. Species-level biodiversity was determined by calculating species richness, diversity, and evenness from 48 plots (19 plots from 11 ecosite phases in the Montane and 29 plots from six ecosites in the Subalpine) in the LSA. Benga did not calculate species richness, diversity, or evenness from plots in non-forested areas of the LSA.

[1535] Species richness for each ecosite phase was highest for the hydric-rich horsetail (g2), mesic-medium creeping mahonia–white meadowsweet (d1), hydric-rich horsetail (g1), and submesic-medium Canada buffaloberry–hairy wild rye (c3) ecosite phases in the Montane Subregion and the subhydric-rich thimbleberry (h1) phase in the Subalpine Subregion. According to Benga, the trend in species richness generally followed the gradient of moisture and nutrients. Ecosite phases that typically occupy lower slope positions had greater species richness compared with drier ecosite phases.

[1536] Benga identified 480 species in the LSA during vegetation surveys. Benga confirmed the project would result in the removal of all vegetation species from the project footprint and a temporary reduction of native species richness and diversity in the LSA. Benga stated that after closure and initial reclamation, native species richness would likely be lower than intact, naturally developed vegetation in the LSA but would increase over time. Benga stated that most of the species will either be “encouraged” or will ingress from surrounding communities, although what Benga meant by encouraged is unclear.

[1537] Benga assessed community biodiversity by ranking the biodiversity potential of each vegetation community. Biodiversity potential was calculated as the sum of species richness, diversity, and evenness; the rare plant potential; the number of structural layers, rare plants, unique species, and noxious and non-native invasive species; the relative species richness; and the proportion of the landscape covered in each ecosite phase. Benga stated that the biodiversity potential of mapped ecosite phases not sampled in the field was based on ecosite phase descriptions, professional judgements, and observations of sampled ecosite phases. Areas mapped as anthropogenic were not ranked for biodiversity potential.

[1538] Benga stated that the application-case biodiversity potential will decline for vegetation communities that have a high biodiversity potential. The extent of non-forested areas dominated by grasslands will decline by 50.9 per cent and the extent of ecosite phases with high biodiversity potential will decline by 36.9 per cent and 28.6 per cent for Subalpine and Montane Subregions, respectively.

[1539] Benga used fragmentation analysis of mapped land units in the LSA to assess project effects on landscape biodiversity. A fragmentation analysis of ecological land classes in the RSA was applied for cumulative effects resulting from the project. The number, size, and distribution (e.g., perimeter length and mean distance to nearest patch of similar type) of different patches or land units were used to determine biodiversity at a landscape level. All mapped units, including anthropogenic classes, were used in the fragmentation analysis.

[1540] The application-case landscape biodiversity showed an overall reduction in the total number of patches. Benga stated that this was a product of removing many smaller, undisturbed natural patches in the baseline case and replacing them with a few anthropogenic disturbed patches in the application case. The number of natural patches decreased in the application case from 685 to 643 relative to the baseline case, and the mean natural patch area decreased from 5.9 ha to 4.3 ha. The number of anthropogenic patches increased from 339 to 346.

[1541] Benga submitted that measures proposed to mitigate the loss of areas of terrestrial vegetation and effects to species composition and abundance would effectively mitigate the loss of biodiversity. This would include mitigation measures for rare plant species abundance, wetlands, and old-growth forests, and mitigation to attenuate the spread of non-native and invasive species due to the project. Additionally,

Benga stated that the following measures will be used to mitigate reductions in species, community, and landscape diversity and any increase in landscape fragmentation:

- Direct placement of soil salvaged (with propagules) from new mining areas as much as practical.
- Re-establishment of native species by planting native trees, native shrub species, and native graminoids to provide structural diversity and wildlife habitat and food.
- An adaptive revegetation strategy to establish a variety of target vegetation communities and wetlands as outlined in the reclamation plan or other vegetation communities that may become more appropriate with knowledge gained from adaptive management.

[1542] The coalition’s expert, Mr. Wallis, highlighted the ecological importance of the Montane Subregion as a contributor to biodiversity. He cited a 1995 Alberta Environmental Protection (now AEP) publication that describes the montane subregion and why it is ecologically important:

“Montane landscapes are of restricted distribution in Alberta, found primarily along major river valleys in the Front Ranges from Grande Cache to Waterton. They are recognized as having high biological diversity and ecological values but are also among the most affected landscapes in the province.”

...

“The montane occupies a relatively small portion of Alberta, covering about 5897 km², or less than 1 percent of the province’s land area (Alberta Government, GIS digital data), but it is disproportionately important for biodiversity conservation. Several rare plant species and rare/uncommon plant associations occur in the montane. Montane landscapes apparently rival the best areas in North America for songbird diversity.”

“These landscapes function as centres of ecological diversity and productivity within the region. They also provide important seasonal migration corridors for large carnivores, ungulates and songbirds as well as critical reproductive and overwintering habitat for a variety of species.”

“Thus it is imperative that the ecological integrity of montane landscapes remains intact. Consequently, the “wholeness” of these landscapes, with all their elements and processes, must be maintained and not severely modified through inappropriate or incompatible development or other land uses” (CIAR 553, PDF pp. 267–268).

[1543] Benga’s ability to re-establish biodiverse landscapes depends on the success of reclamation. As discussed in the conservation and reclamation chapter, we are not confident that Benga’s plan would result in reclamation of the closure landscape to equivalent levels of species, ecosite phases (plant communities), rare plants, or whitebark pine. Nor would it bring about equivalent levels of species, community, or landscape biodiversity.

[1544] While Benga’s proposed reclamation plan would initiate vegetation community succession within the project footprint, residual effects associated with biodiversity would persist for an extended period of time, likely longer than 100 years. Revegetation will occur, but the following elements of Benga’s reclamation plan indicate the plan would not effectively mitigate project-related effects on biodiversity:

- Benga is disturbing 27 naturally occurring ecosites phases and seven non-ecosite phase areas, but the conservation and reclamation plan contains just six reclaimed ecological units, two of which are open water and barren land.
- Benga is removing 480 vegetation species, including 27 rare vascular plants, mosses, and liverworts and lichens, and revegetating with, at best, seven vascular plants in addition to whitebark and limber pine.
- Benga is removing 9.6 ha of organic wetlands in an area where wetlands are rare and replacing them with treed swamps in the areas of the surge ponds and littoral areas of the end pit lake.
- The existing habitats for many species of wildlife and birds will be reclaimed to one with less variety (four broad vegetation communities).
- The elevation, slope angles, and aspect of the footprint will be reclaimed to a more subdued terrain that does not mimic the areas immediately adjacent to it.
- Project construction and operations have the potential to increase the prevalence of weeds and non-native invasive species.

[1545] In addition, we note that most of the ecosite phases that are limited in distribution within the LSA and contributing to biodiversity will experience a greater than 50 per cent loss in area in the LSA as a result of the project.

[1546] We find that Benga's proposed plans to revegetate to four broad vegetation communities using a uniform soil depth of 20 cm across the disturbed area and a limited number of species will not be sufficient to mitigate the loss of species and community-level biodiversity in the LSA. As we discuss in the conservation, reclamation, and closure chapter, Benga has not adequately considered the potential effects of the harsh climatic conditions of the Montane and Subalpine Subregions of the Rocky Mountains on plant development and succession. Short growing seasons and a harsh climate mean that natural ingress of native species and community succession will be slow. As a result, species and community biodiversity is expected to remain low for an extended period, which could be up to 100 years for low-lying areas with adequate moisture, and more than 200 years for steeper slopes at higher elevations.

[1547] We consider the loss of rare plants, and species and community biodiversity, irreversible because the existing levels of biodiversity have evolved over hundreds of years and cannot be mitigated through reclamation. While Benga identified some rare vascular plants that could be included in its proposed reclamation plan through seed collection or propagation, it acknowledged potential challenges with seed collection, seeding, and propagule relocation. As a result, we are not confident that these measures will make a meaningful contribution to restoring biodiversity within the project footprint.

[1548] A reclamation plan that proposes to plant a few species is not sufficient to mitigate the loss of species that have occupied and persisted in an area for hundreds of years. We do not agree with Benga that climate change is unlikely to affect reclamation effectiveness because of the short timeline for reclamation (about 25 years). While short-term effects due to climate change may not be observed during the reclamation timeline, the development of reclaimed ecosystems to maturity and the return of acceptable levels of biodiversity and successional trajectories toward more diverse vegetation

communities for Benga's proposed four broad vegetation communities may suffer if changes in annual temperature, precipitation, or increased evapotranspiration occur. This could affect growth and development, and may prevent some species in the reclaimed landscape from becoming established. The indirect effect of climate change on the fire regime is likely to have the largest impact on individual species' abundance, potentially further delaying the return of rare plant species and biodiversity.

[1549] We find that project effects will be moderate to high in magnitude. The collective loss of species and plant communities, rare plants, rough fescue, whitebark pine, and wetlands in the reclaimed landscape would greatly reduce both species and community biodiversity. We find the effect would be local in extent, continuous, and persist into the far future. While some effects will diminish with time and may be partially reversible in the future, reduced biodiversity would likely extend more than 100 years into the future and may be considered effectively irreversible. We find that these effects are significant and likely.

The project may increase the risk of the spread of noxious and invasive species within the LSA

[1550] Benga stated that noxious and invasive vegetation species observations were recorded during the vegetation and wetlands surveys within the LSA. According to Benga, the Government of Alberta's *Weed Control Act* and *Weed Control Regulation (2010b)* was used to determine the noxious and prohibited noxious status of each species observed. For non-regulated species, the Alberta Conservation Information Management System list of elements was used to determine which species were invasive.

[1551] Benga identified nine noxious weeds and 20 invasive vegetation species in the LSA. Most of the noxious and invasive species were observed in disturbed areas (i.e., pipelines, well sites, clearings, pastures, and cut blocks, and along roads). Benga did not provide the specific location of noxious and invasive species within existing disturbances. Benga stated that, although noxious and invasive species are already present in the project area, construction and operations activities may enhance the spread and establishment of these species into areas adjacent to disturbed sites.

[1552] Benga proposed the following mitigation measures to address the potential for the spread of noxious and invasive species due to land disturbance:

- Adherence to *Weed Control Act* regulations
- As required by the *Weed Control Act*, noxious weed populations identified during baseline field sampling would be controlled prior to site disturbance and mine operation to prevent the further spread of weeds
- Conduct annual weed inspections to detect noxious weed presence
- Control noxious weeds identified during surveys
- Implement progressive reclamation to ensure prompt reclamation and revegetation of bare ground upon completion of mining

[1553] The M.D. of Ranchland expert, Dr. T. Osko, provided a report critiquing Benga's approach to weed assessment. The M.D. of Ranchland is concerned that noxious weeds and invasive species will spread beyond the project footprint into the LSA and beyond, increasing the existing costs associated with noxious weed control in the municipality. The municipality is not satisfied that Benga sufficiently

assessed the type of weeds or their extent in the LSA, or provided satisfactory measures to mitigate current or future weeds resulting from the construction, operation, or reclamation of the project. Specifically, the municipality listed the following shortcomings and problems with Benga's approach to the problem of weeds in the municipality:

- Benga failed to recognize the conservation value of the landscapes within the municipality adjacent to the proposed mine site and how increased weed infestations would jeopardize landscapes such as rough fescue grasslands.
- The Benga weed assessment underestimated the significance of the risk posed by weeds to adjacent lands and the actions required to mitigate those risks.
- Benga failed to recognize the many vectors that could contribute to the spread of weeds from the project footprint into the LSA and beyond, resulting in a failure to provide mitigation strategies that would sufficiently address each potential method of spread.
- Benga's assessment of weeds in the LSA was considered incomplete because it did not conduct an inventory of weeds present in the LSA but a survey of a representative part of the LSA.
- Benga underrepresented the extent of weeds in the LSA because its surveys missed certain species known to be prevalent in the area, including the orange hawkweed (*Hieracium aurantiacum*), a prohibited noxious weed, and common tansy (*Tanacetum vulgare*), a noxious weed.
- Proposed mitigations were inadequate because they lacked context and specificity. Benga used standard weed control practices across Alberta and did not consider the conservation value of the lands surrounding the proposed project area.

[1554] During the hearing, Benga committed to additional measures to limit the spread of weeds to areas outside the project footprint, including

- installation of an onsite wash bay station for all vehicles and equipment leaving the site to ensure that dirt or weeds do not leave the site,
- restricting the number of vehicles that come onto and leave the site,
- early detection and control of weeds,
- revegetating soon after reclamation to avoid bare spots, and
- monitoring and managing the site until a reclamation certificate is obtained from the Government of Alberta.

[1555] The M.D. of Ranchland concluded that significant adverse effects due to the spread of noxious weeds were likely. They also concluded that the project contribution was negative, the magnitude of the effects high, the duration of effects residual, and the effects irreversible. The municipality came to these conclusions because the project would occur in an area where noxious weeds and invasive species are already a problem, and because weeds would likely spread beyond the LSA into the RSA.

[1556] We agree that Benga did not sufficiently assess the effect of the project on the proliferation of weeds, noxious weeds, and invasive species in the LSA. They confirmed that weeds were sampled only

from vegetation and wetlands survey plots during field surveys. Weeds are primary invaders known to thrive in disturbed environments such as roads, clearings, and other disturbances. Benga's surveys did not target anthropogenic features for weeds. When asked at the hearing how weed surveys were conducted, Benga stated that its teams searched for weeds as they travelled from one plot to another, although Benga never reported this information in its submissions. We also note that the terrain of the majority of the study area precludes searching for weeds between plots. We are not confident that Benga has a good understanding of the distribution of noxious weeds within the project area.

[1557] We also agree with the M.D. of Ranchland that the preliminary mitigation measures proposed by Benga in its EIA were likely not sufficient to control the spread of noxious weeds into the LSA. While Benga committed to a wash bay for equipment and vehicles leaving the site, the effectiveness of the measure would be enhanced by washing all vehicles entering the site to prevent the spread of weeds in cleared areas within the project footprint. Once weeds proliferate inside the footprint, wind and water could spread weeds beyond the footprint.

[1558] However, we find that these effects would be low in magnitude and local in extend. This finding is based on the size of the footprint relative to the LSA, the additional commitments Benga made at the hearing to weed control measures, and the fact that there would be a regulatory requirement for Benga to control noxious weeds and destroy prohibited noxious weeds in the footprint. The project effects would be occasional, medium- to long-term, and largely reversible with appropriate weed control measures.

Project effects on vegetation from acid deposition are not expected

[1559] Benga stated that emissions released into the atmosphere during project construction and operations would possibly result in direct and indirect effects on vegetation arising from acid deposition. Levels of potential acid input and nitrogen deposition were assessed by comparing modelled potential acid input levels with critical loads for soils and land cover classes.

[1560] Benga reported that the modelled baseline levels of potential acid input within the LSA and RSA ranged from 0.11 to less than 0.025 kEq H⁺/ha/yr. Modelled baseline levels for nitrogen deposition within the LSA and RSA ranged from 6.5 to less than 2.5 kg/ha/yr.

[1561] Benga reported that baseline values of potential acid input did not exceed the critical values of soils with high sensitivity (0.25 kEq H⁺/ha/yr). While the baseline case for nitrogen deposition may exceed critical loads in isolated locations, areas of exceedance are related to the settlements and transportation infrastructure currently in the study area.

[1562] The predicted maximum potential acid input increased slightly from the baseline case of 0.11 to 0.18 kEq H⁺/ha/yr in the application case, when the application-case model isopleths were overlain on the LSA and RSA maps. The affected land area also increased from the baseline case to the application case. Due to the limited extent of plant communities with highly sensitive soils, Benga considered the indirect impacts of potential soil acidification on plants to be negligible at the local and regional scale across all application assessment cases. Benga concluded that potential acid input would not likely affect vegetation within the LSA or RSA.

[1563] Benga predicted that the project would increase the area affected by nitrogen deposition, but the extent of area is limited and not expected to have a measurable impact on the plant communities at either a local or a regional scale. Benga stated that potential acid input and nitrogen deposition would be effectively mitigated by measures that reduce air emissions. Project effects and mitigation measures related to air emissions and air quality are discussed in the chapter on air quality.

[1564] We agree with Benga's conclusion that project effects related to potential soil acidification are negligible as predicted potential acid input levels do not exceed the critical values of soils with high sensitivity, and few plant communities with highly sensitive soils are expected in the LSA. We also agree that, while the project would increase the area affected by nitrogen deposition, it is not expected to have a measurable impact on plant communities at either a local or regional scale due to the small increase in area affected.

The project is likely to result in significant adverse effects on fescue grasslands, whitebark pine, and species and community biodiversity

[1565] For all vegetation and wetland indicators, Benga determined that residual effects after reclamation were not significant. It based this conclusion largely on the local extent and reversibility of effects after reclamation. Where residual project effects were identified (vegetation communities and biodiversity), Benga indicated that the residual effects would diminish over time as reclaimed plant communities became more complex following mitigation, and natural processes, such as fire, returned to the landscape.

[1566] We do not agree with Benga's assessment that all residual effects on vegetation and wetland indicators will be not be significant. As discussed in this chapter and the conservation, reclamation, and closure chapter, we find that a number of limitations and uncertainties are associated with Benga's proposed reclamation measures, particularly its ability to restore rare plant species and communities, fescue grasslands, whitebark pine, and wetlands. We are not confident that Benga's proposed reclamation measures for these indicators are feasible or would result in the restoration of these vegetation species and communities in the post-closure landscape.

[1567] Furthermore, as Benga's reclamation plan incorporates only a limited number of species and ecosite types, and relies on natural succession to re-establish vegetative diversity over time, it is uncertain when or whether the project area would return to something approaching predisturbance levels of species and community diversity. We find that some effects on vegetation and wetlands may be reversible only in the far future, while others may be effectively irreversible.

[1568] We consider the ecological and social context for the vegetation valued component indicators to be neutral to negative. Historic surface mining has occurred on Grassy Mountain and previously disturbed areas were not reclaimed. Weeds, noxious weeds, and invasive species occur in the LSA. Some valued components—such as rare plants and rare plant communities, old-growth forest, whitebark pine, and rough fescue grasslands—are limited in extent and subject to other pressures. Table 16-1 summarizes our assessment of the significance of project effects.

Table 16-1. Assessment of project effects on vegetation and wetlands

Indicator	Geographic extent	Duration	Frequency	Reversibility	Magnitude	Ecological or social context	Significance
Vegetation Community	Local	Persistent	Continuous	Reversible in the far future	Moderate	Neutral	Not significant
Rare plants and communities	Local	Persistent	Continuous	Irreversible	Moderate	Negative	Not significant
Whitebark pine	Regional	Persistent	Continuous	Irreversible	High	Negative	Significant
Limber pine	Local	Persistent	Continuous	Irreversible	–	Negative	–
Rough fescue grassland	Local	Persistent	Continuous	Irreversible	High	Negative	Significant
Forest resources	Local	Persistent	Continuous	Reversible	Moderate	Neutral	Not significant
Old-growth forests	Local	Persistent	Continuous	Reversible in the far future	Moderate	Negative	Not significant
Traditionally used vegetation	Local	Long	Continuous	Reversible	Moderate	Neutral	Not significant
Wetlands	Local	Persistent	Continuous	Reversible/irreversible	Moderate	Neutral	Not significant
Noxious weeds	Local	Medium to long	Occasional	Reversible	Low	Negative	Not significant
Potential acid input / nitrogen deposition	Local	Medium	Continuous	Reversible	Low	Neutral	Not significant
Species and community biodiversity	Local	Persistent	Continuous	Irreversible	High	Negative	Significant
Landscape biodiversity	Regional	Persistent	Continuous	Irreversible	Moderate	Negative	Not significant

[1569] In summary, we find that the project is likely to result in significant adverse effects on rough fescue grasslands, whitebark pine, and vegetation species and community biodiversity. Our confidence in this assessment is high.

Benga provided insufficient information to properly assess the cumulative effects on vegetation

[1570] Benga stated that project residual effects were predicted for all valued vegetation and wetland components, and all were carried forward to the cumulative effects assessment, with the exception of noxious weeds, potential acid input, and nitrogen deposition. Benga carried forward valued components to the cumulative effects assessment regardless of whether the residual effects were positive, neutral, or negative.

[1571] Benga used an RSA of approximately 284 024 ha, predominantly within the province of Alberta (83 per cent), for its cumulative effects assessment, although a portion also occurs within British Columbia (17 per cent). Benga used a temporal boundary of 41 years following commencement of the project in the cumulative effects assessment.

[1572] In describing the current landscape, Benga stated that it was moderately to highly fragmented from both historical and a current human use perspective. Benga explained that the existing disturbance in the RSA largely consisted of agricultural lands, closed and open regenerating forest lands, settlement areas, and linear disturbances. Agricultural lands were the most extensive form of disturbance and occupied 9.5 per cent (27 010.6 ha) of the RSA. Regenerating lands accounted for 13.3 per cent (37 876.7 ha) of the RSA, while mining (both active and historical) occupied 1.1 per cent (3183.6 ha) of the RSA. Benga noted that linear disturbances accounted for 2.7 per cent (7626.1 ha) of the RSA, although it did not clarify what kind of linear disturbances were considered. Altogether, Benga estimated that 27 per cent (76 292.5 ha) of the RSA is already disturbed.

[1573] Benga noted that, within the LSA, close to 763.9 ha (16 per cent) of the terrain is already occupied by existing disturbances, such as well sites, gravel pits, historic mine disturbances and permanent rights of way. Benga considered the following certain and reasonably foreseeable activities in its cumulative effects assessment for vegetation and wetlands:

- Timber/forest harvesting in Alberta (planned and predicted to 2056) would create 13 530.7 ha of new disturbance. Timber operations included in the cumulative effects assessment only included Crown timber operations on Crown land. Privately owned timber operations were not specifically included in the cumulative assessment.
- Alberta Transportation Highway 3 re-alignment would contribute 91.5 ha of new disturbance.
- The Teck Coal Limited Coal Mountain Phase 2 Project would contribute 80.8 ha of new disturbance.

[1574] Benga also initially considered the Altalink (Chapel Rock to Pincher Creek), Teck Elkview Baldy Ridge, and Michel Creek Coking Coal Projects, but excluded them from the future-considerations section of the cumulative effects assessment for various reasons.

[1575] In response to an information request, Benga provided a revised cumulative effects assessment for vegetation and wetlands in the Eighth Addendum. Overall, Benga determined that cumulative effects to all valued components of vegetation and wetlands were not significant. Benga therefore determined that no additional mitigation measures, follow-up, or monitoring plans were required.

[1576] As each valued component was assessed separately, we discuss them individually in the sections below. However, some findings are common to all valued components.

[1577] In the chapter outlining the panel’s approach to its review, we discuss some of the issues regarding Benga’s assessment of cumulative effects. We find that Benga’s assessment of cumulative effects for vegetation and wetlands suffers from the issues raised in that section. We find that for the quantitative assessments it was not always clear how Benga determined the effects of the project in combination with other physical activities that have been or will be carried out. We also note that, in some cases, such as in the biodiversity and fragmentation analysis, Benga’s assessment would have benefitted from additional context and interpretation. With respect to Benga’s assessment of cumulative effects to vegetation, we also find that

- for some valued components, such as wetlands, Benga appeared to only assess the cumulative effects in the LSA;
- Benga did not provide the necessary baseline information for the occurrence, distribution and/or abundance of rare plants and rare plant potential, forest resources, old-growth forests, rangeland resources, or traditional ecological knowledge vegetation in the RSA;
- the accuracy of Benga’s cumulative effects assessment could have been improved had Benga obtained forest harvesting data or traditional ecological knowledge vegetation data, or consulted rare plant databases in British Columbia;
- although Benga provided a description of past activities in the Eighth Addendum, it did not explicitly consider how those past activities may have influenced the criteria for the determination of significance of cumulative effects; and
- although Benga indicated “no new cumulative effects are predicted based on future activities, and the cumulative effects assessment results are similar to the Application case results” (CIAR 89, PDF p. 556) for rangeland resources, forest resources, and old-growth forest, Benga proceeded to characterized residual cumulative effects.

Vegetation communities

[1578] Benga concluded that the residual effects of the project on vegetation communities would be high in magnitude and neutral, largely due to the planned mitigation measures and reclamation of the project site.

[1579] Benga mentioned several projects that would occur in the RSA, but was of the view that forest harvesting was the only activity within the LSA that would contribute to cumulative effects. Benga explained that, as forest harvesting is a highly regulated activity, “sustainable forest harvesting does not result in a change of ecosite classification for harvest areas outside the project footprint.” Based on this

statement, it appears that Benga only considered the cumulative effects within the LSA when measuring changes to ecosites.

[1580] Benga also assessed the cumulative effects through changes in ecological land classes. Benga mapped the RSA into 27 individual ecological land classes consisting of 12 forested classes, four wetland classes, three natural non-forested classes, seven disturbed classes, and one barren land class. The land classes include 143 006.8 ha (49 per cent) forested land, 46 421.3 ha (16 per cent) naturally non-vegetated land, 76 292.5 ha (27 per cent) disturbed land, 18 650.5 ha (7 per cent) barren land, and 2591.7 ha (less than 1 per cent) wetlands. To assess cumulative effects, Benga placed the planned and predicted forest harvest areas into regenerating ecological land classes, then aged them, as appropriate, toward the predisturbance condition.

[1581] Benga compared the ecological land classes 41 years after commencement of the project with and without the project, including the consideration or mitigation measures and reclamation. Benga noted that no ecological land class of limited distribution would be removed from the LSA or RSA during the project lifetime, except for open water. Benga noted that cumulative changes in ecological land class attributable to the project would not be significant at 41 years.

[1582] We note that Benga's assessment of cumulative effects only included the effects of future forest harvesting and is likely an underestimate of the total cumulative effects on vegetation. We also note that, while Benga provided information regarding its modelling work, it did not provide context for its analysis and the results were not well explained. Similar to our conclusions for the project effects, we find that there will be an adverse residual cumulative effect for vegetation communities. However, we note that the effects will instead be regional. The cumulative effects will not be significant.

Rare plants and rare plant potential

[1583] Benga concluded that the residual project effects on rare plants and rare plant potential would be high in magnitude and negative or neutral, respectively. Benga determined that inclusion of the projects identified for the cumulative effects assessment, and their effects with respect to rare plants and rare plant potential, did not differ materially from project effects. Therefore, according to Benga, no new predicted cumulative effects arose based on future projects. However, Benga noted one exception to this case for whitebark and limber pine. Cumulative effects on whitebark are discussed in the section below.

[1584] Based on the information provided in Consultant Report 8 and Appendix 8 in the EIA, it is not clear how Benga determined that there would be no cumulative effects on rare plants and rare plant potential. Benga did not provide any information about the occurrence, distribution, or abundance of rare plants and rare plant potential in the RSA. Therefore, we cannot accurately predict cumulative effects from the project on rare plants and rare plant communities.

Whitebark pine

[1585] Benga concluded that the residual project effects would be positive, based on anticipated successful re-establishment of rust-resistant whitebark pine. As discussed in the previous section on the significance of project effects, we disagree with Benga's assessment that there will be no negative residual effects from the project for whitebark pine.

[1586] When assessing the cumulative effects to whitebark pine, Benga noted that there was limited distribution of whitebark pine within the RSA. Benga provided a map showing whitebark pine occurrences in the RSA, and stated that there were roughly 6019 ha of whitebark pine in the RSA. Benga explained that the loss of whitebark pine from the project footprint would contribute incrementally to loss of whitebark pine for an extended period. But it added that these losses were predicted to be very low in relation to the amount of whitebark pine habitat in the RSA (3.5 per cent of habitat in the RSA).

[1587] Benga noted that the largest potential disturbance would be from future timber harvests, which were predicted to cover approximately 5 per cent of the RSA. Land disturbance associated with other future projects (including the project) were approximately 1 per cent of the land in the RSA. As a result, Benga predicted that 6 per cent of the RSA would be subject to future land disturbance. Benga also noted that the cumulative effects on whitebark pine should be limited in the RSA. It is not clear how many whitebark pine can be expected to be removed as a result of future projects in the RSA. Nor is it clear if areas of future harvest overlap with areas of whitebark pine. The future timber harvest was limited to Crown timber operations on provincial lands and did not include privately owned timber operations.

[1588] The *Alberta Whitebark Pine Recovery Plan* notes that, as of 2010, there were an estimated 28 903 700 mature whitebark pine stems in Alberta. The recovery plan notes that as a result of poor inventory data on provincial Crown lands, this number may be greatly underestimated. The whitebark pine was listed as endangered in Alberta in 2008 and Canada in 2012 due to observed and projected population declines across the species' provincial range, primarily due to the introduced white pine blister rust and outbreaks of mountain pine beetles. White pine blister rust is considered the primary threat and substantial data have been collected to determine the rate of population decline in Alberta.

[1589] Based on plots established across the Canadian Rocky Mountains, in 2009 the average rust infection rate of living trees was 52 per cent, while mortality was 28 per cent. However, there is much variability in those rates, with significantly higher levels of both infection and mortality occurring in southern Alberta. As of 2010, the estimated rate of population decline for the Canadian Rockies was 78 per cent over 100 years.

[1590] Although Benga acknowledged that these effects would happen, Benga was of the view that the project would contribute positively to whitebark pine recovery by planting 63 000 white pine blister rust-resistant seedlings. As discussed in the project effects section, we do not accept that Benga has provided sufficient evidence that it can achieve its reclamation goals for whitebark pine. Ktunaxa Nation requested that the cumulative effects be evaluated and that "locally derived data to estimate success of planted disease-resistant whitebark pine" be used in the assessment of effects and reclamation. CPAWS requested that an assessment of cumulative effects be carried out, and that the effects of climate change on whitebark pine be assessed.

[1591] Based on the existing and future predicted decline of whitebark pine, and that fact that it is an endangered species, we find that the project would contribute to significant adverse cumulative effects on whitebark pine.

Rangeland resources

[1592] Participants expressed concern with respect to existing cumulative effects to rangeland resources, including native grasslands and rough fescue communities. The Oldman Watershed Council stated that “grasslands are the most endangered ecosystems on the planet,” noting that only 26 per cent of Alberta’s native grasslands remain (CIAR 554, PDF p. 12). The council’s representative, Ms. Frank, stated that losing these additional hectares as a result of the project was a concern as the small incremental losses continue to add up over time.

[1593] Mr. Wallis, the Coalition’s expert, noted the importance of native grassland protection under the *SSRP*. The Livingstone Landowners Group stated that the area is among the “last best ranching country in the world because it contains large remnant tracts of native rough fescue grasslands” (CIAR 1351, PDF p. 26).

[1594] Benga concluded that the residual effects of the project on rangeland resources would be high in magnitude and neutral, largely due to the planned mitigation measures and reclamation of the project site. Benga stated that, as the majority of the rangeland resources within the LSA and RSA were located on steeper slopes that were not subject to forest harvest or other types of disturbances, the inclusion of the projects identified for the cumulative effects assessment and their effects on rangeland resources did not materially differ from project effects.

[1595] Despite this statement, Benga characterized residual cumulative effects for rangeland resources, concluding overall that the cumulative impact on the range health of the natural upland herbaceous grasslands would not be expected to be significant given the implementation of the mitigation measures. It is not clear how Benga determined that there would be no cumulative effects on rangeland resources, or what the cumulative effects characterization that follows this statement applies to. Benga did not provide any information about the occurrence, distribution, or abundance of rangeland resources, including rough fescue communities, in the RSA.

[1596] Without quantitative information, we are unable to accurately characterize the cumulative effects on rangeland resources. However, we find that participant submissions, and the importance placed on native grasslands in the *SSRP*, make it clear that past activities resulted in a reduction in native grasslands in southern Alberta. Given our finding that project effects on rough fescue dominated grasslands will be adverse and irreversible, we find that the project, in combination with other past and present project and activities, would contribute to a cumulative effect on rangeland resources. However, we cannot characterize the significance of the cumulative effect.

Forest resources

[1597] Benga concluded that the residual effects of the project on forest resources would be low in magnitude and neutral, largely due to the planned reclamation of historically disturbed unproductive lands in the project footprint.

[1598] Benga estimated that, combined with the project’s removal of 2814.1 ha of harvestable timber, the total future timber harvest in the Alberta portion of the RSA was expected to be 16 969 ha. We note that this is likely to be an underestimate, as future forest harvesting data for the British Columbia portion of the RSA (which accounts for roughly 17 per cent of the RSA) was not available, and therefore not

considered in the cumulative effects assessment. It is also not clear how Benga came up with the amount of harvestable timber area to be removed by the project, since Benga's amount exceeds the area of the project footprint.

[1599] Benga stated that timber harvesting was the only future activity with potential cumulative effects on forest resources. It stated that some amount of timber harvesting would take place, regardless of whether the project were to proceed, because the project is in a timber management zone. Consequently, Benga expected the cumulative effects on forestry resources to be substantially similar with and without the project. Nonetheless, Benga characterized residual cumulative effects for forest resources, concluding overall that the project effects on timber resources are not significant.

[1600] We note that Benga did not provide any information about the occurrence, distribution, or abundance of forest resources in the RSA. Without that information, we cannot accurately assess cumulative effects on forest resources.

Old-growth forests

[1601] Benga concluded that the residual effects of the project on old-growth forests would be low in magnitude and positive over the long term, noting that planned reclamation would help establish forests with high old-growth potential.

[1602] Benga noted that approximately 13 460 ha (4.7 per cent of RSA) of old-growth forest was identified within the RSA. Benga explained that, at a regional scale, harvesting activities not associated with the project would have the greatest impact on old-growth forests, noting that future forest harvest of old-growth forests was expected to be 13 530 ha within the Alberta portions of the RSA. Benga stated that as the project is in a timber management zone, some amount of harvesting would take place in the project LSA. This harvesting would occur regardless of whether the project proceeded, while the cumulative effects on old-growth forest would likely be substantially similar with or without the project. Yet Benga characterized residual cumulative effects on old-growth forests, concluding overall that the cumulative effect would not be significant.

[1603] We note that Benga did not estimate the amount of future old-growth forest harvesting, and appears to have used total forest harvesting numbers instead. As such, it is not clear how many hectares of old-growth forest would be removed in the cumulative effects case. Without that information, it is not possible to accurately assess the cumulative effects on old-growth forests.

Traditionally used vegetation species

[1604] Benga stated that the project would remove 1042.8 ha (28.5 per cent of the LSA) of ecosite phases that support vegetation used in traditional ecological knowledge. Benga concluded that the residual effects of the project on traditional ecological knowledge vegetation would be high in magnitude and neutral, largely due to the planned mitigation measures and reclamation of the project site to the capabilities equivalent to those of the surrounding lands prior to development.

[1605] Benga explained that it did not measure the occurrence and distribution of traditional ecological knowledge vegetation in the RSA. Instead, Benga assumed that the distribution of traditional ecological knowledge species in the RSA was comparable to what was observed in the LSA. Benga noted that, other

than forest harvesting, the projects included in the cumulative effects assessment would have an insignificant effect on plant communities. Based on the assumption that forest harvesting would be carried out in a sustainable manner (as per provincial regulations), Benga argued that impacts on traditional ecological knowledge vegetation would be “substantially similar with and without the project.” Despite this viewpoint, Benga characterized the residual cumulative effects for traditional ecological knowledge vegetation. It concluded that with mitigation, the cumulative effects are not significant as no irreversible effects to sustainability of the resource would be expected.

[1606] It is not clear how Benga determined that there would be no cumulative effects on traditional ecological knowledge vegetation without measuring the occurrence and distribution of traditional ecological knowledge vegetation in the RSA. Benga did not provide a rationale for its assumption that the regional distribution of traditional ecological knowledge vegetation would be similar to that of the LSA. We find that Benga did not provide the information necessary for a cumulative effects assessment and we cannot accurately predict cumulative effects from the project on traditional ecological knowledge vegetation.

Wetlands

[1607] Benga concluded that the residual effects of the project on wetlands would be moderate in magnitude and positive, largely due to planned reclamation that would include establishing wetlands and wetland vegetation. Benga noted that it carried out a cumulative effects assessment on wetlands, even though the residual effects were positive, because “based on the assessment it is suspected a change in wetlands may have regional implications.” However, Benga did not provide any further information about the potential regional implications.

[1608] Benga noted that wetlands occupy just 2592 ha (0.9 per cent) of the RSA. For the cumulative effects case, Benga anticipated an increase in open water of 47.8 ha, as well as decreases of 6.6 ha of graminoid wetland, 1.8 ha of shrubby wetland, and 18.4 ha of treed wetland in the RSA. In total, Benga anticipated a net increase of 21 ha in RSA wetland area due to the increase of area occupied by open water as a result of the end-pit lake in the project’s reclamation plan.

[1609] We note that Benga assumed that its reclamation efforts would have a positive effect by increasing the amount of wetlands in the LSA, and therefore the RSA. However, we find that there would be an adverse residual project effect associated with the loss of wetlands due to uncertainties associated with the timing and success of wetland restoration. We also do not accept that open water associated with the end-pit lake is equivalent to wetlands, as the water depth in much of the end-pit lake will preclude the establishment of vegetation. Given these limitations, and uncertainties associated with the information provided by Benga, we find we cannot accurately assess cumulative effects on wetlands.

Biodiversity and fragmentation

[1610] To assess the cumulative effects on biodiversity and fragmentation, Benga used ecological land-class map-unit cover classes to map the development of the project, as well as other planned developments. Benga selected two time periods for the assessment: 14 years after project start (maximum extent of area cleared or mined, with minimal area of the footprint progressively reclaimed) and 41 years after the start of the project (approximately 15 years after final reclamation, with associated aging structural changes of the map units). Benga used its original conservation and reclamation plan from the

EIA to map the progressive reclamation of the project footprint (minimal at 14 years) and final reclamation (complete and aged at 41 years). Benga acknowledged that, because these comparisons take into account the project mitigation and reclamation plan, they are not worst-case scenarios.

[1611] Benga stated that the project, in combination with other projects in the RSA for the planned development case, would be predicted to contribute to an increase in fragmentation cumulative effects. Of particular note would be an increase in the number of patches, a decrease in patch perimeter length, and a decrease in patch core area. However, due to the already highly fragmented condition of the project development area—including the results of 55-year-old mining activities, roads, and oil and gas developments—the project contribution to the increase in fragmentation cumulative effects is minimal, and positive compared with other projects included in the planned development case, particularly compared with forest harvesting in the RSA. Establishing large contiguous forest patches during reclamation would somewhat offset the unnaturally small patches created by harvesting.

[1612] Benga concluded that most populations and communities of native vegetation would recover, given time, to near-baseline levels after reclamation. Reclaimed habitat would be structurally and compositionally similar to that existing at baseline, including previous disturbed areas in the project footprint. Benga stated in the Eighth Addendum that, with mitigation, the cumulative effects on biodiversity and fragmentation at the species, community, and landscape level would not be significant because no irreversible effects to sustainability of the resource would be expected.

[1613] While Benga provided information regarding its modelling, it did not provide context for the analysis, and the results were not well explained or interpreted. As previously discussed in this chapter and the conservation, reclamation, and closure chapter, we are not confident that Benga's conservation and reclamation plan will return the closure landscape to near-baseline levels of vegetation species and community composition and diversity in the foreseeable future (less than 100 years and possibly much longer). We find that the project is likely to result in adverse residual effects on species and community biodiversity, and contribute to existing cumulative effects on biodiversity. But the available information makes it impossible to accurately assess or characterize the significance of these cumulative effects.

Recommendation 4: We recommend that the Government of Canada finalize and implement the federal recovery strategy for whitebark pine under *SARA* as soon as possible.

Several participants noted that this strategy is overdue. Finalizing the recovery strategy and providing further clarity around the definition and location of critical habitat for whitebark pine would provide clarity for industry, decision makers, and the public.

17. Wildlife

Benga selected appropriate valued components and considered relevant species at risk

[1614] Benga was required to include in its EIA wildlife valued components that may be affected by changes to the environment, as well as species at risk and their critical habitat according to the requirements in section 79 of *SARA*.

[1615] Benga selected a wildlife LSA occupying 5646.4 ha, a wildlife RSA occupying 73 547 ha and a grizzly bear RSA occupying 284 024 ha for its baseline studies and effects assessments.

Selection of valued components

[1616] Benga stated that, because it was not feasible to assess all wildlife species, it selected a set of those representative of wildlife in the area that make similar uses of various habitat types at various spatial (foraging) and temporal (e.g., breeding, overwintering) scales. Benga used the following criteria to determine the representative wildlife species:

- known or reported occurrence in and overlapping with the wildlife LSA
- reported to have value to traditional (Indigenous), recreational (hunter), subsistence (trapper), and/or non-consumptive (wildlife-viewer) users
- designated provincial (“at risk,” “may be at risk,” or “sensitive”) and/or federal (“endangered,” “threatened,” or “special concern”) status, or known to be declining in the region
- use of major habitats and/or reliance on habitat types that are limited in geographic extent and that may be affected by project development
- a “keystone” species that has a disproportionate effect on the ecosystems in which it is found, or that other species require so they can persist in the area

[1617] Based on this approach, Benga selected 10 species consisting of two amphibians, two birds, and six mammals. We summarize these valued components in Table 17-1.

Table 17-1. Valued wildlife components selected by Benga

Valued component species		
Amphibians	Birds	Mammals
Columbia spotted frog (<i>Rana luteiventris</i>)	Olive-sided flycatcher (<i>Contopus cooperi</i>)	Little brown bat (<i>Myotis lucifugus</i>)
Western toad (<i>Anaxyrus boreas</i>)	Great grey owl (<i>Strix nebulosa</i>)	American marten (<i>Martes americana</i>)
		Canada lynx (<i>Lynx canadensis</i>)
		Grizzly bear (<i>Ursus arctos</i>)
		Moose (<i>Alces alces</i>)
		Elk (<i>Cervus canadensis</i>)

[1618] Benga stated that it appreciated the traditional value of many wildlife species to Indigenous groups. Benga indicated it could not individually assess all species with traditional value identified in the available traditional use reports, or all those identified by Indigenous groups during the consultation process. Benga indicated that it carefully considered all identified species of traditional value during the selection of the valued wildlife components. Before starting the assessment, Benga presented the 10 valued components to the Treaty 7 First Nations for their approval or recommended additions or alternatives. None of the Treaty 7 First Nations suggested any additions or changes. Benga assessed an additional eight species at a higher level to provide supplemental information to the wildlife assessment. Benga chose these eight species based on the same criteria as the valued components, and labelled them “special status” species.

Table 17-2. Special status wildlife species selected by Benga

Special status species	
Birds	Mammals
Barn swallow (<i>Hirundo rustica</i>)	Mountain goat (<i>Oreamnos americanus</i>)
Common nighthawk (<i>Chordeiles minor</i>)	Bighorn sheep (<i>Ovis canadensis</i>)
Short-eared owl (<i>Asio flammeus</i>)	Wolverine (<i>Gulo gulo</i>)
Bald eagle (<i>Haliaeetus leucocephalus</i>)	
Golden eagle (<i>Aquila chrysaetos</i>)	

[1619] Some participants expressed concerns about the selection of valued components, suggesting they did not capture all of the wildlife species present in the wildlife LSA. For example, the Timberwolf Wilderness Society questioned the decision to exclude the grey wolf as a valued component. They stated that the grey wolf is a keystone species with profound effects on entire ecosystems, even at low population densities. They noted that grey wolves were historically present in the regional ecosystem, but now are functionally extinct in the area, although they do occur infrequently. The society stated that loss of the wolf demonstrates that this species’ limits have already been exceeded. They also indicated that additional damage to grey wolf habitat is intolerable, and expected the project would further reduce the quality of habitat for grey wolves.

[1620] The Ktunaxa Nation expressed concern that the valued components selected for the EIA did not adequately represent the full range of wildlife in the wildlife LSA. Some species of value to Indigenous peoples, such as small furbearers, were omitted. The Ktunaxa indicated the species omitted in the assessment included aquatic furbearers, wetland riparian birds, grassland birds, cavity-nesting birds dependent on trees for breeding, reptiles, small mammals, and invertebrates. Instead, Benga included in its assessment several federally and/or provincially listed species not valued by First Nations. The Ktunaxa stated that, in some cases, Benga chose valued components that are not at risk instead of those that are. They stated that Benga either did not consider, or underestimated residual effects, leading to a lack of mitigation measures to address the listed species.

[1621] Benga did not initially identify Clark’s nutcracker as a special status species. But in response to our information request, it provided information on the potential effects of the project on this species given its importance to whitebark pine. Benga also provided information on the plains bison (*Bison bison bison*), a species of importance to Indigenous groups, in response to our requests for information.

Consideration of relevant species at risk

[1622] The final Environmental Impact Statement Guidelines required Benga to provide a list and assessment of all potential or known federally listed wildlife species at risk that may be affected by the project, along with their respective habitat requirements. The assessment needed to include a description of the baseline conditions as well as the direct and indirect effects of the project on the species at risk and their critical habitats. The provincial EIA terms of reference required that Benga identify species listed in the General Status of Alberta Wild Species as at risk, may be at risk, or sensitive.

[1623] In the EIA, Benga assessed all provincially and federally listed species at risk known to occur in the wildlife LSA. It conducted either a detailed assessment of those species as valued components, or a high-level assessment for species it identified as special status. In response to our information requests, in 2019 and 2020 Benga provided a high-level assessment of the latest federally listed species at risk.

[1624] Table 17-3 lists the species at risk that Benga assessed, as well as their federal and provincial conservation designations under COSEWIC, SARA, and the *General Status of Alberta Wild Species*.

Table 17-3. Species at risk assessed by Benga and their federal and provincial conservation status

Species	COSEWIC	SARA	General Status of Alberta Wild Species	EIA
Amphibians				
Columbia spotted frog	Not at risk	Not at risk	Sensitive	Valued component
Western toad	Special concern	Special concern (Schedule 1)	Sensitive	Valued component
Birds				
Baird's sparrow ^a	Special concern	Special concern (Schedule 1)	Sensitive	Assessment through information request
Bald eagle	Not at risk	Not at risk	Sensitive	High-level assessment as special status
Barn swallow ^a	Threatened	Threatened (Schedule 1)	Sensitive	High-level assessment as special status
Clark's nutcracker	Not at risk	Not at risk	Sensitive	Assessment through information request
Common nighthawk ^a	Special concern	Threatened (Schedule 1)	Sensitive	High-level assessment as special status
Golden eagle	Not at risk	Not at risk	Sensitive	High-level assessment as special status
Great grey owl	Not at risk	Not at risk	Sensitive	Valued component
Olive-sided flycatcher ^a	Special concern	Threatened (Schedule 1)	May be at risk	Valued component
Short-eared owl	Special concern	Special concern (Schedule 1)	May be at risk	High-level assessment as special status

Mammals				
American badger	Special concern	Special concern (Schedule 1)	Sensitive	Assessment through information request
Canada lynx	Not at risk	Not at risk	Sensitive	Valued component
Little brown bat	Endangered	Endangered (Schedule 1)	May be at risk	Valued component
Grizzly bear	Special concern	Special concern (Schedule 1)	At risk (threatened)	Valued component
Wolverine	Special concern	Special concern (Schedule 1)	May be at risk	High-level assessment as special status

^a Also a migratory bird under the *Migratory Birds Convention Act*.

[1625] We note that participants suggested that other species should have been included in Benga's assessment, but they did not explain how these other species demonstrated spatial or temporal habitat use trends that would be significantly different from the valued component species. We agree with Benga that common habitat use in spatial and temporal scales is an important criterion, among several others, for selecting representative valued components in a wildlife assessment. Further, we note that there is no *SARA* recovery strategy for the grey wolf and it is listed as secure in Alberta.

[1626] We find that Benga identified suitable species and that these species fill a variety of ecological niches. The final Environmental Impact Statement Guidelines indicate that the final list of valued components presented in the EIA should reflect knowledge about the environment acquired through public consultation and Indigenous engagement. We find that Benga presented clear explanations of why each valued component was selected, and gathered information from Indigenous groups on species of importance. Benga also focused on species listed under *SARA* or identified by the *General Status of Alberta Wild Species* that occur in the LSA or have the potential to occur.

[1627] Some of the listed species were not considered valued components, but were instead considered to be special status species and were only assessed at a high level. We find that Benga should have carried out a detailed assessment for all listed species, as a high-level assessment may not be sufficient to determine the effects of the project on species at risk within the wildlife LSA or even the RSA. However, in response to our information requests, Benga provided an adequate level of supplemental information on the potential effects of the project on listed terrestrial wildlife species.

[1628] We are satisfied that Benga assessed all listed terrestrial wildlife species that may be affected by the project. The rest of this chapter focuses on species about which participants raised concerns, as well as migratory birds and species listed under *SARA* and their critical habitat, as required by our terms of reference.

Benga chose appropriate indicators to assess the potential effects of the project on wildlife

[1629] Benga assessed effects on wildlife according to four indicators: habitat availability, habitat fragmentation and connectivity, wildlife mortality, and regional abundance and diversity.

[1630] Some participants, including the Wildlife Society and the Timberwolf Wilderness Society, stated that the assessment provided by Benga lacked appropriate process and rigour. The Timberwolf Wilderness Society's expert, Mr. Mayhood, stated that, although Benga completed much work regarding the EIA, it did not integrate many relevant studies into the knowledge base for the wildlife RSA and LSA. The Ktunaxa Nation expressed concern about the methodologies used by Benga for baseline data collection, and the spatial and temporal scales used for the baseline assessment.

Habitat availability indicator

[1631] Benga stated that habitat availability will be affected either directly through habitat loss or indirectly as wildlife avoid sensory disturbances such as noise and light. The habitat availability of valued components was determined with species-specific models that assign a habitat suitability rating. For example, highly suitable habitat for the western toad consisted of wetlands and waterbodies suitable for breeding. These ratings represented the importance of the current habitat to the persistence of a wildlife population in the wildlife LSA and RSA. Benga acknowledged limitations with this approach due to predation, disease, and social interactions that can affect wildlife abundance in an area. The habitat rating approach also takes into consideration critical life processes for each species, including reproduction, foraging, or hibernation, and the season in which those life processes occurred.

[1632] Benga stated that the arrangement and distribution of habitat can be just as important as the quantity of available habitat. It defined effective habitat as a combination of both the high and moderate suitability ratings for the valued components. Benga also defined "core habitat" for elk and moose as effective habitat that occurs outside the zone of influence of disturbance and is assumed to be a patch of at least five hectares that provides food resources and security from human disturbance and predation. A zone of influence is an area, beyond the impact itself, in which wildlife behaviour, movement, and distribution are affected.

[1633] Benga indicated that the project footprint will occupy 1520.7 ha over the lifetime of the project, comprising 26.9 per cent of the wildlife LSA. Benga predicted that the largest change in areal extent of habitat types in the wildlife LSA would occur at year 14 and be associated with the loss of moderate mixed-coniferous (387 ha or 28 per cent) and closed mixed-wood habitats (309 ha or 31 per cent). Benga expected that the availability of closed mixed-coniferous and grassland habitats would decline by 148 ha (35 per cent) and 151 ha (52 per cent), respectively, by year 14. Benga stated that most habitat types that would be directly affected by the project were relatively common in the region.

Habitat fragmentation and connectivity indicator

[1634] Benga indicated that the project could adversely affect wildlife by disrupting movement patterns and reducing access to seasonally important areas. Benga's assessment addressed the potential for reductions in regional habitat connectivity and the significance this may have for wildlife populations and their respective movements. This assessment included the effects of the overland conveyor, road and utility corridors, mining operations, progressive reclamation, and further exploration activities in the area. Because effects on wildlife movement are different for each species, Benga assessed the habitat connectivity for each valued component in each of the baseline, application and planned development cases. Benga highlighted that effects on wildlife movements tend to be species specific. For example, species with small home ranges tend to be less vulnerable to fragmentation effects compared with species

with large home ranges, such as moose, elk, and grizzly bears, while birds are generally considered to be affected less by physical barriers.

[1635] Benga noted that wolverines have large ranges and can disperse over long distances, although no wolverines were detected during baseline surveys. The wolverine is a species of special concern under *SARA* because its range is being fragmented by industrial activities, and wolverine populations require large, undisturbed areas to remain viable. Benga indicated that ungulates in the wildlife LSA likely undergo seasonal changes in their habitat use. For example, Benga noted that aerial surveys show seasonal movements of moose in Alberta, while elk in mountainous areas often migrate to lower elevations during the winter.

[1636] Benga provided permeability mapping for moose and elk, as it anticipated that the project would likely affect both species. Permeability mapping provides an understanding of which areas an animal can easily move through versus areas that present barriers or which redirect movement. Benga also used road-density thresholds to assess changes in ungulate movements. An effect was considered significant if road densities were above these threshold values, regardless of the effect's reversibility. Benga considered that if road density was already above the threshold at baseline, any increase due to the project was not significant.

[1637] For example, Benga assigned a rating of "low permeability" to the mapping of the coal conveyor system, and stated that this system, along with the active mine site, would have the greatest effect on moose and elk movements. Benga acknowledged that the rail loadout facility could provide a further barrier (in addition to Highway 3 and urban development at Blairmore) to the north-south movement of ungulates between the Crowsnest River valley and higher-elevation summer ranges to the north during mine operations.

[1638] The Wildlife Society and CPAWS stated that the road density in the area was a cumulative effect, and that Benga's significance conclusions were inadequate. Both the Wildlife Society and CPAWS stated that the project would further reduce the ecological functionality and connectivity of the landscape and affect wildlife movement.

[1639] Benga defined road densities in terms of kilometres of road per square kilometre (km/km^2) of area within the wildlife LSA for each assessment scenario. Benga predicted that, over the life of the mine, road densities in the wildlife LSA would decrease from $0.88 \text{ km}/\text{km}^2$ at baseline to $0.69 \text{ km}/\text{km}^2$ at year 14 and to $0.61 \text{ km}/\text{km}^2$ at year 27, taking into consideration the planned progressive reclamation.

[1640] The Wildlife Society stated that Benga did not thoroughly address the impacts on connectivity caused by the conveyor and industrial road access. The Wildlife Society stated that Benga did not incorporate Alberta Government data to assess and model linear disturbance impacts in the area, affecting Benga's overall modelling of the movement potential for wildlife.

[1641] Benga provided a specific assessment of the overland conveyor, which would create approximately 5.4 km of linear disturbance in the southern portion of the project. Benga surveyed the length of the proposed conveyor for signs of wildlife use and to determine east-west movement potential along the route. It used cameras and pellet-count surveys to gauge the potential use of the area by large and small mammals, respectively.

[1642] Benga assessed the potential changes in movement for other valued components qualitatively without permeability mapping. Benga concluded that the potential barriers to movement included

- loss of vegetation and landscape alteration from construction of surface mine, infrastructure, and road,
- vehicular traffic associated with the mine access roads and other mining activities,
- coal-conveyor infrastructure, and
- the railway loop.

Wildlife mortality indicator

[1643] Benga stated that the project had the potential to indirectly increase mortality risks for wildlife through several mechanisms. These included but were not limited to the clearing and removal of habitat; wildlife-vehicle collisions; potential increases in access leading to hunting, trapping and predation opportunities; and contaminant exposure. The potential for effects on wildlife health resulting from exposure to contaminants is discussed in the chapter on wildlife health.

[1644] The Wildlife Society stated that Benga may not have considered wildlife displacement as a mechanism of increased wildlife mortality. It stated that grizzly bears may be displaced to habitat adjacent to the mine site, including private lands, increasing the risk of human-bear conflicts on agricultural lands.

[1645] Benga acknowledged that habitat loss and fragmentation, specifically related to linear features and the increased human activity associated with these features, could increase the risk of wildlife mortality. Benga assessed the potential impacts related to road density on moose, elk, and grizzly bears. Because effects on wildlife mortality differ by species, Benga provided an assessment for each valued component and special status species in the baseline, application, and planned development cases.

[1646] The Ktunaxa Nation indicated that the wildlife mortality risk assessment should include edge effects, and argued that these areas should not be considered effective habitat. Additionally, the Ktunaxa did not agree with Benga's selection of sources affecting the zone of influence. The Wildlife Society stated that Benga did not include zones of influence to measure the impact of human activity at the mine site on surrounding areas, specifically for grizzly bears.

[1647] Benga stated that it used the zone-of-influence model in its assessment to refine habitat suitability, and for the mortality risk for the selected valued components; but not for special status species or grizzly bears. Although it did not define a zone-of-influence in the modelling for the grizzly bear, Benga stated that it used models and data from the Foothills Research Institute Grizzly Bear Program to inform the grizzly bear assessment. ECCC stated that it considered mortality risks for the nine federally listed wildlife species (under *SARA*) would be low with mitigation.

Wildlife abundance indicator

[1648] Benga stated that wildlife abundance will most likely be influenced by changes in habitat availability; however, changes in habitat connectivity, fragmentation, and mortality risk may also lead to changes in abundance in the wildlife LSA. If persistent, these changes could affect landscape-level populations, in particular those species with small or declining populations.

[1649] For each species, Benga assessed the change in abundance in the wildlife LSA during the construction and operation phases of the project. For these valued components, Benga predicted the following regarding wildlife relative abundance when compared to baseline:

- Columbia spotted frog: decline in abundance
- Western toad: decline in abundance
- Olive-sided flycatcher: displacement to other suitable habitat in the wildlife LSA; decline in abundance
- Great grey owl: relatively uncommon at baseline and will likely remain low
- Little brown bat: decline in abundance
- American marten: decline in abundance with potential to continue to be low after year 27 due to habitat requirements of old-growth forests
- Canada lynx: decline in abundance with potential to continue to be low after year 27 due to habitat requirements of mature reclamation
- Grizzly bear: increased abundance will only be realized with successful progressive reclamation; otherwise, grizzly bears will be displaced
- Moose: minor effects on long-term winter habitat are expected but overall effects are likely to be low
- Elk: increased abundance will only be realized with successful progressive reclamation and hunting restrictions; otherwise, elk will be displaced

[1650] The Ktunaxa Nation indicated that the baseline valued component survey data for current relative abundance of certain species had not been adequately completed, missing key habitat areas in Benga's baseline assessment.

[1651] CPAWS, the Coalition, the Oldman Watershed Council, the M.D. of Ranchland, and members of the public raised concerns over the removal of key habitat for species at risk and the risk of increased mortality due to decreased water quality and quantity. These participants were concerned that the project would result in a decline in wildlife populations and species at risk that depend on the area. Participants raised concerns about specific species at risk such as the grizzly bear, wolverine, little brown bat, and olive-sided flycatcher.

[1652] Benga's wildlife abundance assessment reviewed available data on wildlife densities to determine the potential loss of individuals from changes in factors such as loss of suitable habitat, changes in movement behaviours, or increased mortality risk. Benga stated that if other factors influenced wildlife abundance, such as wildlife displacement to adjacent habitats, it evaluated these impacts qualitatively.

[1653] Benga provided an estimate of abundance for each assessed wildlife species within the wildlife LSA at baseline, and then assessed the potential impacts of the project after mitigation. It did so for both the application and planned development cases. It also assessed the significance of these effects. The Ktunaxa Nation identified uncertainties related to the impact of changes to abundance that would require adequate monitoring to validate the impacts stated by Benga.

[1654] ECCC's expert, Mr. P. Gregoire, stated that, although there could be minor impacts from the project within the wildlife LSA for specific species, such as the barn swallow, common nighthawk, and olive-sided flycatcher, many of these species are not habitat-limited and have wide distributions. As such, ECCC stated the primary concerns with these specific species are habitat loss on wintering grounds and pesticide use, neither of which are specific to Benga's project-related impacts.

[1655] We find that the indicators selected to assess the potential project effects, including the spatial and temporal aspects of the wildlife assessment, are appropriate. While participants raised some general concerns about Benga's wildlife assessment, they did not identify specific concerns about the indicators used. The selected indicators are consistent with the provincial terms of reference and federal environmental impact statement guidelines and are assessed within an adequately defined wildlife LSA and RSA. We also find that Benga considered relevant literature and applied appropriate datasets and modelling practices to identify thresholds for indicators where they were available.

[1656] We find that each of the indicators were applied appropriately to assess potential project effects on valued components within a detailed assessment or on special status species as part of a high-level assessment. We recognize that the project may adversely affect wildlife habitat availability within the wildlife LSA, resulting in impacts on life processes important to terrestrial wildlife species. We agree with Benga's approach to defining effective habitat, habitat ratings, and consideration of habitat distribution.

[1657] We recognize that the project may adversely affect wildlife movement patterns and reduce accessibility to seasonally important areas, and that moose, elk, grizzly bears, and wolverines may be particularly vulnerable to fragmentation effects of the project due to their large home ranges. We also recognize that the project could directly and indirectly increase mortality risks for wildlife through clearing and removal of habitat, wildlife-vehicle collisions, and increase in human access, leading to harvesting and predation opportunities and contamination exposure.

[1658] We find that most terrestrial species that inhabit and/or use the project area may decrease in abundance within the wildlife LSA over the life of the project. Several of the terrestrial wildlife species may have a wide distribution within the RSA and project impacts on these species may be limited to the LSA.

[1659] We are satisfied that Benga assessed the appropriate indicators for wildlife. In the sections that follow we focus on the indicators that had the greatest potential for effects on specific species, concerns expressed by participants, and areas of uncertainty.

Benga's approach to assessing the cumulative effects on wildlife was not precautionary

[1660] Benga indicated that the natural environment of the Crowsnest region has been extensively modified by both anthropogenic activities and natural factors, including fire and climate change. Benga highlighted that, although the status of wildlife populations prior to European settlement is unknown, habitat loss and fragmentation—together with increased mortality from hunting, road kills, and other factors—have reduced the region's ability to support certain wildlife species.

[1661] Benga emphasized that the project is located on a landscape that has experienced anthropogenic disturbances from past activities, including historical surface mining. Benga stated that this legacy disturbance was not reclaimed and provides poor habitat quality for wildlife. Numerous participants

raised concerns regarding cumulative effects, and highlighted the existing stressors faced by a number of species at risk, including the grizzly bear and little brown bat.

[1662] Benga carried out a cumulative effects assessment on the species that it identified as valued components, but did not assess the cumulative effects on special status species. Four of the selected valued components, the olive-sided flycatcher, little brown bat, American marten, and Canada lynx depend on mature and/or old-growth forest. The predominant driver for cumulative effects in the wildlife and grizzly bear RSAs over the next 30 years is anticipated to be timber harvesting, and these species may be particularly sensitive due to their habitat requirements.

[1663] In terms of other planned or reasonably foreseeable projects and activities, Benga quantitatively included timber harvesting and several other infrastructure projects, including the Michel Creek coking project, the Altalink transmission project, and the Highway 3 realignment project in its cumulative effects assessment for wildlife. Benga noted that wildfires, climate change, and recreational activities could also be stressors for wildlife. Benga stated that forestry is expected to be the main land use activity in the RSA.

[1664] ECCC indicated that if logging took place in the wildlife LSA and RSA, this would increase cumulative effects, and birds would be displaced further from the project. Because logging of the forests will change the seral stages and alter the dynamics in the area, different species and different guilds of species can be expected to enter the area.

[1665] Benga stated that it adopted a precautionary approach to assessing habitat change, and used a threshold of 20 per cent (i.e., a species will tolerate the loss of up to a 20 per cent of effective habitat) for species at the wildlife RSA and grizzly bear RSA levels. Using supporting literature, Benga indicated that the use of 20 per cent loss as a residual effect to determine significance is a conservative threshold at which healthy populations will exist.

[1666] Benga's planned development case considered the effects of planned developments separate from the project, which does not represent a comprehensive cumulative effects assessment. Cumulative effects, as defined in the *Technical Guidance for Assessing Cumulative Environmental Effects under CEAA 2012*, should include cumulative effects likely to result from the project in combination with the environmental effects of other physical activities that have been or will be carried out.

[1667] In the chapter on the panel's approach to its assessment, we discuss some of the issues regarding Benga's assessment of cumulative effects. We find that Benga's assessment of cumulative effects on wildlife suffers from the issues raised in that section. For the quantitative assessments, it was not always clear how Benga determined the effects of the project, in combination with other physical activities that have been or will be carried out.

[1668] Benga's predictions for habitat loss in the RSA during the planned development case did not add the predicted habitat losses from the project in the wildlife LSA to the predicted habitat losses from planned developments in the RSA. In the application case, for example, Benga predicted a loss of 832.9 ha of effective habitat for the olive-sided flycatcher in the LSA in year 14. For the planned development case, Benga predicted a loss of 53.9 ha of effective habitat for the olive-sided flycatcher in the RSA. The habitat loss for the planned development case in the RSA is less than that of the project, and therefore

does not include the contribution to the project. This is also the case for other species for which losses during the planned development case were quantified.

[1669] Although it is important to quantify the loss of effective habitat due to planned developments, the planned development case did not predict the effects of the project in the LSA in addition to that of planned developments across the RSA. This resulted in an underestimate of percentage habitat loss in comparison with the 20 per cent threshold.

[1670] Based on the information provided by Benga, none of the terrestrial species for which a quantitative assessment was carried out exceeded the 20 per cent loss threshold. Benga stated that for all species, the cumulative effects of past, existing, and future activities, in combination with predicted project effects, have been determined to be not significant following mitigation.

[1671] We agree that timber harvesting in the wildlife RSA would have the greatest potential for cumulative effects on wildlife due the removal of habitat, including old-growth and mature forests. We find that a 20 per cent loss threshold may not be appropriate for species at risk that are already facing pressures and may have crossed an ecological threshold resulting in a decline in the species. We note that species are listed under *SARA* because of a variety of existing threats. No species-specific habitat loss thresholds are described in the available recovery strategies, management plans or action plans for listed species, nor are they defined by participants, yet populations of these listed species are susceptible to additional pressures.

Our approach to assessing project and cumulative affects on wildlife species

[1672] Benga indicated that the project will affect wildlife valued components through changes in habitat availability, habitat fragmentation/connectivity, mortality risk, and abundance—all of which affect local populations to some degree. Benga stated that the project could also affect several special status species through habitat loss and alteration, changes in movement, and increased mortality. Benga provided a significance conclusion for each valued component in terms of the four indicators (habitat availability, habitat fragmentation and connectivity, mortality, and abundance).

[1673] For all valued components and for all indicators, Benga concluded that, with mitigation, the project is not likely to result in significant adverse residual effects. For special status species, Benga presented a single significance conclusion for each species, and concluded that, with mitigation, the project is not likely to result in significant adverse residual effects.

[1674] For the purposes of our significance determination of project effects on wildlife species, we focused on the indicators with the greatest potential to affect each wildlife species. We consider this to be a conservative approach. Our assessment of the effects of the project on wildlife, and discussion of those effects on specific species, follows below. A summary of our characterization of residual effects and determination of significance for each assessed species can be found in Table 17-5. In many instances, we draw on our findings in the chapters on conservation, reclamation, and closure; vegetation and wetlands; and wildlife health to support our analysis.

[1675] The majority of the evidence from Benga and participants focused on habitat loss. Therefore, for the majority of wildlife species our significance determinations also focus on the habitat availability indicator. For amphibians and birds, we also consider mortality due to exposure to contamination. For the

little brown bat we take into consideration potential mortality from the loss of previously unidentified hibernacula. For the grizzly bear, much of the evidence on the record discussed potential effects on landscape connectivity, as does our significance determination.

[1676] The definitions of magnitude provided in the chapter on the panel's approach to the review refer to whether the effect is within levels of protectiveness for a valued component. Within the recovery strategies or management plans for listed species, no defined thresholds for habitat loss were provided and we were unable to assign quantitative values to define the magnitude of a loss of habitat.

[1677] Moreover, for some species, Benga did not provide quantitative information on habitat loss. In the absence of defined thresholds, we considered whether there was critical habitat as defined under *SARA* in the wildlife LSA or grizzly bear RSA, and whether there was any evidence that the project served as a site of importance for key life functions, including breeding and foraging, or as a migratory stopover site. We also considered whether similar habitat was available in the RSA for wildlife species being displaced. We define the magnitude of habitat loss as follows:

- **Low magnitude:** an effect that resulted in the loss of effective habitat in the LSA, but similar effective habitat is abundant in the wildlife RSA
- **Moderate magnitude:** an effect that resulted in the loss of effective habitat in the LSA, but there is moderate to limited effective habitat in the wildlife RSA
- **High magnitude:** an effect that resulted in the loss of critical habitat in the LSA, or loss of effective habitat in the LSA that is present in limited quantities in the wildlife RSA

[1678] The geographic extent of the effects on all wildlife species, with the exception of grizzly bears and wolverines, would be local due to the localized nature of activities to the project footprint. The frequency of the effect for all species would be continuous due to the removal of habitat, the presence of project infrastructure, and persistent levels of contaminants.

[1679] One of the main mitigation measures proposed by Benga is its progressive reclamation program. In assigning criteria for the duration and the reversibility of the effect on wildlife species, we considered the length of time that it would take for the habitat to re-establish and for species to return following progressive reclamation. The ecological context for all of the species is negative. All the species we assess below are listed under *SARA* or under the 2015 *General Status of Alberta Wild Species* as sensitive, may be at risk, or at risk. Due to their listed status, many of these species have faced historical pressures from habitat loss, fragmentation, or overharvesting, and we consider this context important in the determination of significance.

[1680] With respect to cumulative effects, we focus our assessment on the species listed under *SARA* for which we received relevant information from Benga, and particularly the olive-sided flycatcher, little brown bat, grizzly bear and western toad. Due to the sensitive nature of many species in the wildlife RSA, we adopted a precautionary approach to determining the significance of cumulative effects that considers the current state of the species.

The project will reduce wildlife and habitat diversity within the wildlife LSA

[1681] The EIA terms of reference required Benga to provide a description of the terrestrial diversity metrics used to understand the current ecosystem and the potential impacts of the project on overall biodiversity, including wildlife. During the baseline assessment, Benga indicated that the presence of more than 91 species indicated a high wildlife diversity rating, while between 71 and 90 species indicated a moderate to high diversity rating. Overall, habitats with these two ratings made up 86.8 per cent of the wildlife LSA and accounted for 219 wildlife species potentially occurring in the wildlife LSA. For the application case, Benga stated that it expected areas with a high wildlife diversity rating within the wildlife LSA to be reduced by 22.1 per cent from year 14 to year 27. It expected moderate- to high-diversity areas to decrease by 27.0 per cent by year 14, followed by an increase as a result of progressive reclamation by year 27 (for a decrease of 18.0 per cent from baseline conditions).

[1682] In contrast, Benga stated that the project footprint will increase low-diversity habitats in the wildlife LSA by 495.3 per cent (819.2 ha) at year 14. But at year 27, low-diversity habitats in the wildlife LSA would be expected to be reduced by 74.0 per cent compared with the baseline. Benga indicated that this represents a conversion of 122.4 ha of low-diversity habitat to moderate-diversity habitat in the wildlife LSA over the life of the project.

[1683] In the grizzly bear RSA, Benga stated that habitats of moderate to high wildlife diversity are expected to decline by 0.2 per cent (451.2 ha) at year 14, while low-diversity habitats are expected to increase by 16.9 per cent (538.5 ha). Benga indicated that these spatial alterations are negligible at the grizzly bear RSA scale.

[1684] Benga stated that it expected the long-term effects on wildlife diversity to be effectively mitigated by the project's progressive reclamation strategy. It proposed early establishment of vegetation diversity and encouragement of structural complexity within forests. Benga's proposed use of progressive reclamation as a mitigation measure is discussed further in this chapter as well as in the chapter on conservation, reclamation, and closure, and the chapter on vegetation and wetlands.

[1685] Mr. Kansas, Benga's wildlife expert, indicated that other mines have used reclamation to return wildlife diversity to predisturbance levels or higher after 30 to 35 years. Mr. Kansas also stated that the main area of uncertainty for increases in wildlife diversity is related to the decisions made on the details of reclamation planning from a vegetation perspective, as vegetation structure may be a leading factor in increasing wildlife diversity post-closure.

[1686] The Coalition's expert, Mr. Wallis, stated that Benga's examples of increased wildlife diversity following mine reclamation are inflated and different than equivalent land capability. As an example, Mr. Wallis stated that the data presented by Benga in a wildlife assessment carried out for the Mercoal West and Yellowhead Tower Mine extension project represented an inflated number of bird species when compared with surrounding habitats due to the methodology used. Mr. Wallis indicated that many of these birds were nonbreeding migrants or accidentals and, as a result, bird diversity could have been inflated by almost 50 per cent.

[1687] Mr. Wallis stated that making the landscape significantly more homogenous is at odds with structural and plant species diversity, and would therefore affect wildlife diversity for well over 100 years,

particularly in more mature and old-growth habitats. Mr. Wallis stated that those habitats currently provide an inherent complexity and structure of ecological goods and services.

[1688] We find that the predicted reductions in the wildlife diversity rating will result in a moderate-magnitude effect that would be local in extent and persistent in duration. We find that changes in diversity in the grizzly bear RSA are low in magnitude. As vegetation structure and diversity is the leading factor in determining wildlife diversity, we acknowledge that for wildlife diversity to be retained, successful reclamation would be required, and this may take several decades.

[1689] We find that the types of species and the timing of their return will depend on the habitat created and the vegetation communities established. As discussed in the vegetation and wetlands chapter, the limited number of ecosite types in Benga's proposed reclamation plan and the reduced vegetation diversity expected in the future closure landscape mean some wildlife species may not return to the area for several decades—or not at all. This is particularly likely for species that require specialized habitats and where there is considerable uncertainty about whether Benga will be able to recreate these habitats in the closure landscape (e.g., Clark's nutcracker and whitebark pine). It is also the case for species that depend on habitats that take a long time to mature (e.g., old-growth forest). Similarly, the removal of wetlands and uncertainties about the timing and probable success of Benga's plans to restore them has implications for amphibians and other wetland-dependant species and the return of wildlife biodiversity to the closure landscape. We find that, although low-diversity habitat can be created during progressive reclamation, moderate- and high-diversity habitat may remain below baseline conditions far into the future.

Wildlife species that currently use the project site may not return following reclamation

[1690] Benga stated that the long-term project effects on habitat availability, wildlife movement, mortality risk, wildlife abundance, and wildlife diversity would be effectively mitigated through progressive reclamation and extensive mitigation. Benga indicated that reclamation of disturbed areas will occur progressively through the life of the project, with reclamation in some areas beginning as early as year 2 of operations. Benga emphasized that restoration of wildlife habitat to predisturbance conditions is a reclamation goal.

[1691] Several participants raised concerns about the effectiveness of Benga's proposed reclamation plan to mitigate the effects of the project on wildlife, and disagreed with the examples that Benga provided to illustrate what it considered to be evidence of successful reclamation at other mining sites. Mr. Gardner, representing the M.D. of Ranchland, said that total reclamation of the project site is impossible. The Coalition said that it is doubtful and highly uncertain that Benga will return the project area to pre-existing conditions. The Wildlife Society stated that reclamation is not a guarantee of ecological functionality or successful restoration of an ecosystem to predevelopment conditions. The Livingstone Landowners Group said that Benga's wildlife habitat design is based on a "build it and they will come" model rather than a landscape ecology approach. The Ktunaxa Nation's expert, Ms. Machmer, characterized the timing and success of the proposed reclamation plan as overly optimistic.

[1692] Benga's proposed conservation, reclamation, and closure plan is discussed in more detail in the chapter devoted to the subject, while the use of progressive reclamation to mitigate effects on vegetation is discussed in the chapter on vegetation and wetlands. Benga stated that the project footprint, once

revegetated, will evolve through stages of initial revegetation to self-sustaining ecosystems consisting of mature vegetation communities typical of the Subalpine and Montane Subregions of the Rocky Mountain Natural Region. Benga said that biodiversity and the wildlife species that occupy the project footprint will change over time as habitats progress through different seral stages, because species have varying preferences for habitats at different stages of succession. Benga emphasized that species preferring recently disturbed and young habitats are expected to return first, followed by species preferring increasingly older habitat types.

[1693] Benga indicated that mature forests take several decades to become established. Benga's wildlife expert, Mr. Kansas, noted that the first animals to be attracted to the reclaimed mine would be those that prefer grasslands and open habitats, such as the common nighthawk, short-eared owl, and bobolink (*Dolichonyx oryzivorus*). He said that these species would be attracted to the early successional habitat. He indicated that the removal of old-growth forests is "no different than fire," and that Benga would be "mimicking nature" by removing the timber and that wildlife would thrive as a result (CIAR 928, PDF pp. 203 and 204).

[1694] The Coalition acknowledged that while some wildlife species may return rapidly to the landscape following reclamation, there are some species of conservation concern that may not return in significant numbers for decades or longer. Mr. Kansas indicated that Benga would investigate how much agronomic grass would be used during reclamation. He argued that if Benga only used native seed mixes, big game would not be attracted because native seed mixes do not have the same amount of digestive protein that larger animals need.

[1695] The Coalition's expert, Mr. Wallis, warned that replacing complex and diverse montane habitats, particularly on public lands with habitats dominated by longer-lived agronomics, is not only inappropriate but does not translate to equivalent land capability. The Ktunaxa Nation stated the assessment failed to acknowledge the loss of wildlife habitat suitability and lower ecosystem structure, composition, and function of reclaimed sites relative to the native ecosystems lost.

[1696] ECCC stated that they agreed with Benga's intention to carry out progressive reclamation. ECCC added that progressive reclamation should occur as soon as possible to restore migratory bird habitat, and that Benga should use monitoring and adaptive management to improve the efficacy of reclamation. At the hearing, Benga discussed several examples of coal mine reclamation in Alberta, including the Luscar, Gregg River, Coal Valley, Obed, and the Grand Cache Coal Mines. Benga said that there is a considerable amount of wildlife, including elk, deer, grizzly bears, wolves, moose, cougars, and birds on reclaimed lands at the Luscar Mine.

[1697] Benga stated that it took between 30 and 35 years after mining and reclamation for the Gregg River Mine to host wildlife communities comparable in composition to what was present before the mine. Benga's expert, Mr. Kansas, stated that, after 35 years, more wildlife species are using the habitat at the Coal Valley Mine than in the Grassy Mountain area or parts of the Yellowhead area that are not yet mined. Benga acknowledged that, following reclamation, the Gregg River Mine became home to different species than those discovered there initially.

[1698] Mr. Wallis refuted the evidence of Mr. Kansas and stated that the reclamation efforts at the Coal Valley Mine have not restored the mature and old-growth forests or rare wildlife habitats, such as fen wetland complexes and stream/valley habitat diversity. Mr. Wallis stated the reclaimed wetlands at Coal Valley do not closely resemble natural regional wetlands. And he said these young, reclaimed wetlands had a relatively high proportion of non-native species. Mr. Wallis indicated that a lack of native plant species for an extended duration in the reclaimed landscape means the area does not support a wide range of wildlife species, and illustrates that mining is not actually mimicking natural fires.

[1699] The Coalition stated that even if Benga is more successful in reclaiming the landscape in the project area than Coal Valley Mine was, it took 40 years after reclamation before any noticeable wildlife was seen. It will still take more than 100 years after reclamation to regenerate much of the forest structure and old-growth characteristics, and the rarest and endangered wildlife will be lost.

[1700] ECCC's expert, Mr. Gregoire, stated that the ultimate goal of reclamation from a wildlife species perspective is to achieve mature, closed-canopy forests that replicate what was removed. Mr. Gregoire stated that a different approach is to accept that reclamation will not replicate 100 per cent of the existing forest and that wildlife will return, but as a different mix of wildlife or different guilds of species. He said that this is not necessarily a bad thing, as long as the species that do return are representative of different seral stages of forests and it is clear the forests are on the trajectory to becoming mature stands. He said that ideally, if a mine tried to restore a mature forest, 60 years would be the likely minimum time to expect natural conditions to reappear.

[1701] Benga stated that one of the reclamation goals is to restore wildlife habitat to predisturbance baseline conditions. As noted in the chapter on conservation, reclamation, and closure, we find that Benga's conservation and reclamation plan lacks detail and does not give us confidence that reclamation will effectively mitigate all effects on terrestrial resources. We accept that Benga's proposed conservation and reclamation plan will likely achieve equivalent land capability from a land use perspective at some point in time; however, we are not confident that the plan will result in a return of the closure landscape to predisturbance levels of vegetation species and community diversity in less than 100 years. This finding has implications for the types of wildlife habitat that will be created.

[1702] While Benga may be able to recreate early successional habitat types that will be used by some species, we are not confident that Benga's proposed conservation and reclamation plan will restore more specialized habitat types such as whitebark pine, treed wetlands, and fescue grasslands. Furthermore, old-growth forests will take more than 100 years to become established. Benga has provided examples of what it considers to be successful reclamation at other mines. But the species that returned to the reclaimed site were often different than those that previously used the site. As such, we are not confident that all species that used the project area will return following reclamation. Certain species, such as listed or specialist species, may not return for decades or longer, if at all. We agree that species that are dependent on grasslands may return soon after project activities cease; however, species that depend on old-growth forests, such as Clark's nutcracker and the little brown bat, may not return to predisturbance levels.

Benga's proposed mitigation and monitoring measures remain incomplete and contain uncertainties

[1703] Benga provided a draft wildlife mitigation and monitoring plan that outlined measures to address project effects on wildlife, assessed the effectiveness of the proposed measures, and discussed adaptive management. The proposed mitigation measures Benga provided were designed to reduce or minimize project effects on wildlife, and monitor these effects to allow for effective adaptive management over time. General wildlife mitigations may apply to all valued components with additional species-specific mitigation measures discussed in separate sections. The general wildlife mitigations proposed by Benga include but are not limited to the following:

- minimization of the overall disturbance footprint through the mine planning process to avoid critical breeding habitats, nesting and denning sites, and movement corridors to the extent possible
- implementation of progressive reclamation and the reclamation of the existing legacy mining disturbances so that existing habitat loss, habitat fragmentation, linear disturbance features, and cumulative habitat loss are corrected
- protection of important wildlife habitat features on the edge of the project footprint boundary with appropriate setback distances or other suitable measures
- avoidance of undisturbed areas within and adjacent to the project footprint
- incorporation of appropriately sized wildlife crossings into the design of the covered overland coal conveyor and access road, with the crossings strategically placed to maximize wildlife use

[1704] The draft wildlife mitigation and monitoring plan includes many more mitigation and monitoring measures that are both general and species-specific. The Timberwolf Wilderness Society, the M.D. of Ranchland, and members of the public stated that there is uncertainty regarding how the mitigation measures provided by Benga align with action plans provided under *SARA*. Many were also uncertain as to how the mitigation measures line up with the Livingstone-Porcupine Management Plan.

[1705] The Wildlife Society stated that, although Benga provided a draft plan for mitigation and monitoring, its proposed mitigation measures are generic in nature and do not address the unique attributes of the landscape. For example, the planned mitigation measure for migratory birds is inadequate as it only addresses the timing of clearing as a measure for direct mortality; no measure is provided for potential habitat loss.

[1706] The Wildlife Society also stated that the mitigation and monitoring measures lack the details required for an adequate review. For example, Benga committed to preserving remnant forest patches where feasible to provide habitat and connectivity. The Wildlife Society stated that no map or discussion was provided to demonstrate how these patches will facilitate movement.

[1707] Benga stated that its draft wildlife mitigation and monitoring plan is based on the best information currently available, adheres to relevant provincial and federal regulations, and provides for adaptive management. Benga stated that the project would be unlikely to cause adverse effects if proposed mitigation measures are implemented. Benga acknowledged that several factors may remain uncertain, but monitoring would be carried out to ensure mitigation and adaptive management are effective.

[1708] Benga's adaptive management framework involves establishing end land use objectives according to predevelopment land use capability, site-specific conditions, improved practices based on research and monitoring, and input from public engagement and Indigenous consultations. Benga stated that, if environmental effects are greater than predicted, the plan will be evaluated, and mitigation measures revised.

[1709] CPAWS stated that expert evidence shows that adaptive management cannot alleviate all environmental risk and that many adaptive management projects that Benga proposes are not scientifically or financially feasible. CPAWS' expert, Mr. Olszynski, stated that adaptive management is largely misunderstood and misused in the impact assessment context. Mr. Olszynski concluded that Benga's adaptive management approach does not address uncertainties, does not set clear objectives or suitable indicators, and does not provide for alternative management actions. CPAWS stated that the information provided by Benga regarding adaptive management is insufficient.

[1710] ECCC raised several areas of concern and uncertainty with respect to Benga's mitigation measures. ECCC stated that, although many of these measures were resolved in whole or in part, several remaining elements would pose a risk if not appropriately addressed. ECCC provided a review of Benga's mitigation measures as they relate to migratory birds, species at risk, and amphibians, which are discussed in detail in this chapter.

[1711] Benga stated that reclamation monitoring would be added to the plan as progressive reclamation begins. Monitoring would include active mine areas, reclaimed landscapes within the project footprint, and adjacent undisturbed areas for comparison. Benga indicated that the main mitigation that will be used for habitat loss and wildlife movement is progressive reclamation of the project footprint. Monitoring the effectiveness of progressive reclamation would include tracking reclamation and ecosite development and wildlife use of reclaimed areas.

[1712] The Wildlife Society stated that the locations of the crossing structures designed to mitigate the impact of the coal conveyor are not supported by adequate modelling. The society stated that examples of other crossing structures, such as the ones used in Banff National Park, took approximately five years for grizzly bears to begin using. The length of time it may take other wildlife species to use the crossing structures is unknown and uncertain.

[1713] Benga stated that six wildlife crossings (underpasses and overpasses) are to be incorporated into the 5.4 km length of the coal conveyor. Final locations of the crossings would be informed by predisturbance surveys and landscape features. Benga's diagram of potential locations for the crossings are based on preliminary wildlife surveys and data adapted from other sites. Benga concluded that proper installation of the wildlife crossing structures may effectively mitigate project impacts on ungulate movement.

[1714] During the review process, the Ktunaxa Nation drew attention to uncertainties related to Benga's proposed mitigation efforts and the draft wildlife mitigation and monitoring plan. For example, the Ktunaxa stated that another study found that common nighthawks were not responsive to proposed mitigation measures, increasing their susceptibility to human-wildlife mortalities. Benga stated that it has

worked with Indigenous communities to develop mitigation measures and provided a commitment to continue these collaborations.

[1715] We recognize that a final wildlife mitigation and monitoring plan is not generally required at this stage of the regulatory process. It is common for project proponents to submit draft plans as part of their EIAs or regulatory applications, and then submit a final and more detailed plan, often as a condition of approval, if the project is approved. However, given some of the sensitivities of the proposed project location, and the stakeholder concerns regarding the lack of information, we find that additional detail in Benga's draft wildlife mitigation and monitoring plan would have been helpful in a number of areas.

[1716] While certain general and targeted mitigation and monitoring measures proposed by Benga are appropriate, the draft plan does not provide enough detail on the selection of monitoring methods and indicators, thresholds for adaptive management actions, or overall plan objectives. Furthermore, we find that Benga has not demonstrated that monitoring would effectively assess EIA predictions and confirm mitigation success. As such, we find that the information provided is not sufficient to address areas of uncertainty or give us confidence that adaptive management measures will be effective and can be implemented in a timely manner.

[1717] We recognize that crossing structures that facilitate wildlife movements have been effective in other settings. However, Benga did not provide sufficient detail or supporting evidence to demonstrate that such structures would facilitate movement of certain species within the project area. We find that the effectiveness of crossing structures remains uncertain, and we are not confident that they will mitigate project impacts. There is also a lack of understanding of the length of time it may take for wildlife species to learn to use crossing structures.

[1718] Additionally, while we accept that the use of progressive reclamation may be an effective tool to minimize the impact of project effects on wildlife, we are not confident that progressive reclamation will effectively mitigate all project effects, including effects on wildlife.

The project will result in habitat loss and increased risk of contaminant exposure for bird species

[1719] In the wildlife assessment, Benga reported on the effects of the project on bird species, including migratory species, provincially and federally listed species, and species of interest to participants such as birds of prey.

[1720] Benga selected two bird species as valued components and five as special status species: the olive-sided flycatcher, the great grey owl, the barn swallow, the common nighthawk, the short-eared owl, and the bald and golden eagles. It also assessed Baird's sparrow at our request because the species was added to Schedule 1 of *SARA* in 2017. The olive-sided flycatcher, the barn swallow, Baird's sparrow, and the common nighthawk are listed under *SARA* and protected under the Migratory Birds Convention Act. Benga divided the migratory species into groups according to habitat requirements. It assessed the effects of the project on each group of migratory birds in comparison with the wildlife valued components and special status species that have overlapping habitat requirements. For example, Benga stated that project effects on habitat availability for the Columbia spotted frog and western toad were expected to be similar for waterfowl, shorebirds, and other migratory bird species that rely on ponds, streams, and wetlands. Several participants raised concerns during the review regarding the loss of important habitats that bird

species use for foraging, breeding, and wintering. Participants also indicated that the project would increase the risk of exposing birds to contaminants, both during and after the project.

Loss of bird habitat

[1721] Benga stated that bird species, including migratory birds, present in the wildlife LSA occupy the full breadth of available habitat types to fulfill their need for security, shelter, breeding, nesting, foraging, and overwintering. Benga reported that the primary effect of the project on all bird species in the wildlife LSA, including migratory birds, is the direct and indirect loss of habitat. Vegetation clearing during project construction and development would directly decrease habitat availability for bird species. Benga stated that the largest extent of habitat loss would occur by year 14, and that the largest losses would occur in forests classified as moderate mixed-coniferous and closed mixed-wood forests.

[1722] Under baseline conditions, Benga noted that coniferous and mixed-wood forests cover a large portion (about 70 per cent) of the wildlife LSA, and host the greatest species richness and diversity of all habitats occurring in the wildlife LSA. By year 27, Benga predicted that coniferous forests will be reduced by 661 ha (23 per cent); mixed-wood forests by 345 ha (27 per cent), and deciduous forests by 3.2 ha (percentage not provided). Consequently, Benga explained that forest-dwelling migratory bird species, particularly those that nest in coniferous and mixed-wood forests, will likely be the most affected by project development.

[1723] Benga stated that bird species preferring old-growth forests, such as the great grey owl, will be the most vulnerable to habitat loss as it can take 100 years or more for a young forest to acquire old-growth characteristics. Benga anticipated that the effects of habitat loss due to the project on these species will be minimal but long-lasting. Benga noted that loss of habitat may be offset if mature forests within the undisturbed parts of the wildlife LSA reach the old-growth stage by year 27. Benga indicated that the wildlife LSA contains 169 ha of old-growth forest, of which the project would affect 8.3 ha. We note that there is a discrepancy in the loss of old growth forest reported by Benga. Benga reported that there would be a loss of 8.3 ha of old-growth forest in the wildlife LSA but stated that there would be a loss of 27.4 ha of old-growth forest in the vegetation LSA. Based on the information provided to us, we believe that the reported loss of 8.3 ha of old growth forest in the wildlife LSA to be an error.

[1724] Benga predicted that the loss of mature coniferous and mixed-wood forests will result in the direct loss of 833 ha (27.8 per cent) of effective habitat for the olive-sided flycatcher in year 14, and 729 ha (24.3 per cent) in year 27. However, Benga predicted that with mitigation, project effects on olive-sided flycatcher habitat availability in the wildlife LSA would be local in extent, extended in duration, continuous in frequency, reversible in the long term, moderate in magnitude, and not significant. It stated that reclaimed habitats will eventually mature to the point where they will provide effective breeding habitat for olive-sided flycatchers, although this may take several decades. ECCC indicated that olive-sided flycatchers are notable in the area, and could be “slightly more impacted” by the project compared with other migratory birds. But they are not habitat-limited and are widely distributed.

[1725] In the baseline assessment, Benga indicated that there was only 18 ha of shrubby wetland, 5 ha of treed wetlands, and 64 ha of waterbody habitats in the wildlife LSA. Benga’s wildlife expert, Mr. Kansas, said that in the Grassy Mountain area, waterfowl were rare because there was very little open-water

habitat and open-water wetlands. Benga predicted that, because the loss of wet, shrubby habitat would be minimal, the effects on shorebirds, waterfowl, and other wetland-dependant birds will also be minimal.

[1726] ECCC's expert, Mr. Gregoire, agreed with Benga's assessment and stated that the high mountain habitats of Grassy Mountain are not on a migration trajectory for waterfowl. Mr. Gregoire indicated that waterfowl tend to avoid mountains or go around them, and that the water bodies in the project area would not be attractive to migrant waterfowl or waterbirds.

[1727] Benga indicated that few grassland species were found in the wildlife LSA due to the relative scarcity of grassland habitat (290 ha) and upland shrub habitat (less than 1 ha). Finally, Benga indicated that species preferring open, rocky habitats, including alpine terrain, have 49 ha of suitable habitat in the wildlife LSA.

[1728] Benga stated that habitat loss is the primary project development effect on short-eared owls in the wildlife LSA. Short-eared owl habitat preferences include large, open habitat such as tundra, prairie grasslands, and shrub-steppe lands. However, Benga noted that short-eared owls were likely uncommon in the wildlife LSA, as little open grassland habitat is present, and where present, cattle-grazing would reduce habitat suitability. According to Benga, short-eared owls were more likely to occur in the eastern portion of the wildlife RSA, where more suitable open-grassland habitats occur. Benga stated that the geographic extent of project effects on short-eared owl habitat in the wildlife LSA is predicted to be local, long in duration, and continuous in frequency. Benga indicated that the magnitude of these effects will be low, and the overall impact rating is not significant because short-eared owls appear to be rare in the vicinity of the wildlife LSA. Benga stated that it expected the effects to be reversible in the short term, as reclamation of disturbed mine areas progresses across the landscape.

[1729] Benga predicted that changes in habitat availability for Baird's sparrow due to project development would result in the loss of 150.7 ha (51.9 per cent) of grassland habitat by year 14, and a net increase in of 58.8 ha (20.2 per cent) by year 27. Benga stated that, as reclamation progresses, these grass-dominated reclaimed sites may provide suitable habitat for Baird's sparrows for many years. Benga stated that any Baird's sparrows in the immediate vicinity of the project footprint would be displaced to other, more suitable habitats to the east and southeast until progressive reclamation is initiated after year 14 of the project.

[1730] Benga reported that some bird species with the potential to occur in the wildlife LSA, including the barn swallow, frequently build nests on anthropogenic structures such as buildings or bridges. According to Benga, nesting habitat of barn swallows will decrease if old, abandoned mine structures are removed. In addition, Benga noted that potential foraging habitat for barn swallows will also decrease with the removal of small wetlands.

[1731] Benga stated that the clearing of various habitats available in the wildlife LSA will remove potential foraging and nesting habitat for common nighthawks. Benga noted that the preferred foraging and nesting habitats of common nighthawks include open forested stands (e.g., open pine, open deciduous, open mixed-wood, and open mixed-coniferous types), wetlands (shrubby and treed wetlands), open natural areas (grassland, rock/barren types), and various anthropogenic disturbances (cut blocks, pipelines, well sites, perennial crops, and other clearings).

[1732] ECCC stated that effects on the barn swallow are not a concern, as the species is uncommon in the area and prefers anthropogenic structures. Additionally, ECCC stated that, because the common nighthawk is a widely distributed and opportunistic nester, it would take advantage of open, grassy areas.

[1733] Benga stated that sensory disturbance from the project is the leading cause of indirect habitat loss. Benga stated that ongoing or periodic sensory disturbances may result in wildlife avoiding otherwise suitable habitat. Such disturbances could also cause reduced reproductive success or foraging ability and increased mortality. Benga reported that increased anthropogenic noise can also affect the hunting success of great grey owls, which frequently hunt by sound and rely on acoustic communication to defend territories. Benga reported that common nighthawk abundance in the wildlife LSA could decrease because of noise associated with construction and operation activities.

[1734] Benga concluded that it expects the effects from direct and indirect habitat loss on bird species, especially migratory and *SARA*-listed birds, to be temporary, as disturbed habitats would be progressively reclaimed during operations and following closure. Benga predicted that the longest-lasting effects will be experienced by birds that require old-growth forests to breed and forage.

[1735] ECCC agreed with Benga that the project would affect migratory birds and their habitat, and would mostly affect those migratory birds that nest in coniferous and mixed-wood forests. ECCC stated that habitat destruction resulting from the project would displace migratory birds and *SARA*-listed species into adjacent habitats for a number of years. This effect could also increase bird densities in nearby undisturbed habitats. ECCC indicated that, over the short term, higher nesting densities in adjacent habitats could result in reduced reproductive success because of increased competition for resources, resulting in a decline in the number of new individuals added to the local population. ECCC also noted that, over the longer term, loss of forest cover could lead to local population declines, particularly for specialist species that occupy a specific habitat. However, in the case of the widely distributed olive-sided flycatcher, ECCC did not identify a concern. According to ECCC, habitat displacement would result from the project and therefore, as effects are unavoidable, mitigation measures would be required to address the impacts of the project on migratory birds.

[1736] The Wildlife Society stated that the EIA does not directly address impacts on migratory birds outside of breeding. They were concerned that there is no consideration of how habitat loss will affect nesting success in years subsequent to clearing. They also concluded that Benga's wildlife mitigation and monitoring plan is inadequate because it does not address the habitat that is lost once trees are cleared, regardless of when clearing occurs.

[1737] Benga committed to a series of key mitigation measures specific to wildlife, with the main measures being wildlife sweeps and surveys as well as progressive site reclamation. Benga indicated that predisturbance surveys would be conducted along the edges of all areas to be cleared during project development to determine the occurrence of any important wildlife habitat features. Benga stated that it would do a sweep of the entire area to be cleared on a year-by-year basis, and would take a progressive approach that looked ahead to the next batch of clearing, and would sweep the entire area it planned to clear. Benga stated that it would conduct wildlife surveys ahead of clearing operations to identify habitats of value for preserving. Benga committed to vegetation clearing outside the April 15 to August 15 period to avoid disrupting nesting migratory and resident songbirds and raptors.

[1738] ECCC concluded that the project would result in the loss of migratory bird habitat for many years with varying effects on specific species based on habitat preferences. ECCC said that, while cleared areas could create suitable habitat for some species such as the common nighthawk, other species would not return to the project area until mature forests became re-established. ECCC's expert, Mr. Gregoire, indicated that effective mitigation means restoring ecosystems lost over time, restoring plant communities, and then restoring bird communities. ECCC recommended that Benga work outside of the nesting season and undertake progressive reclamation as soon as possible to minimize effects of the project on migratory birds.

[1739] ECCC stated that it had no conservation concerns and that Benga's proposed mitigation measures are sufficient to address the loss of habitat for migratory birds and *SARA*-listed species. ECCC indicated support for progressive reclamation to mitigate effects on migratory birds. However, in the conservation, reclamation, and closure chapter we discuss uncertainties associated with the likely success and timeliness of Benga's proposed reclamation.

[1740] While we find that progressive reclamation will result in the creation of effective habitat for some species in the short term, other habitat types will take several decades to restore to equivalent habitat capability, if they can be reclaimed at all. For example, it would take many decades for mature forests, and more than 100 years for old-growth forests, to become re-established following reclamation. As a result, uncertainty exists about whether displaced species would return to the project site. We do not believe that the remaining intact patches of forest will be able to reach the status of old-growth forest within a reasonable amount of time to support displaced bird species. Additionally, should logging occur in the wildlife RSA, the availability of mature and old-growth forests for the bird species that will be displaced from the wildlife LSA may be affected.

[1741] We find there will be long-term effects beyond reclamation on forest-dwelling bird species, particularly those requiring mature and old-growth forests and especially if other suitable habitat becomes unavailable outside the project area. We discuss the specific effects on Clark's nutcracker, a forest-dwelling bird, below.

[1742] We find that the magnitude of the effects of habitat loss on Baird's sparrows, common nighthawks, and short-eared owls would be low due to the availability of suitable open-grassland habitats in the wildlife RSA. The magnitude of effects on olive-sided flycatchers would be moderate due to their reliance on open coniferous and mixed-wood forests and the loss of 27.8 per cent of effective habitat in the wildlife LSA in year 14. The magnitude of the effect on barn swallows would be low due to their use of anthropogenic structures, and the limited number of these structures present on the project site. The duration of effects on barn swallow would be long due to their avoidance of the project site during construction and operational activities.

[1743] For birds that can thrive in recently disturbed habitat, including grasslands, the effects would be long in duration, continuing past operations but diminishing with time. Such birds include the common nighthawk, short-eared owl, and Baird's sparrow. For the olive-sided flycatcher, the effects would also be long in duration due to their reliance on open coniferous and mixed-wood forests. The effects would be reversible after operations cease, but diminish after a number of years, once reclamation establishes

disturbed habitat. The frequency of the effect on all bird species would be continuous due to removal of habitat, the presence of project infrastructure, and persistent levels of contaminants.

[1744] We find that the residual effects of the project are not significant for Baird’s swallows, barn swallows, common nighthawks, olive-sided flycatchers, and short-eared owls. For Baird’s sparrows, barn swallows, common nighthawks, short-eared owls, Benga and participants supplied some evidence about past and existing stressors, and Benga assessed the effects of the project. However, because Benga did not present a planned development case for these species, we do not have information on the effects of other reasonably foreseeable projects and activities in the wildlife RSA. While we find that the project is likely to result in an adverse residual effect on these migratory bird species, based on the information provided it is not possible to accurately assess or characterize the significance of the cumulative effects.

[1745] Although the olive-sided flycatcher is more prevalent in the project area compared with other migratory birds, ECCC indicated that they have not identified a conservation concern for this species due to the project. ECCC acknowledged that forestry in the RSA may displace this species farther from the project site, but they also emphasized that the olive-sided flycatcher is widely distributed. We agree with Benga’s conclusions that forestry will be the primary contributor to cumulative effects. Based on the information available to us, we conclude that the residual effects of the project, in combination with other projects and activities that have been and will be carried out, would not cause a significant adverse cumulative effect on olive-sided flycatchers.

Contaminant exposure

[1746] CPAWS raised concerns regarding the potential for exposure to contaminants during the operational phase if birds come into contact with water from the surge ponds and raw water pond. CPAWS questioned how Benga would keep birds away from water bodies contaminated with metals and selenium. Furthermore, CPAWS raised concerns regarding the safety of reclaimed wetlands and the end-pit lake for bird species and the effectiveness of Benga’s proposed mitigation measures. They argued that Benga failed to plan for the long-term toxicity associated with the constructed wetlands. CPAWS stated that the constructed wetlands will continue to be toxic and that Benga will need a long-term monitoring and management strategy that ensures no wildlife interacts with those wetlands. It stated that insects, amphibians, and birds that interact with the waters of those wetlands will carry bioaccumulating metal contamination out of those wetlands, where they can then be consumed in other habitats, including Gold Creek.

[1747] Benga indicated that it could use sound cannons, flagging tape on rope across wetlands, effigies, and scarecrows to keep birds out of the surge ponds. Benga described these measures as “standard methodologies to prevent birds from getting themselves into trouble on industrial sites” (CIAR 928, PDF p. 76).

[1748] CPAWS stated that Benga’s proposed use of sound cannons is incompatible with its plans to control noise from the project or encourage a return of wildlife to the project site. They also noted that Benga did not assess whether sound cannons would deter waterbirds. Benga pointed out that the project is not on a major migratory bird flight path and that, due to the lack of open-water bodies, landings would be less frequent, and that incidental landings would not be immediately harmful.

[1749] ECCC agreed with Benga's assessment, and stated that the high mountain habitats are not a migration trajectory for waterfowl as the birds tend to avoid or go around mountains. ECCC indicated that the water bodies in the project area would not be attractive to migrating waterfowl or other waterbirds. It stated that use of the surge ponds by wildlife, specifically migratory birds, is dependent on the adjacent habitat, and indicated that good tree cover and shoreline vegetation would greatly increase use by waterbirds.

[1750] ECCC stated that it agreed with the deterrents proposed by Benga to minimize the contact of waterfowl with the surge ponds, but added that monitoring should be conducted to determine the species and numbers that interact with the ponds, and the deterrents adjusted to improve their effectiveness.

Residual effects on migratory birds as a result of exposure to contaminants

[1751] We find that the surge ponds and raw water pond may pose a risk to wildlife, in particular migratory birds, that may frequent or interact with contaminated waters. Migratory birds may be attracted to suitable habitat in and around ponds. In the surface water quality chapter, we note that elevated levels of contaminants of concern would persist in the end-pit lake. Although discussions at the hearing focused on mitigating the effects of contact with surge ponds, similar mitigation measures would likely be required for the raw water pond and end-pit lake. We are not confident that the limited mitigation measures proposed by Benga, in both the short and long term, would be sufficient to discourage birds from landing on the surge ponds, raw water pond, or end-pit lake. All of these water bodies would contain elevated levels of contaminants of potential concern for extended periods of time.

[1752] We expect that more bird species will be attracted to these habitats once the reclamation is complete and a higher tree cover surrounds the constructed wetlands. We find that uncertainties remain about the length of time that the surge pond, raw water pond, and end-pit lake would have elevated levels of contaminants of concern that would pose a risk to birds. We are also uncertain whether Benga can successfully prevent contact with these structures until it is determined that they would not pose a risk to birds.

[1753] We discuss our findings on potential project effects to wildlife health as a result of increased exposure to contaminants in the chapter on wildlife health. We find that selenium was the only contaminant of potential concern from the project predicted to pose a potential risk to wildlife health.

[1754] Birds including the American dipper (*Cinclus mexicanus*), great blue heron (*Ardea herodias*), and mallard duck (*Anas platyrhynchos*) were selected as aquatic wildlife receptors in the wildlife risk assessment. Predicted exposure ratios for the American dipper are 1.8 in the end-pit lake, and less than 1.0 in Blairmore and Gold Creeks. An exposure ratio of 1.8 is only marginally indicative of a potential risk, and the American dipper would not be expected to use the end-pit lake habitat if nearby flowing water is available in Blairmore and Gold Creeks. Population-level effects from selenium exposure in the American dipper are therefore unlikely.

[1755] While we found that it is unlikely that selenium exposure would have adverse effects on local resident populations of semi-aquatic birds or listed bird species, the potential for adverse effects on individual listed or migratory birds could not be ruled out. Benga predicted exposure ratios greater than 1.0 for the migratory great blue heron and mallard duck. These risks occur in the end-pit lake, Blairmore

Creek, and Gold Creek. Given the lack of conservatism in the water quality modelling used in the assessment, it is possible that exposures could be higher than predicted.

[1756] However, the exceedance predicted for great blue herons was marginal and not necessarily indicative of risk. While the exposure ratio of 4.1 for mallards is a potential concern, the project area does not lie along a significant flyway for migratory waterfowl. Additionally, migratory birds are present in the project only for a portion of the year, and as such the wildlife health risk assessment overpredicts their exposure to contaminants of potential concern. We conclude that, while adverse effects on individual listed or migratory birds cannot be ruled out, they would be low in magnitude, local in extent, and not likely to occur.

The project will result in habitat loss and increased risk of contaminant exposure for amphibians

Baseline assessment and habitat loss

[1757] Benga's baseline assessment for wildlife consisted of wildlife habitat delineation, a review of existing information, and field surveys for target species. Benga indicated that the primary objective of the field surveys was to describe and map existing wildlife resources in the wildlife local study area, and to evaluate their potential use as habitats.

[1758] Benga stated that it surveyed all known open-water features, including ponds, wetlands, lakes, and slow-moving sections of creeks and tributaries in the wildlife LSA for amphibians using auditory and non-acoustic techniques between May and June of 2014 and 2016. Benga stated that acoustic and visual surveys were conducting during the typical calling and breeding periods of Columbia spotted frogs and western toads.

[1759] Benga confirmed that the Columbia spotted frog and the western toad both occur in the wildlife LSA. During the 2014 survey, Benga identified seven amphibians: one was heard calling and six were observed. During the 2016 survey, Benga identified Columbia spotted frogs at six of the 20 survey stations. At one station, it observed 25 adult Columbia spotted frogs. In 2015, Benga observed juvenile western toads, indicating that breeding occurs in the wildlife LSA. Benga also observed western toads at six stations in the wildlife LSA during both surveys, and incidental sightings were reported at additional locations.

[1760] Benga determined that in the baseline case, the wildlife LSA contains 172 ha (3.1 per cent of the LSA) of effective breeding habitat for Columbia spotted frogs, comprising ponds and wetlands. Benga stated that effective Columbia spotted frog habitat in the wildlife LSA will decrease by approximately 46 ha (27 per cent) by year 14 of project development. Benga noted that by year 27, the effective habitat of the wildlife LSA will be 18 ha (10.5 per cent) smaller than baseline conditions as a result of reclamation of breeding habitat and stream and riparian habitat.

[1761] At baseline conditions, Benga determined that effective breeding habitat for the western toad, in the form of ponds and wetlands, is limited in the wildlife LSA, totalling 269.7 ha or just 4.8 per cent of the area. Benga stated that western toads move in the summer to foraging habitats such as wet terrestrial habitats in deciduous forests. Benga stated that the western toad will move in the winter to suitable hibernating sites such as tree cavities, peat hummocks, and decayed root tunnels. Benga predicted that effective breeding habitat for western toads would be reduced by 53 ha (19.8 per cent) by year 14 of

project development. Available effective available habitat would decrease by 23 ha (8.3 per cent) compared with baseline conditions by year 27, after progressive reclamation.

[1762] At the hearing, CPAWS questioned whether Benga had carried out an amphibian survey in a shrubby open fen, which is the largest wetland in the wildlife LSA. This wetland is 9.6 ha in size and located in the area proposed for the central rock disposal area directly to the west of the proposed southeast surge pond. Benga's wildlife expert, Mr. Kansas, confirmed that Benga did not sample this wetland during the amphibian surveys, and none of the amphibian detection zones included this wetland. When asked why, Mr. Kansas responded: "I can't explain why it wasn't done. Might have been a dry year" (CIAR 928, PDF p. 64). Based on this statement, CPAWS argued that the panel should have no confidence in Benga's baseline wildlife surveys.

[1763] The Louis Bull Tribe submitted that the amphibian sampling stations were unusually close together, and the sampling duration was insufficient to capture the range of natural conditions. Benga stated that both the western toad and Columbia spotted frog are sensitive to changes in water quality, vulnerable to human disturbance, and, in the case of Columbia spotted frog, reliant on breeding ponds that are of limited availability and distribution. Benga stated that the best breeding habitat for the western toad and Columbia spotted frog in the LSA was historical end-pit lakes, but acknowledged that there was also breeding habitat in the shrubby open fen. Mr. Kansas indicated that amphibians, and specifically Columbia spotted frogs and western toads, readily colonize constructed wetlands, and he stated that sometimes manmade features provide as good or better habitat as natural ecological features such as shrubby open fens.

[1764] Benga indicated that amphibians such as Columbia spotted frogs and Western toads may be affected by sensory disturbances associated with project development. Benga stated that the sources of sensory disturbances include increases in noise, vibration, and artificial night-lighting in lands surrounding the project area. Benga explained that other toad species alter their distribution and foraging behaviour in response to anthropogenic light and noise, and that the effective quality of breeding and summer foraging habitats may be reduced.

[1765] Benga noted that the project would remove four potential breeding ponds in the centre of the wildlife LSA. It noted that breeding ponds suitable for amphibians are limited in the wildlife LSA, and the loss of these ponds may affect local amphibian populations during the project. Benga predicted that construction of wetlands during reclamation would offset losses of effective habitat for western toads and Columbia spotted frogs. It stated that it expected the loss of habitat for both species would be temporary, as efforts to reclaim amphibian habitat at abandoned coal mines have frequently been successful.

[1766] Benga predicted that the effects of the project on both the western toad and Columbia spotted frog would be low in magnitude, local in extent, long to extended in duration, continuous in frequency, reversible in the short to long term, and not significant.

[1767] We recognize that Benga's baseline data collection involved sampling selected areas and extrapolation of the results to the entire LSA. However, Benga should have identified and surveyed all areas of potential importance, particularly for species at risk, to create a sound foundation upon which to build its assessment.

[1768] Based on the evidence, it is apparent that Benga did not survey all areas of importance for amphibians, including the western toad and Columbia spotted frog. Benga did not adequately explain why it had not surveyed this important area. In the absence of a survey of the largest wetland within the LSA, Benga may have underestimated the potential for effects on amphibians. Without the inclusion of the large wetland in the amphibian study, we cannot be confident in Benga's prediction of low-magnitude effects on amphibians, particularly as the western toad is a COSEWIC-listed species, and the Columbia spotted frog is a sensitive species in Alberta.

Contaminant exposure

[1769] CPAWS stated that the constructed wetlands would be toxic to amphibians. They argued that the constructed wetlands would have dangerous metal contamination for several decades past the end of project life, and possibly longer. CPAWS stated that Benga failed to plan for the long-term toxicity of the constructed wetlands. CPAWS also argued that the constructed wetlands Benga counted as replacement habitat for amphibians would continue to be toxic and Benga would need to have a long-term monitoring and capture program in place to ensure amphibians do not interact with those wetlands.

[1770] Benga committed to conducting predisturbance surveys (acoustic surveys and visual searches) to identify wetlands and watercourses used by breeding Columbia spotted frogs and western toads. It would input the results into the mitigation plans. At the hearing, Benga proposed to use amphibian pitfall traps to prevent the exposure of amphibians to water in the surge ponds. Benga also stated that it could hire an individual or team to maintain and monitor amphibian pitfall traps. Such details would be defined in the final wildlife mitigation and monitoring plan, although Benga did not include these mitigation measures in their draft plans.

[1771] ECCC stated that wildlife fencing would slow or halt the movement of amphibians across the landscape. ECCC's expert, Mr. L. Mundy, stated that Benga would need to consistently check the amphibian pitfall traps and perform frequent checks during the breeding season to ensure that no amphibians are left in the traps for prolonged periods of time.

[1772] CPAWS stated that Benga could use amphibian fencing and pitfall traps to prevent amphibians from contacting the contaminated wetlands. It stated that these would need to be active and monitored for at least several decades. CPAWS indicated that we should conclude that the project will have significant adverse impacts on the western toad, the Columbia spotted frog, and wetlands, and that Benga failed to quantify or mitigate those impacts.

[1773] We discuss project effects on amphibians related to contaminant exposure in the chapter on wildlife health. While Benga acknowledged that increased concentrations of selenium, nitrates, and nitrites downstream from the mine "have the potential" to cause mortality or deformities in western toad larvae, it did not include amphibians in the wildlife health risk assessment or provide any evidence regarding the potential for exposure to selenium and other contaminants of potential concern to exceed thresholds for effects.

[1774] Based on the evidence provided by Benga, we find that adverse effects on amphibians such as the Columbia spotted frog and western toad from exposure to contaminants of potential concern cannot be ruled out. The consequences of adverse effects on individual amphibians inhabiting the LSA, such as

deformities and increased susceptibility to predation, may affect the local population, particularly if mortality increases and reproductive success decreases. In other words, the exposure of individuals in Blairmore and Gold Creeks, the end-pit lake, and downstream environment could result in a reduction in the local population numbers.

[1775] We find that during operations, the loss of habitat, sensory disturbances and exposure to contaminants would adversely affect amphibians. Depending on the effectiveness of wetland restoration, and Benga's ability to prevent amphibians from contacting contaminated water, amphibians would possibly continue to be adversely affected after operations ceased.

[1776] We find that uncertainties are associated with the potential effectiveness of Benga's proposed mitigation and monitoring plans to prevent amphibians from accessing the surge ponds and raw water ponds. We accept that fencing is likely to be the main mitigation measure to prevent amphibians from coming into contact with contaminated pond water. However, Benga has not provided sufficient information to demonstrate that it would be able to put in place an efficient, rigorous, and long-term plan to monitor pitfall traps that would prevent individual amphibians from being trapped for extended periods. The monitoring of the pitfall traps would need to continue beyond the completion of mine reclamation, as the constructed wetlands may remain toxic to amphibians for some period of time after their construction. This endeavor would require commitments from Benga for several years beyond year 27.

[1777] Benga did not provide specific mitigation measures to prevent amphibians from coming into contact with contaminated ponds within their EIA or subsequent draft wildlife monitoring and mitigation plan. The use of pitfall traps and exclusion fencing was not previously identified in the draft plan, or in Benga's compilation of mitigation measures. It appears that these measures were first mentioned at the hearing in response to questions about persistent levels of elevated contaminants of concern in surge ponds, the raw water pond, and the end-pit lake. We do not have confidence that Benga has made an adequate level of effort to identify appropriate technically and economically feasible mitigation measures that would prevent amphibians from accessing water management structures. We find that Benga's level of commitment to conducting predisturbance surveys did not allow us to determine the magnitude of the effects of the project.

[1778] Benga did not demonstrate that the constructed wetlands will be safe and suitable habitat for amphibians. We are concerned that the loss of effective amphibian habitat may not be mitigated by the constructed wetlands, as Benga is unable to confirm when the wetlands will no longer contain levels of contaminants of potential concern that pose a risk to amphibians. While we accept that the reconstructed wetlands could provide suitable habitat at some point in time, it is not clear that this habitat would—as Benga suggested—be available shortly after cessation of project operations. Until such time as the wetlands are demonstrated to be safe for amphibians, project effects on amphibians would be expected to continue rather than be mitigated.

[1779] We find that the loss of habitat and exposure to selenium due to uncertainty associated with the effectiveness of deterrents such as pitfall traps would result in an effect of moderate magnitude on western toads. The geographic extent is local, as the effect is restricted to the project footprint. Given the expected elevated levels of selenium in surge ponds beyond cessation of operations, we find that the duration of the effect is persistent. We do not have confidence that selenium levels would return to levels

that would not pose a risk to amphibians, making the effects of the project irreversible. Overall, the project would not have a significant effect on regional or provincial western toad populations.

[1780] According to the management plan, western toads are widespread and abundant across a large portion of their Canadian range. The plan expects the most significant effects on the western toad to come from transportation and service corridors. Although elevated contaminant levels in surge ponds and raw water ponds on the project site may persist for extended periods, these effects are localized in nature and contamination is not considered a major threat to the western toad. Benga predicted that habitat loss due to planned developments in the RSA will be low.

[1781] Based on the available information, we conclude that the residual effects of the project, in combination with other projects and activities that have been and will be carried out, would not cause a significant adverse cumulative effect on western toad.

The project will result in habitat loss for little brown bats

[1782] The little brown bat is listed federally as endangered under *SARA*, and in Alberta as secure. The recovery strategy for the little brown bat indicates that it is common throughout its range, but white-nose syndrome, a fungal disease, has decimated populations in eastern North America and the strategy expects the entire population to be affected within 12 to 18 years. ECCC stated that hibernacula are used by little brown bats to survive when ambient temperatures decline and insect prey are unavailable. Hibernacula typically include caves, abandoned mines, hand-dug wells, cellars, and tunnels where light and noise levels are low. ECCC highlighted that the federal recovery strategy for the little brown bat identified all hibernacula (found and not found) as critical habitat, as they are necessary for the survival and recovery of the species.

[1783] The federal recovery strategy for the little brown bat states that, while sufficient summering habitat (i.e., roosting and foraging habitat) is likely available, maternity roosts for giving birth and rearing young contribute to the survival and recovery of the species. The strategy highlighted that the locations of the vast majority of maternity roosts in Canada were either unknown or undocumented. The strategy states that “it is not possible to determine which maternity roosts are necessary for the survival or recovery of these species; therefore, maternity roosts are not identified as critical habitat in this recovery strategy” (Environment and Climate Change Canada 2018).

[1784] The Coalition and other participants were concerned that Benga did not properly identify the locations of maternity roosts and hibernacula. Participants were concerned that the project would result in the loss of little brown bat habitat for an extended period, and could also result in the destruction of hibernacula. Participants also questioned the effectiveness of progressive reclamation and the installation of bat boxes as mitigation measures for little brown bats.

[1785] Benga stated that the main potential effects of the project on little brown bats are the potential loss of hibernacula and roosting habitat where bats raise their young. Benga’s wildlife expert, Mr. Kansas, said the scientific literature indicates that little brown bats strongly favour old-growth deciduous trees for maternity roosting because the bark is broken and the bats can hide beneath it with their young. He stated that except for older Douglas firs, coniferous trees do not have similar bark. Benga indicated that little brown bats typically roost in large trees, including those that are living, partially alive, and dead.

[1786] Benga stated that, although it identified hibernacula and maternity roosts as limiting habitat types for the little brown bat, the lack of known hibernacula and maternity roosts in the wildlife local study area meant these habitat types were not suitable parameters to model in its assessment. Instead, Benga modelled non-maternity roosting habitat, and rated habitats based on their ability to provide suitable day/night roosting trees. We summarize the habitat types, habitat suitability classes, and the corresponding area for each class within the wildlife LSA in Table 17-4 below, which we compiled from information provided by Benga.

Table 17-4. Baseline habitat availability for little brown bats in the wildlife local study area

Habitat type	Habitat suitability class	Area (ha)	Percentage of wildlife LSA
Mature and old-growth deciduous forests	High	37.8	0.7
Mature and old-growth mixed-wood forests	Moderate	1128.7	20
Mature and old-growth coniferous forests and young deciduous and mixed-wood forests	Low	2638.7	46.7
Young, sapling, and shrubby coniferous forests, and sapling/shrubby deciduous or mixed-wood forests, and other non-treed habitats	Nil	1841.3	32.6
Total		5646.4	100
Effective habitat (high- plus moderate-suitability classes)		1166.5	20.7

Source: CIAR 44, Grassy Mountain Coal Project Wildlife Addendum Little Brown Bat, PDF p. 18.

[1787] Benga stated that 20.7 per cent of the wildlife local study area comprised high- or moderate-suitability roosting habitat for little brown bats under baseline conditions. The Coalition stated that significant numbers of little brown bats have been detected in areas classified as unsuitable or poor habitat and that seasonal-use patterns at different elevations and habitat types may not have been captured in Benga's assessment. The Coalition's expert, Mr. Wallis, indicated that a significant portion of the high- and moderate-suitability habitat for little brown bats west of the Livingstone Range occurred in the mine footprint. The Coalition also noted that there was a lack of high- and moderate-suitability habitat in the wildlife RSA.

[1788] Mr. Wallis expressed a lack of confidence in Benga's assessment because the locations of maternity roosts were not known, and Benga did not map all of the moderate-suitability habitat. Mr. Wallis stated that old-growth conifers could be an important roosting habitat, particularly where they are the predominant or only trees in a given area. Mr. Wallis suggested there may be pockets of unmapped moderate-suitability habitat for little brown bats in the mature forests in the northern part of the mine area, particularly along drainages. He added that Benga classified old-growth coniferous forests as being low-suitability habitat for the little brown bat, while the federal recovery strategy does not specify a type of tree but states that large-diameter trees are used for roosting habitats. Mr. Wallis indicated that the area should be looked at more closely to identify maternity roosts.

[1789] Benga responded to the Coalition by noting that the vast majority of high- or moderate-suitability habitat for little brown bats in the region is along the Livingstone Range, and none of that area would be affected by the project. Benga also noted that the little brown bat range extends to western British Columbia, up to Alaska, and down to California, all of which is west of the Livingstone Range.

[1790] In 2017, Benga initiated a field program to identify potential areas within the project's mine permit boundary that may provide suitable areas for little brown bat hibernacula. Benga carried out a desktop review of hibernacula requirements, identified locations with potentially suitable conditions, and conducted field verification of potentially suitable hibernacula locations.

[1791] Benga stated that, due to the nature of the mountainous landscape and an abundance of exposed rock faces and high cliffs, safety concerns made it impossible to observe or assess every crack or rock opening within or adjacent to the mine permit boundary. Benga stated that it had made sufficient effort to identify all abandoned mine sites and the most probable rock features for little brown bats within or adjacent to the mine permit boundary.

[1792] Bats, including little brown bats, may congregate (swarm) in large groups prior to or during the fall migration period at or near hibernacula. Benga conducted swarming surveys at ground-verified sites rated as having a high or high-to-moderate relative potential to provide suitable conditions for hibernating little brown bats. Benga carried out a combination of survey efforts, including acoustic monitoring, visual observations of swarming activity, and mist-netting at the 10 sites it identified as having high and high-to-moderate relative potential. Benga observed that little brown bat activity was the most frequent at site M1, which includes abandoned mine infrastructure to the east of the proposed rail loop. Benga stated that site M1 likely contains a maternity colony and/or summer roost and was likely a migration stopover location for the species.

[1793] Using criteria to determine swarming activity, Benga indicated that swarming events possibly occurred at seven of the sites identified. However, Benga indicated that it was not possible to determine whether swarming occurred at these sites or to count the number of individuals associated with each event. Benga indicated that it could not determine whether potential or actual hibernacula were located at or near any of the locations where possible swarming events occurred.

[1794] Benga concluded that there was no conclusive evidence about the presence of swarming by migrating little brown bats or potential hibernacula, despite an extensive swarming survey. Benga stated that it could not confirm whether there were large swarming events at any of the monitored sites. Benga stated that large swarming events are expected to involve thousands of bat passes per hour, whereas at Grassy Mountain the acoustic activity never surpassed 300 passes per hour at site M1, which is where the greatest activity had been detected. Benga indicated that the lack of large swarming events is not unexpected, given the absence of known large underground caverns, caves, or abandoned mine shafts in the Grassy Mountain mine permit boundary or the areas adjacent to the boundary.

[1795] ECCC stated that Benga's response to information requests regarding the identification of little brown bat hibernacula were fulsome. ECCC said that although some uncertainty regarding the presence of hibernacula remains, there was sufficient information to assess the environmental effects. The Coalition stated that Benga had not provided sufficient evidence to satisfactorily confirm the presence or absence of hibernacula in the region. The Coalition's expert, Mr. Wallis, indicated that even within areas mapped as moderate and low for little brown bat habitat suitability, acoustic surveys detected a significant number of passes of little brown bats. The Coalition also noted that a significant portion of high or moderate suitability habitat for little brown bats was within the soil salvage area, as evidenced by a

significant number of bat passes at nearby survey stations. The Coalition stated that robust bat sampling of the soil salvage area had not occurred, and therefore effects on little brown bats were understated.

[1796] The project is in an area previously disturbed by mining, and we note that little brown bat hibernacula are often found in abandoned mines. We are not confident that Benga has identified all historical mine tunnels and chambers that could contain hibernacula, although we acknowledge this may be in part due to safety concerns associated with conducting surveys in mountainous terrain and abandoned underground mine workings. While Benga has carried out an extensive swarming survey to identify little brown bat hibernacula, the results of the survey were inconclusive. Although hibernacula were not identified, there are sites of importance to little brown bats within the LSA, such as site M1 to the east of the proposed rail loop, which Benga identified as likely containing a maternity colony and/or summer roost, and which is a likely a migration stopover.

[1797] We find that Benga made reasonable efforts to identify hibernacula but, based on the swarming surveys, no hibernacula were identified. While we cannot rule out the possibility that a hibernaculum exists but was not identified, the potential for this is low. However, Benga acknowledged that, due to the complexity of identifying bat hibernacula, the 2017 survey did not definitively confirm the presence or absence of hibernacula in the project area. While Benga made reasonable efforts to locate them, further surveys are needed to ensure there are no negative effects on little brown bat populations or their hibernacula.

[1798] We recognize that there is a lack of data and uncertainty about whether any maternity roosting habitat for little brown bats exist in the project area. Although hibernacula and maternity roosts are identified as limiting habitat types for little brown bats, due to the lack of data on these habitat types, Benga carried out habitat suitability modelling using non-maternity roosting habitat. We find that Benga conducted habitat suitability modelling using the data that were available. In situations where data availability is limited, such as is the case with data on the location of maternity roosts and hibernacula for little brown bat, further targeted surveys would have been useful to confirm habitats of importance and appropriately mitigate the effects of the project on those habitat.

The project will remove suitable little brown bat habitat for an extended period of time

[1799] Benga stated that clearing operations would result in the loss of some mature forest habitat that represents potentially suitable roosting habitat for little brown bats. Benga predicted that approximately 326 ha (30 per cent) of effective roosting habitat in the wildlife LSA would be lost by year 14 of project development. Benga noted that because bats frequently roost in abandoned buildings, disturbance or removal of any old or abandoned buildings within the project footprint could result in colony loss and additional roosting habitat loss. Benga predicted that effective habitat availability for the little brown bat at year 27 would be greater than at year 14 due to progressive reclamation of mixed-wood mature forests. But it would still be 238 ha (20.4 per cent) lower than baseline.

[1800] With respect to changes in mortality, Benga stated that disturbing or destroying a bat hibernaculum could result in the mortality of hundreds of bats. ECCC stated that hibernacula for little brown bats are uncommon and hard to find, but the loss of a hibernaculum could have regional population effects. ECCC indicated that it is preferable to know if hibernacula are present prior to the start of project construction so that appropriate mitigation measures can be identified.

[1801] To gather further data on bat hibernacula, Benga committed to conducting fall swarming surveys, acoustic monitoring, visual observations of swarming activity, and mist-netting to identify species present in the area. Benga indicated it would consult with AEP and ECCC if hibernacula were identified.

[1802] Benga stated that under baseline conditions there was 3591 ha of effective habitat for little brown bats in the wildlife RSA. Benga indicated that little effective roosting habitat would be affected by planned developments in the wildlife RSA in the planned development case (cumulative effects scenario). Benga predicted that by year 14, approximately 77 ha (2.1 per cent) of effective habitat would be lost in the wildlife RSA. By year 27, Benga predicted that this would increase to a loss of 131 ha (3.6 per cent).

[1803] Benga stated that it would carry out predisturbance surveys prior to vegetation clearing or other high-disturbance activities and committed to assessing the presence or absence of bats in potential high-quality habitats in the project footprint at least one year prior to the initiation of any clearing activities. Benga stated that it would develop a mitigation plan in consultation with AEP and ECCC if it identified any maternal colonies and/or roosting sites. Although old or mature trees are most likely to provide suitable roosting cavities for bats in habitats adjacent to the project footprint, Benga indicated it would assess the potential to create roosting sites by constructing and erecting bat houses in habitats adjacent to the project footprint and in reclaimed areas.

[1804] Benga's wildlife expert, Mr. Kansas, stated that little brown bats are extremely amenable to occupying bat boxes, which have been used at other projects. He indicated that bat boxes would adequately replace the decline in maternity roost sites due to the project. He said that bat boxes would be set up near the sediment ponds, as Benga stated the potential exists to construct a treed wetland in those sediment ponds. He indicated there would be an opportunity to install bat boxes because constructed wetlands create more insects, and bats feed on insects, including mayflies, butterflies, moths, and bees. Mr. Kansas said that placing bat boxes next to foraging habitat—the water and littoral zone around the edges of the wetland—would create an optimal situation for little brown bats. He said that if Benga did incidentally harm bats, it could make up for it by using bat boxes.

[1805] Benga stated that with mitigation, it expected the effects of the project on little brown bats roosting habitat availability in the wildlife LSA to be local in extent, extended in duration, continuous in frequency, reversible in the long term, moderate in magnitude, and not significant. Mr. Kansas stated it would take 80 to 100 years before the trees in the wildlife LSA can be used in any way by bats.

[1806] The Coalition noted that although little brown bats most regularly use bat boxes for maternity colonies, their usage comes with caveats. Mr. Wallis referred to studies indicating that occupancy of replacement maternity roosts (e.g., bat boxes) is uncommon. He also noted that a main difference between natural and artificial cavities is that boxes are less likely to provide the same variety of diversity, such as size differences or microclimates, found in mature, intact forests. He also said that, while a few successful uses of bat boxes from maternity colonies have been documented, two of those successes were only due to the placement of the boxes on buildings. The Coalition stated that the project would remove a variety of productive habitats for little brown bats for decades or longer, and noted that a significant portion of effective habitat lies within the soil salvage area.

[1807] The Coalition emphasized during the hearing that it was improper for Benga to universally characterize residual effects as not significant considering that there would be significant impacts on little brown bats. While the Coalition acknowledged that some wildlife species may return quickly to the landscape following reclamation work, some species of conservation concern, including the little brown bat, may not return in significant numbers for decades or longer. Mr. Wallis indicated that this risk warranted describing the impacts on wildlife as significant. The Coalition stated that it was difficult to reconcile approval of the project with ECCC's conservation objective of maintaining current little brown bat population levels when the project would remove a variety of productive habitats for decades or longer.

[1808] We find that the project will have adverse effects on effective habitat for little brown bats due to the removal of mature and old-growth deciduous and mixed-wood forests in the project footprint. While we are unclear as to the exact sources of habitat gains due to progressive reclamation of mixed-wood mature forests by year 27, we find that the effects would be moderate in magnitude and local in geographic extent and note that some effective habitat is available for little brown bats in adjacent areas, particularly in the Livingstone Range to the east. However, we disagree with Benga that suitable roosting habitat is widely available in the wildlife RSA. Benga's estimate of 3591 ha of effective little brown bat habitat in the wildlife RSA accounts for only 4.9 per cent of the 73 547 ha habitat in the wildlife RSA.

[1809] We accept that the use of bat boxes may partially mitigate the loss of roosting habitat but find that the effects of habitat loss cannot be fully mitigated by the use of bat boxes. It is uncertain whether bat boxes can successfully replace lost maternity roosts. Because little brown bats prefer mature and old-growth forests, the effects of the project would persist for an extended period (despite the predicted slight increase in effective habitat availability between years 14 and 27) and possibly for as long as 80 to 100 years.

[1810] We find the effect of the project on little brown bats to be moderate in magnitude due to the potential presence of maternity roosts on the site and because Benga did not confirm the presence of hibernacula during its baseline assessment. We find that Benga's proposed measures to identify hibernacula habitat are reasonable; however, in the unlikely event that an unidentified hibernaculum was destroyed by the project, this would result in a high-magnitude effect. The geographic extent of the effects would be local and restricted to the project footprint, and the duration would be persistent. We have little information on whether exposure to selenium poses a concern for little brown bats. As little brown bats rely on old-growth forest, we are uncertain whether they would return to the project site following reclamation. If they did not return, the effect would be irreversible.

[1811] As little brown bat populations are widespread in areas adjacent to and beyond the project, we find that the project is not likely to have an adverse effect on populations. If a hibernaculum were destroyed by the project, the effect would be significant, but we find this effect would not be likely to occur given Benga's proposed mitigation measures.

[1812] Benga indicated that the combined loss of roosting habitat in the wildlife RSA would be less than 20 per cent (with estimates as low as 3.6 per cent) of the available roosting habitat. Benga concluded that cumulative effects on habitat availability of little brown bats would be regional in extent, continuous in frequency, extended in duration, and reversible in the long term. Benga predicted that the cumulative

effects would be extended in duration because old deciduous trees are most likely to provide high-quality roosting habitat, and once such trees are removed, it can take many decades (and up to a century) for suitable roosting trees to regrow. Benga stated that effects would be low in magnitude because suitable roosting habitat is widely available in the wildlife RSA. Benga concluded that the cumulative effects would not be significant.

[1813] Although no hibernacula for little brown bats were identified in the wildlife local study area after an extensive swarming survey, there are areas of importance to this species in the project footprint, such as site M1. Benga identified this area as likely containing a maternity colony and/or summer roost, and indicated it is likely a migration stopover. We considered the little brown bat's endangered status and habitat loss, which will persist for several decades, and that there is already an existing significant effect on its habitat.

[1814] Based on the available information, we conclude that the residual effects of the project, in combination with other projects and activities that have been and will be carried out, are likely to contribute to an existing significant adverse cumulative effect on little brown bats. These significant adverse cumulative effects occur primarily as a result of other past projects and activities that have occurred within little brown bat habitat and are also driven by white-nose syndrome that has decimated bat populations.

Removal of whitebark pine and limber pine will displace Clark's nutcrackers

[1815] Clark's nutcracker is listed as a sensitive species in Alberta. It is vulnerable to population declines because of its dependency on declining species, including limber pine and whitebark pine, for foraging. Clark's nutcracker is a keystone species because of its role in seed dispersal and forest regeneration for a number of conifer species, including the endangered whitebark pine and limber pine. Benga did not assess Clark's nutcracker as a valued component, but provided information on the potential effects of the project on this species in response to an information request.

[1816] The Coalition expressed concern that the project would remove a large number of whitebark pine and limber pine from the project footprint, which would in turn have an adverse effect on the mutualistic relationship with Clark's nutcrackers. Clark's nutcrackers disperse pine seeds by burying them in small caches for retrieval during times of low food availability, and abandoned caches can germinate new trees. The distribution of whitebark pine across the landscape is almost exclusively due to the caching behaviour of Clark's nutcrackers. Benga stated that the relationship between whitebark pine and Clark's nutcrackers is vital for maintaining the genetic diversity of whitebark pine within and between populations. ECCC stated that Clark's nutcrackers are also the primary seed disperser for limber pine.

[1817] We discuss the effects of the project on whitebark pine and limber pine in the chapter on vegetation and wetlands.

[1818] Benga assessed the potential effects of the project on Clark's nutcrackers in terms of the predicted loss of open forest habitat containing whitebark pine and limber pine, which are two important food sources for the bird. Benga predicted that the project will disturb approximately 208 ha of whitebark pine and open grassland areas containing a sparse whitebark pine canopy, for an estimated loss of approximately 21 000 whitebark pine trees and fewer than 1000 limber pines.

[1819] Benga estimated that 6019 ha of whitebark pine habitat and 583 ha of limber pine habitat occurs within the wildlife RSA. The grizzly bear RSA, which extends 25 km from the LSA, is within the foraging range of Clark's nutcrackers living in the LSA, based on a maximum reported foraging distance of 32.6 km. Benga's wildlife expert, Mr. Kansas, said that Clark's nutcrackers can disperse and find the remaining whitebark pine that occur in the grizzly bear RSA. Benga stated that the loss of whitebark pine and limber pine habitat due to the project would represent 3.2 per cent of the whitebark pine and limber pine foraging habitat in the grizzly bear RSA.

[1820] Benga stated that, although whitebark pine and limber pine provide the preferred foods for Clark's nutcrackers, the birds will forage on the seeds of other coniferous species, including ponderosa pine (*Pinus ponderosa*) and Douglas fir. Benga noted that Clark's nutcrackers can shift to an omnivorous diet during bad-weather years. Benga noted that omnivory may be an important survival strategy when preferred foods are scarce.

[1821] Benga stated that Clark's nutcrackers are not particularly sensitive to anthropogenic sensory disturbances. Benga noted that the stability of the Clark's nutcracker population in Canada over the past 47 years suggests that the adverse effects associated with development and other disturbances are within the resilience and adaptability limits for this species.

[1822] Benga's mitigation measures for Clark's nutcrackers focused on harvesting seeds from disease-resistant whitebark pine and limber pine prior to mining, and planting seedlings during reclamation to restore whitebark pine in the closure landscape. Mr. Kansas stated that Benga would replace the whitebark pine at a three-to-one ratio. Benga's proposed plans for restoring whitebark pine are discussed further in the chapter on conservation, reclamation, and closure, and in the chapter on vegetation and wetlands.

[1823] Benga noted that while the successful planting of whitebark pine and limber pine on reclaimed sites would mitigate habitat loss for Clark's nutcrackers, benefits to the species would be delayed many years into the future. Cone production in whitebark pines does not begin until the trees are 25 to 30 years of age, and sizeable cone crops do not appear until 60 to 80 years of age. Benga indicated that effective mitigation for Clark's nutcracker is not expected to occur until 60 to 80 years after planting. When asked where the expected recruitment of Clark's nutcracker to the reclaimed project area would come from, Mr. Kansas stated that they would come from the outer western edge of the RSA.

[1824] Benga's wildlife expert, Mr. Kansas, stated that Clark's nutcracker would not be required for the initial establishment of whitebark pine because Benga would be planting the seedlings. Benga indicated that Clark's nutcracker becomes important to whitebark pine in the long term once the trees start producing seeds. Clark's nutcrackers harvest the seeds, transport them, and bury them in small caches, which could result in the germination of new whitebark pines.

[1825] The Coalition stated that Clark's nutcrackers rely on old whitebark pine forests because of the cones such stands produce. The Coalition's expert, Mr. Wallis, indicated that it would take 125 to 250 years for whitebark pine to attain good canopy volume for high cone production. The Coalition stated that the removal of whitebark pines from the project area will have an impact on Clark's nutcracker.

[1826] ECCC's expert, Mr. Gregoire, confirmed that whitebark pine will only begin to produce a reasonable seed crop once they are more than 60 years of age.

[1827] Benga characterized the geographic extent of the effect as local, the duration as extended, the frequency as continuous during the operational phase of the project, and reversible in the long term. Benga indicated that the magnitude of the effect is initially expected to be moderate to high in magnitude, depending on the ability of Clark's nutcrackers to forage on other conifers at lower elevations. Benga noted that birds that currently use habitats within the wildlife LSA may have to travel farther to find alternate food sources, which could have energetic costs. Over the long term, effects may be neutral or of low magnitude.

[1828] Benga concluded that the effects of the project on Clark's nutcracker are not significant. Benga based this conclusion on the small proportion of whitebark pine and limber pine foraging habitat that will be lost to the project and the likelihood that much of this habitat will be replaced over the long term through the proposed reclamation program. Benga's conclusion also considered the fact that the Canadian population is secure and the likelihood that the displacement and possible loss of a small number of individuals from the project area would not have a measurable effect on either the Alberta or Canadian populations of this species.

[1829] In the chapter on vegetation and wetlands, we conclude that the project is likely to result in significant adverse effects on whitebark pine due in part to its status as a listed species. Although Clark's nutcrackers would be displaced due to the loss of its preferred food source, the whitebark pine in the surrounding regional study area are within the foraging range of Clark's nutcrackers. We agree with Benga's conclusion that Clark's nutcrackers would be able to forage elsewhere within the grizzly bear RSA.

[1830] We find that the project effects on Clark's nutcrackers are moderate in magnitude due to the species' reliance on whitebark pine and the removal of a large number of whitebark pine trees on the project site. Although Benga considered that other whitebark pine in the grizzly bear RSA would be within the birds' foraging range, the need for Clark's nutcrackers to find alternative food sources requires significant energy.

[1831] As discussed in the chapter on conservation, reclamation, and closure, and the chapter on vegetation and wetlands, we find that there are uncertainties associated with the reclamation program and the replanting of whitebark pine. If restoration is successful, it will take at least 60 years to 80 years for whitebark pine to produce sizeable cones, delaying benefits to Clark's nutcrackers. In a worst-case scenario, in which restoration is not successful, project effects on Clark's nutcrackers would be persistent, lasting decades beyond the end of operations. Due to the mutualistic relationship between Clark's nutcrackers and whitebark pine, it is uncertain whether Clark's nutcrackers would return to the project site if the whitebark pine replanting program is unsuccessful. In this case, the project effects would be irreversible. In consideration of the secure status of Clark's nutcracker, we find the residual effects of the project to be not significant.

Land disturbance and habitat removal will affect habitat availability and grizzly bear movement

[1832] Grizzly bears are classified as a threatened in Alberta and as a species of special concern under *SARA*. The grizzly bear range in Alberta is divided into distinct population units or bear management areas based on population structure and barriers to movement. Benga obtained habitat availability and habitat state data from the Foothills Research Institute Grizzly Bear Program, which uses a variety of

factors to predict the seasonal grizzly bear occurrence in an area. Based on this model, Benga indicated that the wildlife LSA contained approximately 2270.9 hectares (48.2 per cent) of high-quality habitat where the risk of mortality to grizzly bears is low.

[1833] Grizzly bears are habitat generalists and omnivores, although their diet is largely plant-based in Alberta. Ungulates such as deer and elk may supply a small component of the grizzly bear diet in the Rocky Mountain Region of Alberta. Ungulates are more likely to be killed by grizzly bears in non-forested, open forest, and wet forest habitats. While grizzly bears tend to avoid active human disturbances, they often forage in clearcuts, reclaimed well sites, and vegetated linear disturbances (such as transmission lines and pipelines) because these habitats can provide diverse food sources, such as roots, forbs, and berries. The distribution and use of habitat directly correspond with the availability and location of food and this will vary seasonally based on grizzly bear diet requirements.

[1834] Benga's baseline surveys indicated that the occurrence probability of grizzly bears is highest in the higher elevations of the eastern portion and in the lower elevations of the southern portion of the wildlife LSA in the spring. The high-elevation region retains high habitat value through the summer and fall, while the lower southern portion experiences a decrease in habitat value through the seasons. Benga's assessment at baseline indicated that approximately half of the wildlife LSA provides effective habitat with high grizzly bear survival rates.

[1835] Benga used a source-sink model to describe preferred habitat states for the grizzly bear. A source habitat is a high-quality habitat that on average allows a population to increase, while a sink habitat is of low quality and may not support a population on its own. Benga predicted in the application case that at year 14 the wildlife LSA would see declines in both source and sink habitats, of 40.1 and 30.1 per cent, respectively, and it expected these regions to be replaced by less-important habitat. Benga predicted that by year 27, after reclamation, there would be a 63.8 per cent increase in source habitat and a 22.7 per cent decrease in sink habitat compared with baseline conditions in the wildlife LSA.

[1836] The Ktunaxa Nation stated that the project's footprint and associated disturbance will affect the habitat of species such as the grizzly bear that they rely on to exercise spiritual, cultural, and harvesting practices. The Timberwolf Wilderness Society indicated that the ecological limits of road density for the grizzly bear are currently being exceeded in the area and the project may lead to further population fragmentation and reduced population recovery.

[1837] Benga stated that active mine pits, dumps, and haul roads are expected to impede and alter grizzly bear movements, particularly east-west movements. Although Benga reported no known movement corridors within the wildlife LSA, baseline studies indicate grizzly bear movement in a north-south direction along Blairmore Creek, a south-north direction along the existing access road within the centre of the wildlife LSA, and a west-east direction north of the mine footprint. The access road and coal conveyor have the potential to restrict grizzly bear movement; however, Benga stated that use of wildlife crossing structures may mitigate this effect. Benga also proposed that the north-south connectivity for grizzly bears could be improved by the inclusion of wildlife overpasses as part of the twinning of Highway 3.

[1838] CPAWS indicated that primary wildlife corridors, including those of the grizzly bear, bisect the proposed mine permit area at both the south and north ends of the wildlife LSA. They stated that the construction and operation of an open-pit coal mine at this location has the potential to decrease habitat that supports grizzly bear populations in the area and sever movement opportunities.

[1839] The Wildlife Society stated that uncertainty is associated with the mitigation efforts proposed by Benga, such as crossing structures for the coal conveyor. The Wildlife Society stated that Benga does not present modelling to suggest effective locations for crossing structures, and emphasized that Benga does not account for the length of time it takes for carnivores to learn where crossing structures are located and that they are safe to use.

[1840] Benga stated that although the grizzly bear is a wide-ranging species, their natal dispersal capabilities are low and they establish ranges adjacent to or within 20 km of their maternal home range. Although there seemed to be few barriers to grizzly bear movement within the wildlife LSA at baseline, Benga indicated that grizzly bears may avoid access roads in the south and northwest sections due to high levels of human activity.

[1841] Although Highway 3 limits grizzly bear movements, bear movement across the Continental Divide north of the Highway has been documented. Benga expected that active mine pits, dumps, and haul roads would obstruct and alter grizzly bear movements, particularly east-west movements through the project footprint, through direct loss of habitat and sensory disturbance. It noted that extensive research on grizzly bear use of coal mine lands in Alberta suggested that grizzly bears routinely use habitat in the immediate vicinity of active mine operations, particularly remnant forest patches and reclaimed areas.

[1842] The Wildlife Society indicated that it considered the open-road density thresholds for grizzly bears to already be unsustainable, and these linear disturbances may lead to habitat avoidance and create population sinks. The Wildlife Society stated that the Livingstone-Porcupine area, which contains the proposed project, contains a linear disturbance density of 2.4 km/km², indicating that additional linear disturbances created by the project may further reduce ecological functionality for grizzly bears on the landscape.

[1843] Benga stated that roads and railways are important causes of grizzly bear mortality and that mortalities are more common when vehicles are travelling at high speeds (in excess of 90 km/h). Benga clarified that the majority of the project's coal haul would use the coal conveyor, reducing the need for haul trucks. Additionally, Benga planned to enforce a speed limit of 70 km/h on the access road. According to research summarized in Benga's assessment, grizzly bear habitat security can be maintained at road densities below 0.6 km/km² while a maximum of 0.75 km/km² is required to ensure bear population viability.

[1844] The project is in a core grizzly bear zone within which AEP has specified that road density is to be kept below 0.6 km/km². Over the life of the project, Benga stated that it estimated the road density within the wildlife LSA to be 0.69 km/km² at year 14 and 0.61 km/km² at year 27, compared with 0.88 km/km² at baseline. Benga indicated that the density of roads in the grizzly bear RSA was below any of the key established thresholds for road density at baseline (at 0.53 km/km²).

[1845] The Wildlife Society stated that Benga's method of determining the level of impact on grizzly bears did not include a zone-of-influence. They indicated that integrating a zone-of-influence in the impact assessment may help define potential habitat displacement risk spatially. Additionally, the Wildlife Society stated that Benga did not consider grizzly bear displacement to adjacent habitats as a potential impact on grizzly bear populations outside of the wildlife LSA, which may cause an increase in the potential for human-bear conflicts on recreational and agricultural lands. These conflicts, in turn, may lead to an increase in mortality risks for grizzly bears in the area.

[1846] Overall, Benga concluded that the project footprint will affect between 5 to 9 per cent of a typical female grizzly bear's home range, which may result in the displacement of resident grizzly bears. Benga expected that these effects would be local and short-term due to progressive reclamation. Benga's assessment indicated that highly suitable grizzly bear habitat in the wildlife LSA would decrease while mortality risk would increase. It is anticipated that these impacts would be minimized through progressive reclamation.

[1847] With approximately half of the wildlife LSA providing effective grizzly bear habitat, we agree that grizzly bear habitat within the wildlife LSA will be lost temporarily, movement patterns will be affected, and grizzly bears will be displaced to adjacent habitats. We find that the linear disturbances from the project may further reduce habitat availability and movement corridors for grizzly bears during project construction and operations. The road density within the wildlife LSA exceeds 0.6 km/km^2 within the core grizzly bear range at year 14 and is just at 0.6 km/km^2 in year 27. Although this is an improvement compared with the baseline levels of 0.88 km/km^2 , we find that increased density and use of roads associated with the project will have an adverse effect on grizzly bear habitat security within the wildlife LSA and will temporarily displace grizzly bears.

[1848] We acknowledge that there is uncertainty regarding the success of wildlife crossings as a mitigation measure to facilitate movement around project-related disturbances. The evidence is limited and uncertain with regards to the potential use of these structures to facilitate grizzly bear movement within the area. We are of the view that grizzly bear movement within the wildlife LSA and the RSA would be hindered by the project.

[1849] Because grizzly bears are habitat generalists and omnivores that use disturbed sites, we find that progressive reclamation will provide effective habitat for grizzly bears following cessation of project activities. We note that grizzly bears are likely to avoid the project site during operations, but will have adequate foraging opportunities, depending on the vegetative communities that become established and the availability of prey species, including elk and deer, that may be attracted to the site.

[1850] We find that project effects on grizzly habitat and movement will be moderate in magnitude due to effective habitat declines within the wildlife LSA. This loss would be compounded by fragmentation through linear features and other project disturbances that affect movement and displace grizzly bears. There is evidence that the project would serve as a barrier to grizzly bear movement in the east-to-west direction, and therefore the effects on grizzly bear are regional in extent. The effects are long in duration because they would persist throughout the operational phase but would cease once the operational phase ends. The effects on connectivity would be reversible in the long term, assuming the removal of project

infrastructure and successful reclamation. We conclude that the residual effects on grizzly bears would not be significant.

[1851] From a cumulative effects perspective, the project would further hinder east-to-west movement of grizzly bears and the road density within the LSA would exceed 0.6 km/km² in year 14 and will be just at the threshold in year 27. Increased use of existing infrastructure such as Highway 3 can be expected, and reasonably foreseeable activities such as forestry are likely to contribute to further habitat fragmentation and barriers to movement in the grizzly bear RSA.

[1852] We conclude that the residual effects of the project, in combination with other projects and activities that have been and will be carried out, are likely to contribute to an existing significant adverse cumulative effect on grizzly bear. This is based on existing threats to grizzly bear, uncertainty associated with the use of the wildlife overpasses, and evidence that the project would contribute to a moderate-magnitude effect on core habitat and connectivity. These cumulative effects are primarily the result of other past projects and activities that have occurred within grizzly bear habitat.

The project will result in habitat loss for American badgers and wolverines

[1853] The American badger and the wolverine are species of special concern under Schedule 1 of *SARA*. The American badger was listed in 2018, after the EIA for the project was submitted. Benga provided a detailed assessment for the American badger and a high-level assessment for the wolverine, as it was considered a special status species and not a valued component in the wildlife assessment.

American badgers

[1854] Benga stated that direct habitat loss is the primary effect of the project on American badgers in the wildlife LSA. Benga indicated that potential habitat types in the wildlife LSA that provide suitable foraging or burrowing habitats for badgers include native grasslands, open forests, and grass-dominated anthropogenic habitat types (e.g., perennial forage crops, seeded well sites, and pipeline rights-of-way). In addition, Benga noted that indirect habitat loss will occur from increased noise during construction and operations, even though the badger can be relatively tolerant of certain anthropogenic activities. Benga indicated that the project will displace any American badgers present in its immediate vicinity to other habitats to the east and south, at least until it initiates progressive reclamation. Overall, Benga stated that potential badger habitats account for 40.2 per cent (2269.7 ha) of the wildlife LSA.

[1855] During maximum project disturbance in year 14, Benga predicted that the loss of potential suitable badger habitat in the wildlife LSA would include 150.7 ha (51.9 per cent) of grassland and 161.2 (44.3 per cent) of open forest habitats. In year 27, Benga predicted that changes in habitat availability resulting from project development would result in an increase in grassland habitat of 58.8 ha (20.2 per cent) and a decrease in open forest habitats of 129 ha (37 per cent).

[1856] Benga predicted that habitat losses would be temporary because the availability of suitable badger habitat in the wildlife LSA is expected to increase as project-related disturbances are reclaimed. However, Benga noted that existing anthropogenic disturbances (e.g., trails and roads) within the project footprint will be reclaimed at closure. In addition, Benga indicated that grass-dominated reclaimed sites may provide suitable habitat for badgers for many years as reclamation progresses across the landscape. Overall, Benga predicted that potential American badger habitat in the wildlife LSA will decrease slightly

from baseline conditions following mitigation and reclamation. Benga also stated that project development will not affect American badger habitat in the wildlife RSA because most of the suitable habitat is to the east and southeast of the project footprint.

[1857] Benga stated that habitat availability changes at year 14 will affect movements of American badgers in the wildlife LSA. However, it predicted that badgers will not be affected in year 27, following mitigation and reclamation. Benga noted that because critical habitat has not been identified for American badgers in Alberta, there are no federal action-plan requirements for the species in the province. However, Benga indicated that it would implement any future federal action plans, including any species-specific mitigation and monitoring plans for American badgers in Alberta, if ECCC develops them. In the interim, Benga indicated that it would develop specific mitigation measures in consultation with AEP and ECCC if it detected any badgers during predisturbance surveys conducted in the wildlife LSA. Benga stated that it would minimize project effects associated with habitat loss for American badgers by implementing the project's conservation and reclamation plan.

[1858] Benga stated that with mitigation, the effects of the project on the American badger in the wildlife LSA would be local in extent, extended in duration, continuous in frequency, low in magnitude, and high in probability. According to Benga, the project's contributions to changes in abundance and habitat availability would be negative but reversible in the long term. Benga indicated that with respect to the potential effects of the project on the persistence of this species in southwestern Alberta, the effects are considered to be not significant. Benga specified that this rating is based partly on the small proportion of potential grassland and open forest habitats that will be lost. It is also based on the likelihood that most of the habitats potentially used by American badger will be replaced or increased over the long term through the proposed reclamation plan and by implementation of the general wildlife and species-specific mitigation and monitoring plans.

[1859] We find that habitat loss due to the project would displace American badgers to areas outside of the wildlife LSA. The disturbance caused by human activities during project operations would also increase avoidance of the wildlife LSA by American badgers, and potentially cause them to relocate to more suitable habitats to the east and southeast of the project footprint.

[1860] While the project will remove 51.9 per cent of grassland habitats and 44.3 per cent of open forest habitats by year 14, we acknowledge that grassland habitats will be one of the first habitats to be re-established following progressive reclamation. Although we find that the success of reclamation of rough fescue grassland habitat is uncertain, the American badger also uses grass-dominated anthropogenic habitat types, and will therefore likely return to the reclaimed landscape.

[1861] We find that the effects on American badgers would be low in magnitude due to their use of grassland habitats and grass-dominated anthropogenic habitat types. The effect would be local and long in duration. The effects would be reversible in the long term. We find that the residual effects to American badgers would not be significant. While we find that the project is likely to result in an adverse residual effect on American badger, based on the information provided it is not possible to accurately assess or characterize the significance of the cumulative effects.

Wolverines

[1862] Benga explained that wolverines are generalist, opportunistic predators and scavengers that use a wide variety of habitat types, although they are more likely to be associated with cooler, montane, and subalpine forested ecosystems. Benga stated that no wolverines were detected in the wildlife LSA during baseline inventory studies, although the species is known to occur in southwest Alberta. Benga noted that wolverines are difficult to detect because they can have large home ranges (75 to 1500 km²) and may disperse over long distances. Wolverines may also travel periodically through the wildlife LSA and wildlife RSA. According to Benga, potentially suitable habitats for wolverine are present in the wildlife LSA, most of which is associated with forested and rocky or barren habitats at higher-elevation montane and subalpine areas in the northern half of the area.

[1863] Benga stated that project development will result in the direct loss of suitable forested and barren rock habitat in the short-term. In addition, Benga stated that wolverines are likely to avoid habitats within at least 1 km of the project because of increased human activity and sensory disturbance. According to Benga, the active coal mine area, access road, and coal conveyor will likely affect east-west movements of wolverines. Benga also stated that the railway loop may further affect north-south movements through the Highway 3 corridor.

[1864] Benga predicted that the main project effects on wolverines in the wildlife LSA are direct and indirect habitat loss and habitat fragmentation. Benga indicated that the effects will be regional in extent, residual in duration, continuous in frequency, low in magnitude, and not significant. Benga predicted the effects would be reversible in the long term, as affected areas will be reclaimed and subalpine conifers can be re-established in previously mined areas.

[1865] Both the Wildlife Society and CPAWS raised concerns about project effects on habitat availability for wolverines and habitat fragmentation. The Wildlife Society stated that many studies have shown that forested cover is essential to maintaining essential habitat connectivity for species such as wolverine. They also noted that it is difficult to grow trees on reclaimed mines because of the thin layer of topsoil that is placed back on the surface and it may take a century before forests are restored. They referred to several studies that imply the EIA neglected to consider project effects on carnivores and that habitat fragmentation may cause connectivity issues.

[1866] We recognize that wolverines have not been detected in the wildlife LSA and are likely to avoid habitats adjacent to areas of increased human activity and sensory disturbance. We agree that the project would increase habitat fragmentation and decrease forested corridors necessary for wolverines to connect between essential habitats. We also agree that human disturbance would further increase avoidance of the area by wolverines and therefore restrict wolverine movements between habitats.

[1867] Most of the potentially suitable habitats for wolverine present in the wildlife LSA are associated with forested and rocky/barren habitats located in higher-elevation montane and subalpine areas in the northern part of the LSA. We are uncertain when progressive and final reclamation can re-establish sufficient forest cover to ensure the return of wolverines to the wildlife LSA. It would take several decades before planted trees would be able to provide an acceptable forest canopy that ensures sustainable habitat connectivity for wolverines.

[1868] We find that project effects on wolverines would be low in magnitude due to the lack of observed occurrences in the wildlife LSA and the fact that wolverines have large ranges and would be able to access adjacent habitats in the wildlife RSA. The extent of effects would be regional as a result of not only a barrier to movements from the east to the west and the north to the south but also their avoidance of habitats disturbed by human activity and sensory disturbance. The effects are long in duration because they would persist for the duration of the operational phase but would improve after operations cease. The effects on connectivity would be reversible only after removal of project infrastructure and dependent on successful reclamation and re-establishment of forest cover. We find that the residual effects on wolverines would not be significant. While we find that the project is likely to result in an adverse residual effect on wolverines, based on the information provided it is not possible to accurately assess or characterize the significance of the cumulative effects.

The project will adversely affect non-listed wildlife species of importance to Indigenous groups

[1869] Several species identified by Benga as valued components or special status species are important to Indigenous groups for cultural and/or harvesting purposes, but are not listed under *SARA*. The great grey owl, bald eagle, golden eagle, and Canada lynx are listed provincially as sensitive in Alberta, and the American marten, moose, elk, mountain goat, and bighorn sheep are secure in Alberta. Benga concluded that for all of these species, the effects of the project are not significant. A discussion of the effects of the project on the current use of lands and resources and physical and cultural heritage as it relates to these species is provided in the chapter on effects on Indigenous traditional use.

[1870] Benga stated that great grey owls require mature to old-growth forests to breed, and indicated that effective habitat for great grey owls accounts for 58.7 per cent of the LSA. Benga noted that great grey owls using habitat within the project footprint would be displaced to other areas in the wildlife LSA and surrounding area during the life of the project because of direct and indirect habitat loss. Benga indicated that it would mitigate habitat losses through progressive reclamation. Benga highlighted that the primary source of great grey owl mortality associated with the project may be nest destruction from vegetation clearing, which would be mitigated by ensuring the clearing occurred outside the March 1 to July 15 period to avoid disrupting nesting raptors. Benga concluded that the effects on great grey owls would not be significant.

[1871] Several participants and Indigenous groups raised concerns regarding the adequacy of the assessment of raptors. Participants indicated that the Livingstone Range is known around the world as having the largest concentration of migrating golden eagles. The Ktunaxa Nation stated the east slope of the Rockies is a major migration route for raptors, with close to 9000 individual raptors recorded at the Vicki Ridge hawk watch site south of the project site over 140 days in the fall of 2014 to fall of 2017. The Ktunaxa indicated that golden eagles account for 47.2 per cent of total raptor sightings. They stated that the value of the Grassy Mountain area as a key raptor migration corridor and the potential impacts of the project were not considered in the assessment.

[1872] Benga agreed that the Rocky Mountains, including the Crowsnest Pass area, serve as an important flyway for migrating raptors, including the bald eagle and golden eagle. Benga contended that the project would be unlikely to affect the migration pathways of bald eagles and golden eagles because of their tendency to increase their altitudes when flying over highly disturbed areas. Benga indicated that

increased selenium in waterways in the wildlife LSA could have the potential to affect eagles. Other potential sources of mortality included collisions with traffic and destruction of nests from vegetation clearing. Benga indicated that these effects would be mitigated by enforcing a speed limit on access roads, and performing predisturbance nest searches before clearing vegetation. Benga predicted that the effects of the project would be local in extent, long in duration, continuous in frequency, reversible in the short-term, low in magnitude, and not significant.

[1873] The Ktunaxa Nation questioned why American martens were selected as a valued component, and indicated that the marten was not a reasonable choice because it is not of conservation concern. They stated that the American marten is a secure species that makes optional use of tree cavities for denning, and it was chosen over several species that are obligate users of trees and sensitive in Alberta.

[1874] Benga stated that American martens prefer mature to old-growth coniferous forests, which would take many decades to become re-established following the cessation of project activities. Benga predicted a loss of 24.8 per cent of effective habitat by year 14, and 24.7 per cent by year 27. Benga stated that American martens will avoid habitats near high levels of human disturbance, and therefore may avoid habitat adjacent to the project. Benga noted that noise levels will generally be lower at night when martens are most active. With respect to mortality, Benga emphasized that construction-related mortality is expected to be the primary mortality risk mechanism for marten. Benga indicated that scheduling tree-clearing outside of the natal period (March to July), enforcing low speed limits, and appropriate signage should help reduce the effects of mortality. Benga concluded that the effects of the project on American martens are not significant.

[1875] Benga stated that Canada lynx occur at low densities throughout their range in Alberta, and are considered to be sensitive in Alberta because of recent population declines and habitat loss and fragmentation. Benga stated that almost half (45.5 per cent) of the wildlife LSA is effective lynx habitat, most of which is in the northern half of the LSA. Canada lynx have large home ranges and are capable of dispersing over long distances, often in search of prey. By year 14 of project development, 30.1 per cent of effective lynx habitat will be lost compared with baseline conditions, and 31.1 per cent will be lost by year 27. Benga predicted that the effects of the project on Canada lynx habitat are expected to be regional in extent, extended in duration, continuous in frequency, reversible in the long term, moderate in magnitude, and not significant. Benga indicated that any local lynx connectivity that is affected by project development would likely improve with progressive reclamation.

[1876] Benga stated that by year 14, habitat loss and sensory disturbance could displace moose and elk from the wildlife LSA to other areas of effective habitat in the wildlife RSA. However, this effect is expected to be temporary as habitat losses would be reversed through progressive reclamation. Benga indicated that the ability of moose and elk to access core winter habitat is believed to be just as important as the availability of such habitat. Benga indicated that moose and elk movements in the wildlife LSA would be affected to some extent by the access road and rail loop, but the active mine site and coal conveyer are expected to affect movement the most. Benga proposed to incorporate wildlife crossing structures (underpasses and/or overpasses) into the design of the coal conveyer to mitigate this effect.

[1877] Vehicular collisions have the potential to increase mortality, but would be minimized through signage and speed limits. Benga stated that moose have been found to cross roads less frequently when

road densities exceed 0.4 km/km² in winter. Benga highlighted that elk habitat effectiveness declined by 25 per cent at a road density of 0.62 km/km² as areas of core habitat became isolated and movement patterns were altered. Benga estimated that road density in the wildlife LSA is currently 0.88 km/km², and this would decline to 0.69 km/km² at year 14 of project development and 0.61 km/km² at year 27. Benga concluded that, at these road densities, it expects roads to remain semi-passable to moose, and below the 25 per cent habitat effectiveness for road density for elk. Benga concluded that the effect of the project on moose and elk are not significant.

[1878] Benga indicated that no mountain goats or bighorn sheep were detected in the wildlife LSA, but both reportedly occur in southwestern Alberta. Benga predicted that the main effects of the project on mountain goat and bighorn sheep would be potential habitat fragmentation affecting movement. Benga stated that mountain goats and bighorn sheep are likely to avoid the project, particularly during high-impact activities such as blasting. Benga also indicated that the coal conveyor and access road could serve as barriers to movement. Benga indicated that wildlife crossings would be placed at suitable locations to mitigate this potential effect. When discussing the effectiveness of reclamation, Benga indicated that bighorn sheep have always been at mines. Benga concluded that effects on mountain goat and bighorn sheep will be regional in extent, long-term in duration, continuous in frequency, low in magnitude, reversible in the short-term, and not significant.

[1879] Although these species are important to Indigenous groups, there was limited discussion of project effects on them at the hearing. While some participants identified deficiencies regarding the assessment carried out by Benga for these species, we are generally satisfied with the predictions made by Benga regarding changes in habitat availability, movement, mortality, and abundance for these species.

[1880] We agree that, although habitat loss due to the project would occur, it would be limited to the LSA. We acknowledge that progressive reclamation is the main measure to mitigate habitat loss, although we lack confidence in Benga's ability to successfully reclaim the site at the speed and in the manner that they propose. We note that American martens rely on mature to old-growth coniferous forests, and therefore effects on this species will be persistent in duration due to the length of time it takes for old-growth forests to re-establish in reclaimed areas.

[1881] With respect to eagles and golden eagles, while Grassy Mountain is located in an important flyway, the project site has not been identified as an important stopover site. Furthermore, we are satisfied with Benga's proposal to conduct predisturbance nest searches prior to any tree clearing. However, as discussed earlier, we are not confident that Benga's proposed mitigation measures to deter birds, including eagles, from coming into contact with the surge pond and raw water pond will be effective.

[1882] For species with larger home ranges, such as the Canada lynx, moose, and elk, it is clear that the project would present a barrier to movement. Even with the presence of wildlife crossings, these species may avoid the project area due to disturbances at the mine site. Although reclamation could reduce road densities in the LSA, it would take several years for these benefits to be realized. We acknowledge that no mountain goats or bighorn sheep were observed in the wildlife LSA, and although there may be project effects on movement due to avoidance of the project site, these effects would be reversible upon the cessation of project activities.

[1883] Overall, we find that the project is not likely to affect populations of the species identified as important to Indigenous groups. We agree with Benga that, with the implementation of mitigation measures, the project is not likely to result in significant adverse residual effects on the American marten, Canada lynx, great grey owl, bald eagle, golden eagle, moose, elk, mountain goat, and bighorn sheep.

Barriers to the successful reestablishment of plains bison exist in the project area

[1884] Although plains bison (also known as buffalo) were not initially identified as a valued component by Benga, we received submissions from the Ktunaxa Nation and other Indigenous groups throughout the review process regarding the cultural and ecological importance of bison. Plains bison are listed as extirpated/extinct under the *General Status of Alberta Wild Species* and considered threatened by COSEWIC. The Ktunaxa highlighted that they and other Indigenous groups, including all Treaty 7 First Nations, are signatory to the Buffalo Treaty, which focuses on the restoration and stewardship of the return of bison within its historic range. The Ktunaxa said they wanted to ensure that the project provided a reasonable assessment of effects on bison habitat suitability and capability, and that Benga's land use goals supported long-term future bison habitat restoration. The cultural importance of bison to the Ktunaxa is discussed in the chapter on effects on Indigenous traditional use.

[1885] The Ktunaxa indicated that, prior to extirpation, bison were abundant in the area of the project and around Crowsnest Lake, at least until the early 1800s. The Ktunaxa's expert, Dr. C. Candler, indicated that the project area was particularly critical for bison. The Ktunaxa noted that the project area is expected to be one of the critical places for the re-establishment of the plains bison and it is one of the few places in Ktunaxa territory where harvests of bison could occur after restoration. The Ktunaxa Nation indicated that the return of the plains bison to the project area is planned and reasonably foreseeable.

[1886] The Ktunaxa were concerned that the project would further reduce the habitat available to support reintroduction of bison. They indicated that the project could affect the success of bison restoration efforts, and effects of the project could include sensory disturbance, habitat loss and degradation, and connectivity impacts, including fragmentation of an important movement corridor.

[1887] ECCC's expert, Mr. Gregoire, stated that there are currently large tracts of land in private holdings in the project area, and this poses an obstacle to creating open habitat for plains bison, and therefore to bison reintroduction. In its 2017 update on the status of the plains bison, the Government of Alberta stated that future prospects for restoration and recovery of free-ranging plains bison to its original range within southern and central Alberta are limited by the amount of available intact grassland habitat in today's predominantly anthropogenic landscape.

[1888] Benga stated that bison were present on the plains as well as in mountainous areas of the eastern slopes of the Rocky Mountains and were likely present at some time in the Crowsnest Pass and the project area. Benga indicated that plains bison now occur in only five isolated wild subpopulations and occupy less than 0.5 per cent of their original range in Canada.

[1889] Benga stated that the most important habitats for plains bison are prairie grasslands and open meadows. Benga further indicated that because bison are ruminant herbivores and primary grazers of coarse grasses and sedges, there is some potential for habitats within the wildlife study area to support bison. As a preferred forage species for bison, foothills rough fescue occupies 3.9 per cent of the wildlife

LSA. Benga stated that 39.9 per cent of the wildlife LSA could provide suitable habitats for bison, based on the presence of other forage species such as hairy wild rye, pine grass, and sedges. Benga indicated that the project is in the Montane Subregion, which was considered part of the plains bison's winter range. Therefore, the wildlife LSA could potentially provide winter habitat for plains bison if a reintroduction program was successful. Benga stated that the project site would not be an ideal location to attempt to re-establish the species without a connection to a significant herd on the adjacent plains.

[1890] Benga indicated that the potential for the project area to support bison habitat would be similar to pre-disturbance once reclamation and closure have been completed. Benga indicated that it is committed to working with the Ktunaxa and other Indigenous groups to ensure that Indigenous goals are incorporated into reclamation planning, and would consider inclusion of measures specific to possible re-establishment of bison to the area.

[1891] We accept that plains bison were historically present in the project area. We also accept Benga's evidence that plains bison rely on prairie grassland and open meadow habitat, and that habitat within the wildlife LSA could support bison following reclamation. However, we find that there are existing barriers to the successful reestablishment of plains bison in the project area, including land tenure and habitat fragmentation, connectivity, and disturbance. A successful reintroduction program would require connectivity to plains bison on the adjacent plains.

[1892] Many of the existing barriers are not within Benga's care and control. But we acknowledge Benga's commitment to work with the Ktunaxa and other Indigenous groups to ensure their goals are incorporated into reclamation planning. While we understand and respect the purpose of the Buffalo Treaty in the restoration and stewardship of the return of the bison within its historic range, we received no evidence from participants to support the case that bison reintroduction in the project area is reasonably foreseeable.

The project is not likely to result in significant adverse effects on wildlife species, but may contribute to already existing cumulative effects

[1893] For all species, we find that the magnitude of the effect of the project to be low or moderate, except for little brown bats, which would experience a high-magnitude effect if previously unidentified hibernacula were destroyed. For all species, the geographic extent is local, except for grizzly bears and wolverines, for which the effects are regional due to potential effects related to connectivity. We recognize that there is uncertainty associated with the effectiveness of Benga's proposed mitigation measures, particularly progressive reclamation, and certain wildlife species may not return to the project site for an extended period of time.

[1894] However, effective habitat is available for these species in areas adjacent to the RSA, and none of the areas potentially affected by the project are designated as critical habitat. The project will likely displace individuals from the project footprint. The surge ponds, raw water pond, and end-pit lake may pose a risk to wildlife, and migratory birds in particular, that frequent or interact with contaminated pond waters and may be attracted to suitable habitat in and around ponds. We are not confident that the limited mitigation measures proposed by Benga, in both the short and long term, will discourage birds from landing on the surge ponds, raw water pond, and end-pit lake, which are expected to contain elevated levels of contaminants of potential concern for an extended period and affect individual birds and amphibians.

[1895] Although individuals would be affected by the project, we find that the project is not likely to affect the sustainability of the populations of listed species in the RSA. We find that destruction of previously unidentified little brown bat hibernacula would result in the project having a significant adverse residual effect. However, this is unlikely to occur. For all other species, we find that the project is not likely to result in significant adverse residual effects. The criteria for our determination of significance are summarized below in Table 17-5.

Table 17-5. Summary of criteria for determining the significance of project effects on assessed wildlife

	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Ecological context	Significance
Amphibians							
Western toad	Moderate	Local	Persistent	Continuous	Irreversible	Negative	Not significant
Birds							
Baird's sparrow	Low	Local	Long	Continuous	Reversible after cessation of activities	Negative	Not significant
Barn swallow	Low	Local	Long	Continuous	Reversible after cessation of activities	Negative	Not significant
Clark's nutcracker	Moderate	Local	Persistent	Continuous	Irreversible	Negative	Not significant
Common nighthawk	Low	Local	Long	Continuous	Reversible after cessation of activities	Negative	Not significant
Olive-sided flycatcher	Moderate	Local	Long	Continuous	Reversible after cessation of activities	Negative	Not significant
Short-eared owl	Low	Local	Long	Continuous	Reversible after cessation of activities	Negative	Not significant
Mammals							
American badger	Low	Local	Long	Continuous	Reversible after cessation of activities but diminishing after a number of years	Negative	Not significant
Grizzly bear	Moderate	Regional	Long	Continuous	Reversible after cessation of activities but diminishing after a number of years	Negative	Not significant
Little brown bat	Moderate (or high if hibernacula destroyed)	Local	Persistent	Continuous	Irreversible	Negative	Significant (but not likely)
Wolverine	Low	Regional	Long	Continuous	Reversible after cessation of activities but diminishing after a number of years	Negative	Not significant

[1896] We are of the view that existing effects on little brown bats and grizzly bears within the wildlife RSA are already significant as a result of past, present, and existing projects and activities. While the project's contribution to these cumulative effects is moderate in magnitude, we adopted a precautionary approach due to the sensitive nature of these species. We conclude that the residual effects of the project, in combination with other projects and activities that have been and will be carried out, are likely to contribute to an existing significant adverse cumulative effect on little brown bats and grizzly bears. These cumulative effects occur primarily as a result of other past projects and activities.

[1897] We have moderate confidence in our assessment of effects on little brown bat, western toad, and Columbia spotted frog due to the lack of baseline information regarding presence of maternity roosts, hibernacula, and the lack of survey of the largest wetland in the wildlife LSA for amphibians. We also have moderate confidence in our assessment of effects on special status species due to the less-detailed assessment undertaken by Benga.

[1898] We have moderate confidence in our assessment of Benga's mitigation and monitoring measures as many of the proposed measures are standard practice; however, important site-specific details were often lacking. Additionally, many uncertainties with these measures were not addressed by Benga.

[1899] We have high confidence in our assessment for all other wildlife valued components and assessment indicators for which we had sufficient information to make a determination of significance for project and cumulative effects.

18. Wildlife Health

[1900] This chapter discusses health risks to terrestrial and semi-aquatic wildlife. Health risks to fish and other aquatic life are discussed in the chapter on surface water quality and the chapter on fish and aquatic habitat.

The evolution of Benga's wildlife health risk assessment

[1901] Benga submitted its initial wildlife screening risk assessment in 2016. It included only air emission sources and subsequent exposure by ingestion of contaminants deposited from the air onto terrestrial or aquatic environments. Benga did not predict any significant risks to wildlife health. This assessment screened out water-based exposure pathways after Benga predicted no adverse effects on surface water quality or aquatic life from liquid effluent discharges or other waterborne pathways. The original assessment did not address individual species. Instead, generic groups of mammals and birds were assessed for risks from exposure to airborne contaminants through inhalation or deposition from air to soil and water.

[1902] In March 2020, in response to an information request, Benga provided a wildlife health risk assessment that included water-based exposure pathways. Specific semi-aquatic mammals and birds were chosen to represent different feeding guilds; i.e., herbivores (plant-eating), insectivores (insect-eating), omnivores (plant-, insect, and/or other animal-eating), and piscivores (fish-eating). Exposure pathways included drinking water, sediment, aquatic and terrestrial plants, aquatic invertebrates, and fish. The deposition of contaminants of potential concern from air was added to predicted concentrations resulting from direct discharges to water. The assessment predicted potential risks from selenium in the end-pit lake but no risks from selenium or any other contaminant of potential concern at any of the other locations.

[1903] In June 2020, in response to a follow-up information request, Benga provided recalculated risk estimates for selenium and zinc, which resulted in increased risks from selenium in the end-pit lake, Blairmore Creek, and Gold Creek. In the course of providing worked examples of calculations for selenium and zinc, Benga adjusted the input parameters for sediment exposure and corrected a selenium uptake factor for fish tissue. Risks from selenium exposure increased in the end-pit lake and were also then predicted for Blairmore and Gold Creeks.

[1904] At the hearing, Benga acknowledged that its risk calculations did not use the updated water quality modelling results presented in the Eleventh Addendum. In response to an undertaking, Benga provided the results of re-calculated risks from exposure to 40 contaminants of potential concern, including selenium, in Blairmore Creek. Benga stated that the updated results did not produce changes which were substantial enough to change their overall conclusion of a low potential for adverse effects in fish-eating mammals and birds.

Assessment of risks from exposure to airborne contaminants of potential concern is conservative

[1905] The screening-level wildlife health risk assessment presented in the EIA assessed air-based exposure pathways and generic “mammalian/avian” receptors. Benga's air quality modelling was the first step in estimating exposure of wildlife to airborne contaminants of potential concern. The assumptions

used in Benga's air quality modelling assessment, including prediction conservativeness and uncertainties, are discussed in the chapter on air quality. For the purposes of the human health risk assessment, the predictions were considered reasonably conservative, with some concerns about the baseline air quality data and uncertainties around dust emissions estimates.

[1906] Conservative assumptions used to predict exposure to each contaminant of potential concern included

- maximum predicted air concentrations;
- wildlife receptors assumed to obtain 100 per cent of food from the assessed locations, with no consideration of home range or migration;
- evaluation of exposures that occur continuously (i.e., for air, 1-hour, 24-hour, and annual average); and
- use of inhalation rates for the smallest receptor species (little brown bat), for mammalian species only).
- Conservative assumptions for effects included
- use of the lowest reported no-observed-adverse-effect levels for all species associated with population-level endpoints or, if this was not available in the literature, the lowest-observed-adverse-effect level;
- application of an uncertainty factor of 10 for extrapolation from mammalian effects data to avian species for inhalation; and,
- wildlife daily threshold exposure doses derived from the more conservative values from the literature, which were usually no-observed-adverse-effect levels with additional uncertainty factors applied on occasion.

[1907] Hazard quotients resulting from inhalation were all well below 1.0, with the exception of acute exposure to PM_{2.5} and chronic exposure to NO₂, both of which have a hazard quotient of 1.4. Benga used human toxicity reference values for PM_{2.5} because of the lack of data for wildlife. Human toxicity reference values are designed to be protective of individuals, whereas wildlife toxicity reference values are designed to be protective of populations. Benga's use of a human toxicity reference value for PM_{2.5} can therefore be considered conservative. In addition, exposure was estimated using the maximum predicted concentration of NO₂ at the edge of the pit boundary, a location unlikely to be frequented by wildlife on a long-term basis.

[1908] Benga noted that maximum predicted long-term soil and surface water concentrations resulting from air deposition alone did not exceed soil and surface water quality guidelines. Benga stated that because of the highly conservative assumptions used during the wildlife risk assessment, its prediction confidence was considered high.

[1909] We find that given the conservatism used in the assessment and the marginal exceedance of 1.0 for PM_{2.5} and NO₂, it is unlikely that effects on wildlife health from these two contaminants of potential concern would occur. We find that there is a negligible risk of adverse effects from the other contaminants of potential concern because all hazard quotients are less than 1.0.

Key terms used in ecological risk assessment

[1910] Benga provided a reference to the Canadian Council of Ministers of the Environment's *Ecological Risk Assessment Guidance Document* (2020), which includes an explanation of key terms used in risk assessment:

- A **hazard quotient** (which is also called an exposure ratio) is the ratio between the exposure measure and a threshold for effect on health. Exposure can be derived in many ways, ranging from simply the measurement of concentration in soil, water or food to a modelled dose in units such as milligrams per kilogram of body weight per day. Effects thresholds can be based on environmental quality guidelines, literature reviews of toxicity studies, an analysis of the distribution of responses among species, field studies, or a meta-analysis of multiple sources of information.

Hazard quotients are not directly proportional to the magnitude of risk. They do not contain information about the specific probability that an adverse effect will occur, nor convey the magnitude of a potential adverse effect. Instead, they use conservative assumptions to calculate only whether the existence of adverse effects is either possible (a hazard quotient greater than 1.0) or unlikely (a hazard quotient less than 1.0).

- The **lowest-observed-adverse-effect** level is the lowest amount, dose, or concentration of an agent—found by experiment or observation—to cause an adverse alteration of morphology, functional capacity, growth, development or lifespan of an organism, system, population, or subpopulation. While methods of identifying a lowest-observed-adverse-effect level vary, statistical significance is often applied as a criterion.
- The **no-observed-adverse-effect** level is an exposure level at which no statistically or biologically significant increases in the frequency or severity of adverse effects between the exposed organisms or population and the appropriate control are observed. Some effects may be produced at this level, but they are not considered adverse. Methods of identifying a no-observed-adverse effect level also vary, and often apply statistical significance as a criterion.

Assessment of risk from exposure to waterborne contaminants of potential concern is not conservative

[1911] In an information request, we asked Benga to reassess the risk to wildlife health, considering water-based and air-based exposure pathways and individual species that are dependent on aquatic food items, such as migratory waterfowl, fish-eating birds, and northern river otters (*Lontra canadensis*). Benga was asked to screen all water-borne contaminants of potential concern for the tendency to bioaccumulate in lotic (flowing water) and lentic (still water) systems, including Blairmore Creek, Gold Creek, sedimentation ponds, the end-pit lake, and the Oldman Reservoir. Benga was asked to provide a multimedia exposure risk characterization from all exposure pathways.

[1912] Benga provided its response in the Eleventh Addendum. Benga added predicted deposition from air to modelled surface water concentrations to produce total project-related concentrations in water. Except for selenium, the estimated chemical concentrations in dust, soil, sediment, and food items (e.g., vegetation, invertebrates, fish) were based on the same calculations as those used for the human health risk assessment in the Tenth Addendum. Our review of the level of conservatism used in these

calculations revealed issues caused by limited baseline data and no congruence between observed and calculated concentrations in plants. This issue is discussed in detail in the chapter on human health.

[1913] Our review of the methods used by Benga to calculate the selenium concentrations in aquatic food chain items (algae, invertebrates, and fish) concluded that the selected approach was not conservative. Our review in the chapter on fish and aquatic habitat also prompted us to question the level of conservatism used to calculate non-selenium contaminants in aquatic food chains. There is a need for site-specific trophic transfer value data for non-selenium contaminants of potential concern in food chains relevant to the wildlife receptors. Until such data are available, any claim for conservatism in the trophic transfer factors used in Benga's risk estimates is open to debate.

[1914] Benga's assumption that wildlife obtains 100 per cent of food from the assessed locations, and that exposure occurs continuously over the periods being evaluated, is a key contributor to the conservatism in estimates of exposure. Benga's approach to the choice of daily threshold exposure doses also appears to be consistently conservative for assessment of risk at the population level.

[1915] We find that Benga's assessment of risks from waterborne exposure was not conservative. First, a lack of conservatism was used in water quality and aquatic food web modelling, as discussed in the chapter on surface water quality. Second, the calculation for the concentrations in soil and food items of contaminants of potential concern presented some deficiencies, as some calculated concentrations are less (and sometimes considerably less) than measured baseline concentrations, as discussed in the human health chapter. The assumption of 100 per cent residency in an assessed location is not necessarily conservative for species with a small home range. The use of wildlife daily threshold exposure doses derived for the protection at the population level is also not necessarily conservative for individual listed species or migratory birds.

Selenium was the only contaminant of potential concern predicted to pose potential risks of adverse effects on wildlife health

[1916] In its updated assessment in the Eleventh Addendum, Benga predicted that—except for selenium—the calculated exposure ratios for all contaminants of potential concern for all surrogate aquatic wildlife species in all evaluated habitats were below 1.0. Most exposure ratios for other contaminants of potential concern were much less than 1.0. Exceptions were thallium in the end-pit lake (with an exposure ratio of 0.12 for mallard ducks), methyl mercury in Gold Creek (with an exposure ratio of 0.11 for great blue herons), and methyl mercury in Blairmore Creek (with an exposure ratio of 0.21 for great blue herons). These exceptions are noted because of the lack of conservatism in water quality modelling, which raises the question of whether exposure ratios for thallium and methyl mercury would be greater than 1.0 if more conservative assumptions were used.

[1917] Selenium exposure ratios of 1.7 and 3.8 were calculated for the American dipper (*Cinclus mexicanus*) (representing bird species that eat aquatic insects) and mallard duck (*Anas platyrhynchos*) (representing birds with a varied and omnivorous diet), respectively, in the end-pit lake. All other exposure ratios for selenium in the Eleventh Addendum for other habitats assessed were below 1.0, although not always by a large margin. For example, the exposure ratios for mallard ducks and great blue herons exposed to Gold Creek water were 0.99 and 0.73, respectively.

[1918] In an earlier submission, ECCC and DFO expressed concerns about the exposure of migratory birds and *SARA*-listed species, including the little brown bat, to project-related contaminants of concern such as selenium. In its hearing submission, ECCC noted that the purpose of the *Migratory Birds Convention Act* is the protection and conservation of migratory birds, as populations and individuals. They noted that subsection 32(1) of *SARA* states that no person shall kill, harm, or harass an individual of a species listed as endangered or threatened. An interpretation of hazard quotients for migratory birds and endangered or threatened species should therefore include consideration of effects on individuals as well as populations. At the hearing, ECCC stated that acceptable risk to migratory birds would be evaluated according to guidelines proposed by the United States Environmental Protection Agency for selenium in bird egg tissue.

[1919] CPAWS noted that amphibians were excluded from the list of selected receptors in the assessment. The Métis Nation of Alberta – Region 3 requested that the assessment include culturally important receptors such as furbearers, ungulates, and waterfowl. Benga noted that the assessment included the northern river otter (a furbearer) as well as mallard ducks and geese (waterfowl) in its updated assessment, but did not include an ungulate species.

Each successive assessment produced increased selenium risk estimates

[1920] We prepared Table 18-1 from information in Benga’s submissions to summarize how its assessment of selenium risks changed during the assessment process. Reading down the columns of Table 18-1 shows how selenium exposure ratios increased with successive assessments, starting with the assessment in the Eleventh Addendum progressing to re-calculations in the Twelfth Addendum followed by the undertaking presented during the hearing. With each assessment, additional species and more locations were added with selenium exposure ratios greater than 1.0.

Table 18-1. Predicted selenium exposure ratios with successive assessments

End-pit lake			Blairmore Creek		Gold Creek		References
American dipper	Great blue heron	Mallard duck	Northern river otter	Great blue heron	Northern river otter	Mallard duck	
1.7	0.86	3.8	0.28	0.35	0.58	0.99	Assessment in Eleventh Addendum (CIAR 313, PDF pp. 1341 and 1343–44)
1.8	1.1	4.1	1.0	1.4	1.7	1.2	Recalculation in Twelfth Addendum (CIAR 360, PDF pp. 16–17)
Not determined	Not determined	Not determined	1.3	1.7	Not determined	Not determined	Recalculation in undertaking during hearing (CIAR 945, PDF p. 12)

[1921] The Twelfth Addendum includes recalculations that show increases in selenium exposure ratios. The increases were the result of adjustments to input parameters for sediment exposure and a corrected selenium uptake factor for fish tissue. Several selenium exposure ratios, including those for northern river otters and great blue herons in Blairmore Creek and northern river otters and mallard ducks in Gold Creek, increased to greater than 1.0. The highest exposure ratio continued to be associated with end-pit lake water, where the exposure ratio for mallard ducks was 4.1. Benga stated that the results in the Twelfth Addendum indicate that predicted exposures are either lower or slightly higher than acceptable

levels. Benga stated, “While the magnitude of the predicted exposure ratios is higher for selenium, the overall change to conclusions remains the same” (CIAR 360, PDF p. 17).

[1922] In response to an undertaking from us during the hearing, Benga presented recalculated exposure ratios for aquatic wildlife. The undertaking arose from Benga’s confirmation that the wildlife risk assessment presented in the Eleventh Addendum used the original water balance and load model results rather than updated water quality modelling results. For the undertaking response, Benga used results for the modelling node on Blairmore Creek, where the highest concentrations were predicted. Benga selected the average sulphate concentration for the time period with the highest predicted selenium concentration (sulphate concentration of 682.6 mg/L). Benga selected this value because its assessment included the ameliorating effect of sulphate on selenium uptake through aquatic food webs. The assessment included the adjustment of the calculation of sediment concentrations identified in the Twelfth Addendum.

[1923] The undertaking did not request or include recalculated risks for the end-pit lake, Gold Creek or the Oldman Reservoir. Therefore, if updated model results were used, the extent to which exposure ratios might have increased at these locations and whether additional exceedances of 1.0 would have occurred is unknown.

[1924] The changes made to calculations in the undertaking produced increased exposure ratios. However, Benga concluded that the changes were not substantial enough to affect the overall conclusion of a low potential for adverse effects on fish-eating mammal (northern river otters) and bird (great blue herons) surrogates of selenium exposure.

[1925] In their final arguments, participants noted remaining uncertainties in the wildlife health risk assessment. ECCC noted that, following discussions at the hearing, uncertainties remain with respect to the sources of selenium and the concentrations used by Benga to model the bioaccumulation of selenium in migratory birds and other wildlife receptors. For example, the use of water from the raw water pond for dust control on haul roads could allow selenium to enter the environment via runoff from the roads.

[1926] CPAWS asserted that metal (including selenium) levels in the end-pit lake would cause adverse impacts on any aquatic life that may develop in the lake, as well as semi-aquatic insects and birds that consume algae, plants, or insects from the lake. CPAWS noted that when a conservative approach indicated that the end-pit lake would cause problems, Benga re-evaluated the conservative approach as being overly conservative. It proposed to work on solving the metal contamination problems going forward.

[1927] We note that Benga’s risk characterization and associated conclusions regarding risk to wildlife health evolved from “no risk of adverse effects” to “very low” or “low” risk over the course of the review process. The rationale for the assignment of “very low” or “low” risk was based solely on the magnitude of the exposure ratios, accompanied by the conservative assumptions used in the assessment. The consistent increase in estimated selenium risks from the original risk assessment in 2016 to the undertaking response at the hearing in 2020 illustrates that Benga had to correct a series of flawed assumptions regarding exposure pathways, input parameter errors, and lack of conservatism in modelling during the review process.

[1928] We question whether the selenium risk estimates might have increased further if the water modelling had been more consistently conservative, as discussed in the chapter on surface water quality. For example, the Eleventh Addendum presented modelled selenium concentrations in Blairmore Creek that assume 90 and 95 per cent removal of selenium in the saturated backfill zone instead of the base-case assumption of 99 per cent removal. Predicted selenium concentrations of 70 and 35 µg/L, respectively, were described by Benga as “unacceptable.”

Successive assessments produced increased risk estimates for other contaminants of potential concern

[1929] The worked examples for selenium and zinc provided in the Twelfth Addendum showed higher exposure ratios for zinc, although the increases were slight and all exposure ratios remained below 1.0. Benga also reviewed copper and thallium results because both metals had higher exposure ratios compared with zinc. However, Benga found no reason to change its conclusions. No details were provided for copper and thallium. Benga stated that making the same adjustment to sediment bulk density that was made for selenium and zinc would result in the same relative change across the other contaminants of potential concern. Benga noted that its multimedia model accounts for different uptake into tissues for specific chemicals.

[1930] Benga’s undertaking response at the hearing included the assessment of aluminum, which the updated water quality modelling identified as a contaminant of potential concern. The aluminum exposure ratio for the little brown bat was 0.24 for Blairmore Creek water. Aluminum exposure ratios for the other receptors were much lower. Additionally, a change to the daily thresholds exposure dose for nickel was made to align with more current guidance from the Canadian Council of Ministers of the Environment. The adjustment did not produce any exposure ratios approaching or exceeding 1.0. Exposure ratios for cadmium, bivalent and trivalent chromium, cobalt, copper, lead, manganese, methyl mercury, silver, thallium, and zinc were all well below 1.0.

[1931] We believe that the exposure ratios for other contaminants of potential concern may have approached or exceeded 1.0 if water modelling had been more consistently conservative. For example, as discussed in the chapter on surface water quality, Benga’s modelling of non-selenium contaminants assumed the availability of a metals treatment plant. This is not a conservative assumption. At the hearing, Benga stated that it was not planning to install a treatment plant until levels of contaminants become elevated and were detected by its water monitoring system during mine operations. Benga expected that monitoring would provide sufficient advance warning of the need for treatment.

[1932] The surface water quality chapter also presents evidence that Benga’s assessment of the potential for acid generation within waste rock did not include assessment of the Fernie Formation, which is a geological formation at the mine site. We find that the exclusion of a contribution from metals leaching from the Fernie Formation may lead to underestimated predictions of metal loads from Grassy Mountain. But we also find that, given the low magnitude and local extent of effects for non-selenium contaminants, it is unlikely that exposure to these contaminants would cause significant adverse effects at the local or regional population level.

Amphibians were not included in the wildlife health risk assessment

[1933] In May 2020, in a set of recommended information requests, CPAWS raised concerns about the lack of an assessment of risks to amphibian health in Benga's wildlife health risk assessment. CPAWS stated that Benga's use of mammalian or avian surrogate species is not an acceptable substitute to represent the risk to amphibians. They proposed that Benga be asked to provide an analysis of the risks to amphibians within the project footprint. As discussed in wildlife chapter, the Columbia spotted frog and the western toad are rated as "sensitive" in Alberta, and the western toad is rated by COSEWIC as "of special concern." These species have been reported in the LSA, although a particularly important wetland on the project site was omitted from Benga's baseline surveys.

[1934] In the Eighth Addendum, Benga provided information describing the likelihood of selenium bioaccumulation, nitrate, and nitrite negatively affecting Columbia spotted frogs and other amphibians in waterbodies in the project footprint and downstream of the project. The potential effects include larval deformities, hormonal abnormalities, increased mortality, reduced feeding, and increased susceptibility to predation. Benga stated that high concentrations of selenium, nitrates, and nitrites downstream from the mine have the potential to cause mortality or deformities in western toad larvae. Benga provided information from Teck on the relative sensitivity of amphibians to nitrate, sulphate, and selenium. Benga did not provide any evidence about potential effects on local populations of amphibians should exposure to selenium and other contaminants of potential concern exceed thresholds such as those associated with larval deformities.

[1935] In response to questions at the hearing, Benga stated that the United States Environmental Protection Agency's 2016 surface water criteria and British Columbia's 2014 water quality criteria for selenium indicate that birds are the most sensitive to selenium. And if birds are sufficiently protected, so too are amphibians. In a follow-up question, Benga was asked whether amphibians would be expected to have a higher degree of exposure. Benga replied that it would depend on their diet, and noted that insufficient information exists to develop threshold doses for amphibians. Once more Benga argued that, even though amphibians may experience higher exposure than birds, if birds are protected, amphibians are also protected.

[1936] Benga acknowledged that, because some exposure ratios for birds are higher than 1.0, then risks to amphibians may exist as well, and that this possibility needs further evaluation. Benga also acknowledged that exposure to the surge ponds would "not be healthy for amphibians." In some cases, the concentrations of selenium and other contaminants of potential concern in surge ponds are orders of magnitude above water quality guidelines.

[1937] ECCC disagreed that mammalian and avian toxicity reference values can be considered protective of amphibians. They noted that egg-laying amphibians, birds, and fish are both the most likely to be exposed to selenium and the most sensitive species to selenium. ECCC pointed out that, even where similar sensitivity exists, great differences remain in terms of life histories, diet, and how amphibians would accumulate selenium. ECCC suggested that fish would be a better model to use if there were insufficient data for amphibians, particularly in the presence of concerns about selenium bioaccumulation and tissue uptake of different selenium species, such as selenite.

[1938] We find that amphibians may experience substantially greater exposures to selenium and other contaminants of potential concern because of their habitats and food choices. Furthermore, as noted by ECCC, the application of toxicity reference values for mammals and birds for selenium is not necessarily conservative.

Selenium exposure may cause adverse effects on individual listed or migratory birds, but adverse effects are not likely for local or regional populations of semi-aquatic or listed species

[1939] We consider that the issues concerning predicted risks to birds from selenium exposure involve

- local resident populations of American dippers;
- migratory great blue herons and mallard ducks using the LSA and RSA; and
- listed bird species using the LSA and RSA.

[1940] Predicted exposure ratios for the American dipper are 1.8 in the end-pit lake, and less than 1.0 in Blairmore and Gold Creeks. Benga considered an exposure ratio of 1.8 as only marginally indicative of potential risk. We would have greater confidence in this statement if the modelled water quality of the end-pit lake was consistently conservative. However, American dippers would not be expected to use the end-pit lake habitat if flowing water is available in nearby Blairmore and Gold Creeks. Population-level effects from selenium exposure in the American dipper are unlikely.

[1941] Predicted selenium exposure ratios greater than 1.0 have potential implications for migratory birds in the context of the *Migratory Birds Convention Act*. It prohibits the release of a deleterious substance to bird habitats in breeding areas. Selenium would be a substance requiring control and mitigation to ensure any release to bird habitat is reduced. As to what constitutes an acceptable level of risk, ECCC said that the United States Environmental Protection Agency has, for selenium, proposed a bird egg tissue burden guideline of 11.2 µg/g dry weight, based on hatching success. Exceedances of that level would imply an increased risk to birds and hatching success. ECCC added that, under the *Migratory Birds Convention Act*, the American dipper, common nighthawk, and barn swallow are protected as individuals. Under *SARA*, listed species can be afforded a more conservative level of acceptable risk.

[1942] Benga did not provide a predicted selenium concentration in bird egg tissue, and did not perform an assessment of the effects on local populations of migratory birds and amphibians. CPAWS stated that metal and selenium levels in the end-pit lake will cause adverse impacts on aquatic life as well as semi-aquatic insects and birds. They stated that contaminants in the end-pit lake will also bioaccumulate in species not residing in the lake.

[1943] Benga predicted that exposure ratios greater than 1.0 would occur for the migratory great blue heron and mallard duck, ranging from 1.1 to 4.1 (see Table 18-1). These risks would occur in the end-pit lake, Blairmore Creek, and Gold Creek. As noted in the evidence above, migratory birds are protected as individuals. Marginal exceedances of 1.0 may not be of concern, but the exposure ratio of 4.1 for mallard ducks exposed to the end-pit lake is of concern. The uncertain level of conservatism in these exposure ratios leads to the conclusion that effects on individual mallard ducks cannot be ruled out.

[1944] Benga's predicted risks to the American dipper and mallard duck may apply to barn swallows, common nighthawks, and olive-sided flycatchers, all of which are Schedule 1 *SARA*-listed species and rated as threatened by COSEWIC. These three species are known to occur in the LSA and feed on terrestrial adult insects with aquatic egg, larval/pupae, or nymph stages. American dippers and mallard ducks can both be assumed to consume the aquatic forms of the species that later emerge as adults and are consumed by barn swallows, common nighthawks, and olive-sided flycatchers. However, protection of all species of migratory birds is at the individual level, not the population level. Because the exposure ratios for mallard ducks and American dippers are greater than 1.0, this may also be the case for barn swallows, common nighthawks, and olive-sided flycatchers. However, the significance of exposure ratios greater than 1.0 may be higher for listed species.

[1945] Benga predicted low risks for listed bird species from exposure to surge ponds, Blairmore Creek, Gold Creek and the end-pit lake due to the layered conservatism used in the assessment for species considered surrogates for listed species. Conservative assumptions included obtaining food only from a specific location. Benga stated that the numerous levels of conservatism employed will protect listed bird species. ECCC stated that, while there may be health impacts on mallard ducks and the American dipper, the risks may be lower in common nighthawks and barn swallows. These species are not widely present or distributed within the region and may not be feeding in the same kinds of local watercourses as the dipper would be.

[1946] We find that listed bird species with food habits similar to those of the American dipper and mallard duck are unlikely to have risks as high as these two species, because the listed species are uncommon in the local and regional study areas. However, risks to individuals frequenting the LSA cannot be ruled out.

Adverse effects on northern river otters from selenium exposure are unlikely

[1947] Selenium exposure ratios for northern river otters were predicted to be greater than 1.0 for exposure to Blairmore Creek. The lack of exceedances of 1.0 for the end-pit lake (which was predicted to have much higher selenium concentrations compared with Blairmore Creek) can be attributed to Benga's assumption that there would be no fish in the lake. Benga assumed that fish make up 80 per cent of the river otter diet. Therefore, predicted northern river otter exposure to end-pit lake water would have been via drinking water and consuming benthic invertebrates.

[1948] Benga's plans for the end-pit lake do not include the introduction of fish. In response to a question at the hearing, Benga stated that it understands that life in the end-pit lake could include fish. It said that the objective would be to arrive at an end-pit lake that is a healthy part of the environment and that it would have time to gather more information and adjust the end-pit lake design accordingly.

[1949] Over the different assessments, the predicted ratios for exposure to selenium in Blairmore Creek increased from 0.28 to 1.3 for northern river otters.

[1950] The northern river otter is a surrogate for piscivorous mammals. Together with beaver, it represents furbearers, which are culturally important to Indigenous peoples as noted by the request by Metis Region 3 to include culturally important receptors such as furbearers, ungulates, and waterfowl. The potential for adverse effects on local and regional populations of northern river otters due to exposure

to Blairmore Creek is low. The exceedance of 1.0 is small and probably within the conservatism built into predicted exposure as well as the daily threshold exposure dose, which was based on critical effects on reproduction. However, our confidence in the low potential for effects is lessened by the lack of conservatism in the prediction of selenium concentrations in Blairmore Creek. This is discussed in detail in the surface water quality chapter.

[1951] Fish may eventually colonize the end-pit lake, and would then be a substantial contributor to exposure of northern river otters using the lake as a food source. Ratios for exposure to the end-pit lake could be much greater than 1.0 and could affect individual otters' reproductive success. Effects on the local or regional population would depend on the cumulative exposure to selenium from all sources.

Combined effects of chemical toxicity and habitat alteration, degradation, or elimination were not assessed

[1952] At the hearing, Benga was asked about the significant loss of a treed wetland and whether this loss, compounded by contaminant exposure, would cause combined effects. Benga stated that the treed wetland is not connected to creek drainage and would primarily be receiving aerial deposition, which is 1 per cent of the total concentration evaluated. Benga concluded that cumulative effects would be very low in terms of air deposition and potential habitat loss (of the treed wetland) and predicted no habitat loss in the creek areas. Benga stated that there is little documented information on synergistic as opposed to additive effects in the toxicology literature. It noted that even adding some of the exposure ratios would not have changed its conclusions.

[1953] Benga confirmed that it was not aware of cumulative effects modelling tools, which allow for a consideration of both habitat-related stressors and contaminants. ECCC stated that additive effects of contaminants of concern, and synergistic effects, can occur, but that it would be difficult to tease them apart in the natural environment, based on the concentrations that can be expected. ECCC noted that selenium would be the predominant risk in terms of contaminant and biotic receptor interaction. They said any additive effects from other contaminants that are much lower in proportion in the environment around the mine compared with selenium would be drowned out by that relationship. ECCC stated that there is a potential for effects from the combination of exposure to several contaminants plus habitat loss or degradation plus non-project activities, but that they did not review this topic.

[1954] Benga's assessment does not address cumulative risks of exposure to multiple contaminants of potential concern, even though wildlife would be exposed to a diverse and dynamic combination of chemical stressors. However, we recognize that regulatory guidance for conducting cumulative wildlife health risk assessments is not available in Canada. Neither Benga's dismissal of the potential for either additive or synergistic risks from groups of chemicals nor ECCC's expectation that selenium would "drown out" the effects of other contaminants was supported by evidence on the record.

[1955] In summary, we find that there was a lack of evidence regarding the potential combined effects of chemicals and habitat loss or degradation. While not surprising, and not a requirement of the EIA terms of reference for the project, we note it here for the purposes of potentially informing future terms of references for environmental impact assessments.

Benga's proposed mitigation measures to reduce risks to wildlife health vary in the level of detail and potential effectiveness

[1956] Mitigation measures that reduce exposure of wildlife to contaminants of potential concern include measures to reduce air and water emissions. These topics are discussed and reviewed in the chapters on air quality and surface water quality. Exposure ratios for airborne contaminants were greater than 1.0 for PM_{2.5} and NO₂. As discussed in the air quality and human health chapters, Benga proposed reasonable combustion emission controls and technologies to address NO₂.

[1957] The key water quality mitigation measures that drive wildlife health risks from project-related water discharges to Blairmore Creek and downstream to the Oldman Reservoir are the capture of water in contact with waste rock, treatment efficiency in the saturated backfill zone, and the assumption of a metals treatment plant. The key mitigation measures for discharges to Gold Creek are the capture of contact water and the mitigation of seepage to groundwater, which discharges to Gold Creek. In the chapter on surface water quality, we find that neither Benga's assumed capture rate of contact water nor assumed selenium removal efficiency in the saturated backfill zone is conservative. We do not have confidence in Benga's overly optimistic assumptions on either the capture rate or the removal efficiency. The exposure could be higher than predicted by Benga.

[1958] Benga's predicted risks to wildlife health (specifically birds) are higher at the end-pit lake location than any other receptor location. Nevertheless, Benga did not suggest any corresponding mitigation measures. Rather, during the hearing, Benga suggested it might need to assess the quality of the rock at the end-pit lake location, and potentially even move the lake to a slightly different location. Benga did not feel it was necessary to discuss the design and mitigation measures for the end-pit lake because the design of the lake would not occur for 10 to 15 years.

[1959] At the hearing, Benga identified another issue requiring mitigation, namely the exposure of amphibians to high concentrations of contaminants of potential concern in the surge ponds. As presented in the wildlife chapter, Benga proposed to deploy pitfall traps and relocate amphibians away from the surge ponds and other high-exposure areas. Monitoring of the traps during the life of the mine would depend on the season and how often an amphibian was found in a trap. Monitoring of the traps would continue routinely after mining operations until the surge ponds are closed. Benga would engage a local contractor to maintain these traps. Benga stated that the pitfall traps would be supplemented by exclusion fencing, which is often used at long-term industrial sites. Benga also suggested that it would consider installing noise cannons or flags to prevent birds from landing on surge ponds.

[1960] Benga suggested it will need to implement protective measures to limit the interaction of wildlife with untreated water accumulating in the raw water storage pond, surge ponds, or other water management ponds and drainage ditches. This activity would be subject to the results of water quality monitoring. Benga provided a non-exclusive list of deterrents, such as wildlife fencing, amphibian pitfall traps, and mannequins (scarecrows) to limit wildlife interactions with contaminated water bodies. Benga witnesses discussed the potential for using flagging tape on ropes, fencing, water cannons, and effigies or scarecrows.

[1961] ECCC agreed with the deterrents proposed by Benga to minimize the contact of amphibians and waterfowl with the surge ponds. But they noted that monitoring should be undertaken to determine which species and numbers were found to interact with the ponds, and the deterrents adjusted to improve the effectiveness of deterring those species.

[1962] The mitigation of air and water emissions received a great deal of attention in the EIA and subsequent addenda. But mitigation of wildlife contact with waterbodies containing high concentrations of contaminants of potential concern, such as the surge ponds, received little attention. Benga provided virtually all the information it had regarding the reduction or prevention of contact with contaminated areas at the hearing.

[1963] The chapters on air quality and surface water quality present discussions on the effectiveness of mitigation measures related to air and water emissions. We find that uncertainty regarding the effectiveness of water management and treatment measures—such as contact water capture and selenium attenuation in the saturated backfill zone—reduces our confidence that wildlife health risks would be as low as predicted. Evidence of the effectiveness of measures to prevent wildlife interaction with contaminated water bodies, particularly in the long term, was limited to brief statements by Benga and ECCC at the hearing.

Benga did not provide any specific plans for monitoring of wildlife health

[1964] Benga stated that it had committed to a wildlife monitoring program and an Indigenous-led monitoring program that will “lean heavily into” wildlife health. No details regarding the approach to wildlife health monitoring were provided. ECCC stated that any sort of compound with the potential to bioaccumulate and biomagnify through an aquatic food web should be part of the aquatics monitoring program. They said the program should also encompass other constituents associated with coal mining and water quality, such as nitrates and sulphates. A before-and-after, control-impact design was suggested, with abiotic samples and associated values that would trigger additional avian egg monitoring data on a periodic basis, depending whether certain thresholds are passed.

[1965] ECCC stated that it was important to monitor different compartments within the aquatic food web, including algae, and then have Benga identify concentration levels and triggers. At that point, additional mitigation could take place as needed. ECCC explained their use of the term “site-specific thresholds” as it applies to interpretation of selenium monitoring data:

- Factors that modify selenium uptake need to be considered.
- Triggers for lower compartments within the food web are necessary.
- Thresholds should be developed up front and applied to baseline as well as later monitoring that include
 - site-specific thresholds for vertebrates that include a tissue-egg burden threshold for bird species, and
 - efforts to fill data gaps and develop a threshold for amphibians.

Selenium exposure may result in adverse effects to individual migratory birds and listed amphibians

[1966] We find that the overall level of conservatism inherent in the wildlife health risk assessment is difficult to evaluate with confidence. Although the assumptions regarding duration and frequency of exposure are highly conservative, the lack of conservatism in water quality modelling leads to insufficient precaution, specifically for listed migratory birds and amphibians.

[1967] In the chapter on surface water quality, we find that contamination may be underestimated in sedimentation ponds, and that end-pit lake water quality is likely to pose long-term risks to aquatic life. We find that the methods used to model end-pit lake water quality are unclear and the level of conservatism applied is questionable as a result of non-conservative assumptions made by Benga.

[1968] We find that selenium risks to the health of individual migratory birds and listed amphibian species are likely underestimated and of potential concern because

- water quality modelling in Blairmore and Gold Creek is not conservative and may substantially under-estimate concentrations of selenium;
- the exposure ratio for mallard ducks exposed to end-pit lake water is 4.1;
- exposure to selenium is likely to occur at several locations with elevated concentrations in addition to Blairmore and Gold Creeks and the end-pit lake, including the raw water ponds, surge ponds, and drainage ditches; and
- mitigation measures to prevent or reduce exposure to contaminated areas are not described in detail or supported by evidence demonstrating effectiveness.

[1969] We recognize considerable uncertainty surrounds the magnitude and duration of the selenium exposure that would occur should the project be constructed. Given the uncertainties in Benga's assessment and the protection afforded to migratory birds at both the individual and population levels, as well as the protection afforded to listed amphibian species, we adopt a precautionary approach to our assessment of the risk to wildlife health for these species.

[1970] We find that the possibility of adverse effects on individual migratory birds and amphibians cannot be ruled out. We expect that increases in wildlife health risks would be confined largely to the immediate project area. While exposure to some contaminants of potential concern would end when mining operations and reclamation activities cease, exposure to other contaminants, including selenium, may extend into and beyond the closure period.

[1971] We find that residual adverse effects on amphibians such as the Columbia spotted frog and western toad from exposure to contaminants of potential concern cannot be ruled out, based on the evidence provided by Benga. The consequences of adverse effects, such as deformities and increased susceptibility to predation, on individual amphibians inhabiting the LSA may lead to effects on the local population, particularly if mortality increases and reproductive success decreases. In other words, the exposure of individuals in Blairmore and Gold Creeks, the end-pit lake, and downstream environment, may result in a decline in local populations.

[1972] With respect to the American dipper, exceedances of an exposure ratio of 1.0 are confined to the end-pit lake, and the predicted exposure ratio of 1.8 is only marginally above 1.0. Given that American dippers would not be expected to use the end-pit lake if nearby flowing water is available in Blairmore and Gold Creeks, the predicted risk from selenium exposure would be reduced.

[1973] In Blairmore Creek, adverse effects on local and regional populations of northern river otters due to exposure to selenium are unlikely because the exceedance of 1.0 is small and probably within the conservatism built into predicted exposure and daily threshold exposure dose. However, confidence in the low potential for effects is weak because of the lack of conservatism in the prediction of selenium concentrations in Blairmore Creek. We note that any fish that colonize the end-pit lake would be a substantial contributor to the exposure risk for northern river otters using the lake to feed. Effects on the local or regional population would depend on the cumulative exposure to selenium from all sources.

[1974] With one possible exception, we find that adverse effects on wildlife health from other contaminants of potential concern would be unlikely, as most predicted exposure ratios are well below 1.0. The risk to the little brown bat from exposure to aluminum in Blairmore Creek may be an exception because Benga acknowledged that updated modelling identified aluminum as a contaminant of potential concern, with a predicted exposure ratio of 0.24 for the little brown bat. While the exposure ratio is below 1.0, this may be an underestimate due to the lack of conservatism in the water modelling.

[1975] Regarding cumulative risks of exposure to multiple contaminants of potential concern, we cannot make a conclusion. Neither Benga's dismissal of the potential for either additive or synergistic risks from groups of chemicals, nor ECCC's expectation that selenium would "drown out" effects of other contaminants, were supported by evidence on the record. We reiterate the importance of key mitigation measures that would affect wildlife health risks from exposure to Blairmore and Gold Creeks, specifically the capture of water in contact with waste rock, the treatment efficiency in the saturated backfill zone, and the assumption of a metals treatment plant. We note that Benga does not plan to build a metals treatment plant at the beginning of the project.

[1976] We find that Benga did not provide sufficient information on the mitigation of predicted risks to wildlife health at the end-pit lake location. We discuss this further in the wildlife chapter.

Recommendation 5: We recommend the Impact Assessment Agency of Canada develop regulatory guidance for proponents conducting wildlife health risk assessments on how to address the cumulative effects of multiple stressors. We also recommend that the analysis be required in the tailored impact statement guidelines for future impact assessments.

Benga provided limited evidence regarding the potential combined effects of chemicals and habitat loss or degradation in its evaluation of project impacts on wildlife health. Such information would improve the quality of information available to decision makers.

19. Human Health

The evolution of Benga's human health risk assessment

[1977] Benga's initial human health risk assessment, submitted in 2016, predicted the project would cause no significant human health risks. The assessment focused on sources of air emissions, as well as subsequent exposure via inhalation or ingestion of contaminants deposited from air to terrestrial or aquatic environments. The quantitative human health risk assessment is presented in Consultant Report 12 of the EIA. It considers air emissions solely over a spatial area that is defined by the potential extent of air quality effects arising from the project.

[1978] Benga assumed the project would have no direct effect on water quality during or after operations, including the end-pit lake. The assessment considered only baseline and project-related health risks, since in 2016 no planned future developments were identified. Some risks from exposure to NO₂, PM_{2.5}, and PM₁₀ within the project footprint and in Coleman and Blairmore resulted in a hazard quotient of 1.0. (A hazard quotient is the ratio between the potential exposure to a substance and the level at which no adverse effects are expected. A value less than 1.0 suggests exposure will not induce adverse effects.) But none of the predicted risks were judged to be significant. Benga recommended no additional mitigation of emissions beyond those already assumed by other disciplines.

[1979] In 2019, with the submission of the Tenth Addendum, Benga provided an updated assessment of human health risks resulting from air emissions. This was in response to our request for information. The assessment integrated information related to human health risks in Addenda 1 through 9 and additional material that reflected responses to information requests. The assessment also provided total exposure from combined inhalation and multimedia exposures compared with a hazard quotient of 0.2. The updated assessment concluded that air emissions from the project would not pose a risk of adverse health effects at locations accessible to the general public. For multimedia exposure to several metals, Benga attributed exceedances of a hazard quotient of 0.2 entirely to naturally elevated background concentrations. No formal evaluation of significance was conducted for the updated assessment.

[1980] In March of 2020, with the submission of the Eleventh Addendum, Benga provided a human health risk assessment that included water-based exposure pathways in response to our information request. The inclusion of water-based exposure pathways produced additional exceedances of a hazard quotient of 1.0 or 0.2 for multimedia exposure, and exceedances of the incremental lifetime cancer risk target of 1 in 100 000 for arsenic. For example, predicted hazard quotients for the most sensitive receptor age group (toddler) to water-based pathways originating in Blairmore Creek exceeded 1.0 for aluminum, barium, cadmium, lead, and manganese, and 0.2 for antimony, methylmercury, selenium, and thallium. However, Benga concluded that no potential adverse human health effects existed. This conclusion was derived by combining the high contribution of natural background metal concentrations with conservatism in the assessment, which produced "margins of safety."

[1981] In June 2020, in response to our information request, Benga provided further information on the level of conservatism in the human health risk assessment and clarified the calculation methods used to produce risk estimates. Benga provided worked examples of calculations for arsenic and fluoranthene risks in response to the information request. In the course of providing these examples, Benga made small

adjustments to input parameters for fluoranthene and discovered an input error specific to arsenic. Neither of these adjustments changed the overall conclusion of the predicted risk via airborne pathways. However, the incremental lifetime cancer risk from arsenic exposure via water-based pathways was about 200 times higher than through air (1.04×10^{-7} from air deposition versus 2.05×10^{-5} from water-based pathways in Blairmore Creek). Benga concluded that long-term exposure to surface water in Blairmore and Gold Creeks would result in a “very low” risk of adverse health effects. Benga acknowledged that “a higher potential” for adverse health effects existed from long-term exposure to end-pit lake water.

[1982] During the hearing, Benga acknowledged that its risk calculations did not use the results of the updated water quality modelling results in Appendix 6.25-1 of the Eleventh Addendum. In response to an undertaking, Benga recalculated the risks from exposure to arsenic and copper in Blairmore Creek. The results were higher than those originally calculated. The undertaking did not request and does not include recalculated risks for other contaminants of potential concern. Arsenic is the only contaminant of potential concern that exceeds Health Canada risk targets. Updated modelling of copper produces the greatest increase in predicted concentrations when compared with the original modelling.

The potential for increased health risk due to dust and fine particulate matter is a key concern of participants

[1983] In the Tenth Addendum, Benga noted the predicted exposure to the maximum predicted air concentrations exceeds the target hazard quotient of 1.0 for inhalation of $PM_{2.5}$ and PM_{10} , and a hazard quotient of 0.2 for coal dust, silica, and diesel particulate matter. Benga stated that the locations of the maximum point of impingement receptors are close to key project activities at the edge of the pit boundary within the project footprint. This area would be off-limits to the general public during construction and operation. Exceedances predicted for areas outside of the mine permit boundary are for PM_{10} and coal dust, which was modelled from PM_{10} concentrations. Benga concluded in the Tenth Addendum that “based on multiple lines of evidence the potential risk of adverse health effects caused by chronic exposure to PM_{10} is low” (CIAR 251, Package 5, PDF p. 517).

[1984] Benga acknowledged that its predicted hazard quotients for coal dust in the Tenth Addendum were based on a very conservative estimate of PM_{10} toxicity. Benga concluded that chronic inhalation exposure to project-related coal dust presents a negligible risk of adverse human health effects. This conclusion was based on multiple lines of evidence. These include restricted access to those locations where predicted hazard quotient values were greater than 0.2; the conservatism in using PM_{10} data and comparing those data to a toxicity reference value based on PM_4 (particulate matter $>4 \mu m$ in diameter); and the fact that all predicted hazard quotient results were less than 1.0 (apart from the on-site location).

[1985] In the Tenth Addendum, Benga stated that silica presents a negligible risk because the location where the hazard quotient was greater than 1.0 would be inaccessible to the public. Meanwhile, the off-site exceedances of a hazard quotient of 0.2 were “marginal.” Benga concluded in the Tenth Addendum that project-related diesel particulate matter would not pose a risk of adverse health effects. This conclusion was based on the restricted access to the mine site and the fact that, outside the mine area, the contribution of diesel particulate matter would be primarily from baseline emissions. Benga also relied on the conservatism inherent in the derivation of the toxicity reference value, as well as air quality modelling.

[1986] During the hearing, Health Canada stated that it does not necessarily agree with the use of PM₁₀ as a surrogate for exposure to coal dust. Health Canada noted limitations in the assessment of risks to human health such as the lack of total project dust considerations from all sources (not just coal dust), a single year's accumulation of dust, and the lack of analysis of the health effects of coal and mixtures that include coal. Health Canada also expressed reservations about Benga's assessment of risk from metals that may be associated with coal dust, given that no actual assessment occurred of metal bioavailability.

[1987] Benga did not use Health Canada's recommended California Environmental Protection Agency approach to assessing health risks associated with diesel particulate matter. Benga argued that the 1998 California Environmental Protection Agency standard lacks scientific justification, and that current epidemiological studies are not representative of emissions from newer diesel engines. Benga concluded that a carcinogenic assessment of diesel particulate matter using the California Environmental Protection Agency approach was inappropriate. At the hearing, Health Canada noted that using individual compounds that are part of the diesel mixture to assess potential cancer risk is not as appropriate as assessing the potential cancer risk as a mixture. The implications of this to the defensibility of the ultimate analysis of health risks associated with diesel particulate matter are unknown.

[1988] In its final argument, Health Canada identified the following limitations associated with risks from dust exposure: only a single year's worth of data on accumulation of dust; lack of consideration of total project dust from all sources, not just coal; lack of cumulative exposures from all media (including project dust plus resuspended dust); and lack of analysis of the health effects of coal and mixtures that include coal.

[1989] R. Fraser and M. Fraser expressed their concerns about being in the direct path of substantial prevailing winds (chinooks) in the area. They pointed out that the release of dust and smaller polluting particulates from mining activities will affect air quality, human health, and the environment. The use of explosives in mountain-top removal releases large quantities of dust into the atmosphere, as the mountain gets reduced to rubble for processing. They stated this dust will be made up of rock and coal dust, which are universally recognized as dangers to human health and the environment. Ms. J. Lawson noted that many studies show how dire the effects of pollution, including particulate matter from coal, can be, and that there are no safe levels. Such pollution, she stated, can not only result in lung and heart disease, but birth defects and even dementia, as it can cross the blood-brain barrier in humans and animals. Such knowledge, she added, can cause great anxiety.

[1990] During the review process, Piikani Nation elders identified concerns about physical health, particularly those related to dust and fires, given that the prevailing winds are from the west through Crowsnest Pass blowing toward Brocket. Prior to withdrawing their objection to the project, Tsut'ina expressed a similar concern, stating that Benga had not assessed the impacts from coal dust, which will adversely affect the surrounding areas, polluting the water, contaminating plants, and deterring Tsut'ina harvesters from using the area.

[1991] The Eco-Elders for Climate Action stated, "We have long known that coal mining is dangerous to human health. Some of us have lost grandparents because of coal dust over a life of working in the mines. With underground mining the poisons are somewhat contained, however surface mining does not have that containment" (CIAR 536, PDF p. 2). In their submission, the Eco-Elders provided scientific journal articles on the human health impacts of mountain-top removal mining.

[1992] The Livingstone Landowners Group stated that the human health risk assessment methods do not readily lend themselves to the assessment of complex mixtures such as dust. Nor do such methods address the broader aspects of community health and wellness. The group argued that a proper human health impact assessment is a more comprehensive process that, in addition to the results of the risk assessment, considers other available information, such as epidemiological studies. The group’s expert witness, Dr. J. Dennis, described an extensive epidemiological literature review (33 peer-reviewed studies) in which the human health effects of mountain-top-removal open-pit coal mining are examined. He described the studies as the gold standard for conducting human health risk assessments. Benga stated that if “good epidemiological studies” are available, they could be used in addition to laboratory toxicity studies in risk assessments. The landowners group submitted that “it is clear that epidemiological studies of actual populations are superior to studies that rely wholly on predictive modelling” (CIAR 1351, PDF p. 98).

[1993] In its hearing submission, the Livingstone Landowners Group provided a document prepared by Dr. Michael Hendryx regarding the health effects of mountain-top-removal coal mining in the Appalachian region of the U.S. Dr. Hendryx, who did not appear as a witness at the hearing, was described by the group as a “well-respected and prominent US academic with expertise in human health impact assessment and epidemiology.” The document provided a compilation and brief summary of more than 30 studies that Dr. Hendryx believed showed a link between public health consequences and Appalachian coal mining.

[1994] The Livingstone Landowners Group’s submission included a summary that stated that coal mining in Appalachia, particularly in mountain-top-removal mining areas of West Virginia and other parts of central Appalachia, is associated with a set of serious public health problems. These include higher rates of cancer and heart and lung disease. It also stated that the economic costs of health problems in Appalachian coal-mining areas are more than five times greater than the economic benefits from mining. The group noted that Dr. Hendryx concluded the overall pattern of results from this research—and from research conducted by other scientists—indicates that mountain-top-removal coal mining is destructive of local environments and impairs human health. In their final argument, the landowners group reiterated concerns that Benga failed to address and acknowledge relevant epidemiological studies in its human health risk assessment.

[1995] Benga noted in its final argument that the paper described by Dr. Dennis as the “most objective human health impact review of all the literature” included the following quotes:

“However, a direct link between the exposure and health effects cannot be confirmed.”

“The observational literature was found to include inconsistent associations of MTR [mountain-top removal] mining with a variety of human health effects.”

“...these studies were not designed to tie individual-level exposure data to individual-level health effects.”

“Particulate matter in the air and contaminants in the water supply can adversely affect the people who breathe and drink them, but without this additional research, the contribution of MTR mining on the health of residents in nearby communities cannot be fully assessed.” (CIAR 962, pp. 134–135).

[1996] Benga argued that Dr. Dennis did not connect the Appalachian studies he cited to coal mining in Canada, nor to mining at Grassy Mountain in the Crowsnest Pass. Benga stated that Dr. Dennis' evidence is based on email correspondence received from a professor who did not assess this project, and included a "meta-analysis" that clearly identifies the data's limitations.

[1997] Benga acknowledged at the hearing that the *Sparwood Livability Study* identifies nuisance coal dust as a primary concern. Benga stated that it would implement a suite of mitigation measures to keep coal dust down to acceptable levels, and will consult with a community committee to address these issues up front. Benga confirmed that dust-fall would be monitored, and acknowledged that attempting to correlate community dust complaints with dust-monitoring data is worthwhile. Health Canada confirmed at the hearing that it does not have any guidance with respect to nuisance effects of dust on health. Nor is Health Canada aware of any research correlating nuisance dust levels with mental or physical health effects.

[1998] Benga's assessment of the potential risk of adverse health effects from exposure to fine particulates is based on Benga's air quality modelling assessment, although some uncertainty related to particulate predictions remains (see the chapter on air quality). We agree that exceedances of a hazard quotient of 0.2 at off-site locations are marginal and recognize the proportionately high contribution of baseline fine particulate concentrations to these exceedances.

[1999] Several uncertainties exist in Benga's assessment of the potential risk from exposure to dust in general and coal dust in particular. Baseline data are limited to a single year. Benga did not perform an assessment of coal dust as a complex mixture. Instead, Benga relied on assessments of individual chemicals of potential concern that can be associated with dust. Chemical-by-chemical assessments of risk are not the same as an assessment of risk posed by a complex mixture. Benga did not assess the combined risk of coal dust plus dust from other sources. Several participants noted the prevalence of dusty conditions already occurring in the Crowsnest Pass and expressed concerns about additional dust sources.

[2000] We find that Benga's assessment of the potential risk of adverse health effects from exposure to fine particulates is conservative, indicates only marginal exceedances, and is driven by baseline concentrations. However, we conclude that Benga's assessment of risk from exposure to dust in general and coal dust in particular is not conservative, relies on limited baseline data, does not consider the effects of coal dust as a complex mixture, and does not consider the combined risk of coal dust plus dust from other sources. We note the limited evidence on the record regarding nuisance effects of dust and the potential coal dust has to cause health effects (including mental health effects). We recognize the potential for nuisance effects; yet we did not receive sufficient evidence to draw a conclusion.

[2001] We find that the information on health effects of coal mining in the Appalachian region is subject to several important limitations, which are listed in the Livingstone Landowners Group's hearing submission. These limitations raise uncertainty regarding the validity of the interpretation of the information by the group's expert, Dr. Dennis. This is particularly the case with respect to extrapolation to effects on people living in the Crowsnest Pass and surrounding area. While suggestive of the potential for health effects, the information from the Appalachian region requires confirmation using definitive

longitudinal and/or cross-sectional epidemiological studies. Given these limitations and that the information provided by Dr. Hendryx could not be tested at the hearing, we gave it low weight.

[2002] Notwithstanding the limitations of the information provided by Dr. Hendryx, we recognize the value in supplementing the quantitative human health risk assessment with other types of information. For example, a collection of concurrent baseline health and environment information from the Crowsnest Pass and the surrounding area would have strengthened Benga's proposed monitoring program, and indicated that Benga understands that the protection of human health goes beyond consideration of individual hazard quotients. A proposed study of dust and health and wellness indicators would also have strengthened Benga's case. This study could have been designed to be similar to the *Sparwood Livability Study*.

The potential risks of adverse effects from inhalation of nitrogen dioxide are low

[2003] In accordance with a Health Canada recommendation, Benga compared predicted NO₂ concentrations with the CAAQS in the Tenth Addendum. This is to address the lack of clear evidence of a threshold dose for NO₂, below which no adverse effects were reported. The resulting hazard quotients were greater than 1.0 at 11 of the 15 human health risk assessment locations. All exceedances at off-site locations were only slightly above 1.0. Benga stated that off-site NO₂ concentrations were either lower than background contributions or only marginally elevated. Benga predicted that the CAAQS would be exceeded less than 2.85 per cent of the time, except at on-site locations and the Blairmore North location. The frequency of exceedance at the Blairmore North location was 5.28 per cent of the time.

[2004] Benga stated that a sensitive individual would be unlikely to experience any adverse respiratory symptoms (shortness of breath or wheezing) at any of the receptor locations. However, in the unlikely event an incident occurred, the effect would be transient and occur only at the maximum point of impingement (the hypothetical worst-case location with highest predicted air concentrations).

[2005] Benga concluded that, although there are predicted exceedances of the CAAQS for NO₂, multiple lines of evidence indicate that the risk of adverse health effects is low. Benga's lines of evidence are

- the dose-response curve for NO₂ is likely to be close to linear; therefore, any exposure, no matter how low, has the potential to cause adverse health effects;
- CAAQS offer the most conservative toxicity reference value;
- predictive air quality modelling is inherently conservative;
- modelled background concentrations are "overly conservative"; and
- time-series modelling shows that predicted exceedances are infrequent.

[2006] At the hearing, Health Canada expressed no concerns about the conservatism in the predictive modelling. Health Canada agreed that the contribution of project sources to predicted concentrations of NO₂ within Blairmore and Coleman is relatively small. They noted that other receptor locations farther to the north have relatively larger project-related contributions.

[2007] Health Canada stated that the CAAQS are meant to improve air quality over time; however, NO₂ is a non-threshold substance because there is no threshold at which effects are known not to occur. Because effects may occur below the standards, Health Canada's view is that there should be constant and continuous improvement and reduction of levels to ensure health benefits. Health Canada noted at the hearing that, while there has been new modelling for NO₂, no new human health risk assessment has been conducted. Health Canada acknowledged that the results of the modelling have been fairly consistent, but its representatives did not know if there would be differences in predicted risks.

[2008] At the hearing, ECCC said that Benga's NO₂ baseline data are inadequate. They noted that the updated modelling provided by Benga in its October 5, 2020, hearing submission corrects some aspects of baseline data. ECCC went on to say that the modelling does not alleviate the need for effective baseline data in advance of the project. ECCC noted that the NO₂ sensor being used by Benga to collect baseline data in Blairmore may not provide data of sufficient quality.

[2009] We agree with Benga's conclusion that the risks from inhaling NO₂ are low. This conclusion is consistent with the balance between conservative modelling of NO₂ emissions, which tends to overestimate concentrations, and the non-threshold (below CAAQS) nature of the effects. Two points emerge from the evidence: first, improvements in the baseline data are needed to confirm that baseline NO₂ is substantially higher than project-related sources; and second, there should be continuous improvement and reduction of NO₂ emissions.

The assessment of water-based exposure to contaminants is not conservative

[2010] Benga described its conservative assumptions regarding derivation of concentrations in water as follows:

- The risk assessment was based on 95th percentile concentrations calculated from monthly concentrations of 23 years of operations and a 57-year post-closure period from the upper-case model scenario, which was based on highly unlikely source terms.
- The effectiveness of progressive reclamation to reduce quantities of percolating water through external rock dumps has not been considered.
- Predicted concentrations of contaminants of potential concern would persist for 80 years.
- Each of these assumptions is subject to question.

[2011] During the hearing, Benga amended its description of the basis for predicted concentrations in water. It clarified that the 95th percentile concentrations refer only to upper-bound source terms in the 2016 water quality model, not the 2020 updated model. In response to an undertaking at the hearing, Benga presented results for arsenic and copper using the updated model. The results show that the incremental lifetime cancer risk increases from 2.5×10^{-5} to 3.2×10^{-5} for multimedia arsenic exposure, including from Blairmore Creek water. We note that the original incremental lifetime cancer risk for exposure to arsenic from Blairmore Creek was 2.05×10^{-5} . The copper risk was recalculated because it had the greatest increase in predicted concentrations, with the hazard quotient for copper increasing from 3.6×10^{-3} to 7.1×10^{-3} for multimedia exposure, including in Blairmore Creek water.

[2012] In the Twelfth Addendum, Benga acknowledged that there was an input error in calculations of risk from arsenic exposure. The correction of this error increased the incremental lifetime cancer risk from exposure to surface water concentrations of arsenic in Blairmore Creek, Gold Creek, and the end-pit lake to levels above Health Canada's target risk of 1 in 100 000. The lack of conservatism in Benga's water quality modelling is illustrated by the results of sensitivity analyses, which are described and discussed in the chapter on surface water quality. For example, sensitivity analyses in Appendix 10b of the EIA showed that if the capture efficiency of water that has been in contact with waste rock is 80 per cent instead of 95 per cent, selenium concentrations in Blairmore Creek more than double.

[2013] With the exception of a reference to water sampling at historical mine sites, Benga did not provide evidence for the reversibility of elevated selenium loading over time. During questioning at the hearing, Benga acknowledged that historical mine information related to selenium loading is primarily associated with underground mines because surface mining was a small fraction of the footprint. Benga stated that loading to Blairmore Creek and then farther downstream is expected to decrease naturally over time. But Benga acknowledged that it is not possible to reliably estimate a timeframe for the decrease. Benga agreed that metal leaching can occur for extended periods after mine closure.

[2014] According to Benga, its conservatism in the modelling of end-pit lake water quality is based on the use of upper-case source terms and assumes that incoming water has been in contact with rock that is leaching contaminants of potential concern. Benga assumed that the end-pit lake will have a constant volume.

[2015] Health Canada identified potential concerns with respect to arsenic concentrations in the end-pit lake, given that the concentrations are approaching or exceeding Canadian drinking water guidelines. Health Canada recommended that levels of arsenic be as low as reasonably achievable because the Canadian drinking water quality guideline is a risk-managed value based on treatment. The guidelines do not provide a "pollute up to" level and they are considered neither safe nor sufficient to ensure zero risk to human health. The health-based value, which is essentially the negligible risk of cancer, is therefore considerably lower.

[2016] At the hearing, Health Canada stated that they are not confident in the results of the risk assessment for other contaminants of potential concern in the end-pit lake. This viewpoint was based on uncertainties associated with the modelling of end-pit lake water quality.

[2017] The Oldman Watershed Council stated that surface water quality is a key concern for maintaining safe and secure drinking water sources for human communities. In its submission, the council provided a copy and discussed the results of the *Oldman Watershed Headwaters Indicator Project Final Report, 2014*. The council noted that hundreds of studies have demonstrated that human land use can have profoundly negative impacts on all aspects of ecosystem function, including water quality. The council's study shows high pressure ratings from the density of all linear features in the project area, and a low watershed integrity index. The council correlated these results with effects on water quality.

[2018] During the review process, changes in the assumed concentrations of contaminants of potential concern in water resulted in an evolution in Benga's risk characterization. In its 2016 assessment, as well as in its assessment in the Tenth Addendum, Benga screened out project-related direct discharges to water

based on interpretations of water quality modelling results. But in the Eleventh Addendum, Benga updated its assessment to include water-based exposure pathways. Benga concluded that there would be a “very low” risk of adverse health effects from long-term exposure to surface water in Blairmore and Gold Creeks and “a higher potential” for adverse health effects from long-term exposure to end-pit lake water. However, these conclusions were not based on Benga’s updated water quality model. Benga further updated its conclusion regarding incremental lifetime cancer risk from exposure to arsenic in Blairmore Creek, where the use of updated water quality modelling results increased the estimated risk.

[2019] Benga assessed whether the increased incremental lifetime cancer risk for exposure to arsenic from Blairmore Creek is an indication of the potential risk of cancer or a result of the precaution used in the assessment. Benga concluded that conservative assumptions in the assessment drive this result; specifically, the assumption that a person lives 100 per cent of the time at each location and surface water is the only source of drinking water. Benga also noted that a study of regional arsenic concentrations shows some values greater than drinking water guidelines. The study noted that predicted concentrations for Blairmore Creek are within the same order of magnitude as historical concentrations in the Grassy Mountain area.

[2020] Conservatism in the updated water quality modelling is questionable; Benga acknowledged that the results are sensitive to the capture efficiency of water that comes in contact with waste rock, as well as selenium removal rates in the saturated backfill zones. Benga acknowledged that risks would increase with lower capture or selenium removal rates. Benga indicated that it is committed to a number of back-up mitigation plans, given that the targets are not optional.

[2021] We found that Benga did not provide sufficient evidence to support its position that progressive reclamation would reduce the amount of water percolating through the external rock dumps, or that concentrations would in turn become reduced in Blairmore Creek, Gold Creek, or the end-pit lake.

[2022] Benga characterized as conservative its assumption that concentrations would remain the same over 80 years but provided minimal evidence to support this position. While Benga expects that loading to Blairmore Creek would decrease naturally over time, it acknowledged that it could not reliably estimate the time horizon over which selenium release will diminish. In contrast to this expectation, Benga agreed that metal leaching could occur for a long period after mine closure.

[2023] Concentrations of contaminants of potential concern in the end-pit lake used in the updated health risk assessment provided in the Eleventh Addendum are higher than concentrations predicted by the original modelling. Benga stated that conservative assumptions (e.g., the assumption that 2 m of the pit walls are actively leaching) were used “to a large extent” in the end-pit lake modelling. However, Health Canada stated that confidence in the results is not warranted due to uncertainties in to how the predicted concentrations were produced.

[2024] We find that the level of conservatism in the assessment of risk from water-based exposure pathways, and therefore the margins of safety, is questionable. This is due to the sensitivity of the model to changes in capture rates from the waste rock disposal areas and attenuation by the saturated backfill zone. As well, the evidence is insufficient to support the contention that progressive reclamation or

natural attenuation would reduce the leaching of contaminants of potential concern. This issue is discussed in the chapters on surface water quality and groundwater.

The relative contribution of water-based exposure pathways to human health risk appears low [2025] We assembled Table 19-1 from information presented in the Eleventh Addendum. It shows that, with the exception of cobalt, hazard quotients greater than 1.0 for multimedia exposure (water, soil, sediment, food, dermal) are similar or identical for Gold Creek, the Oldman Reservoir, Blairmore Creek, and the end-pit lake in the application case, despite predicted water concentrations which are considerably different.

Table 19-1. Comparison of hazard quotients greater than 1.0 for the application case

Contaminant of potential concern	End-pit lake	Blairmore Creek	Gold Creek	Oldman Reservoir
Aluminum	3.2	3.2	3.2	3.2
Barium	1.0	1.3	1.1	1.1
Cadmium	2.1	2.2	2.2	2.8
Cobalt	1.5	0.33	0.34	0.32
Lead	1.1	1.1	1.1	1.2
Manganese	12	11	11	11
Thallium	9.9	10	10	9.6

Source: CIAR 313, Tables 7-1, 7-2, and 7-3, PDF pp. 1258–1263.

[2026] These results suggest that the water-based pathways make little to no difference to the calculation of the hazard quotients, and that the project contributes a small incremental increase to baseline hazard quotients. Benga confirmed this in response to questions at the hearing, and explained that this result was due to exposure being dominated by ingestion of vegetation.

[2027] In contrast to the results for metals with hazard quotients greater than 1.0, results for metals with hazard quotients greater than 0.2 are not identical or near-identical across sites. This is illustrated by Table 19-2, which we assembled from information in the Eleventh Addendum.

Table 19-2. Comparison of hazard quotients greater than 0.2 for the application case

Contaminant of potential concern	End-pit lake	Blairmore Creek	Gold Creek	Oldman Reservoir
Antimony	0.93	0.58	0.28	0.21
Copper	0.21	0.2	0.2	0.32
Methylmercury	0.0001	0.32	0.17	0.1
Molybdenum	0.3	0.27	0.14	0.16
Nickel	0.54	0.09	0.09	0.06
Selenium	0.43	0.57	0.97	0.25
Vanadium	0.6	0.38	0.37	0.41
Zinc	0.6	0.59	0.59	0.59

Source: CIAR 313, Tables 7-1, 7-2, and 7-3, PDF pp. 1258–1263.

[2028] Benga stated in the Tenth Addendum that exceedances of the target hazard quotient of 0.2 for aluminum, antimony, barium, cadmium, cobalt, copper, lead, manganese, molybdenum, selenium, thallium, vanadium, and zinc were “entirely a result of naturally occurring concentrations in background media.” Benga asserted that the soil baseline concentrations and the vegetation ingestion pathway are primarily responsible for exceedance of the target risk quotient. Our confidence in this assertion depends on soil and plant baseline concentrations, calculated concentrations in plants, and amount eaten per day for plant food items.

[2029] Baseline data for concentrations of contaminants of potential concern in soil and vegetation provided in the Tenth Addendum are limited to 13 samples of saskatoon berries and bearberry leaves and 21 samples of mineral soil collected in the LSA. Concentrations of the metals listed in Tables 19-1 and 19-2 are higher in saskatoon berries than bearberry leaves, often by more than a factor of 10. This illustrates the variability among plant species and also differences among plant tissues such as berries, leaves, or roots.

[2030] We find that the limited baseline data are insufficient for locations outside of the LSA. To produce identical hazard quotients across a wide area (from the project site to the Oldman Reservoir), metal concentrations in soil and vegetation would have to be relatively similar. Benga assumed regional similarity in baseline soil and vegetation measurements. There are no baseline metal data for soil or vegetation beyond the vicinity of the project. The available baseline data in the Tenth Addendum show a relatively wide range between mean and maximum concentrations for some metals. For example, cadmium and manganese in berries show a relatively wide range between mean and maximum concentrations for some metals.

[2031] Benga stated that hazard quotients greater than 0.2 are driven by baseline concentrations in soil and vegetation. But that does not explain why hazard quotients greater than 0.2 but less than 1.0 are not similar or identical (see Table 19-2). Benga referred to the same set of soil and vegetation data for all locations assessed in the Eleventh Addendum. Benga stated in the Eleventh Addendum that selenium in Gold Creek is the only situation in which the project makes more than a minimal contribution to the application-case hazard quotients. The project’s contribution to hazard quotients in Blairmore Creek may be underestimated because of the lack of conservatism in water quality modelling. This is discussed in the chapter on surface water quality.

[2032] We also find that the predicted concentrations in vegetation bear no resemblance to baseline data. For example, the arsenic concentration in berries in the Twelfth Addendum at the Blairmore Creek location is 0.0104 micrograms per gram ($\mu\text{g/g}$) but the mean and maximum baseline arsenic concentrations in saskatoon berries in the Tenth Addendum are 0.31 and 0.42 $\mu\text{g/g}$, respectively. The arsenic concentration in bearberry leaves presented in the Twelfth Addendum 12 is 0.0239 $\mu\text{g/g}$. This concentration is used as a substitute for Labrador tea (*Rhododendron* spp.) along with a Labrador tea ingestion rate of 1 gram per day (g/day), but the mean and maximum arsenic concentrations in bearberry leaves are 0.31 and 0.35 $\mu\text{g/g}$, respectively.

[2033] The lack of congruence between calculated concentrations and baseline concentrations reduces our confidence in Benga’s explanation of the results summarized in Tables 19-1 and 19-2. Baseline data should have been used to calibrate predicted concentrations. This is particularly true for those

contaminants of potential concern with a large difference between measured and predicted concentrations, such as arsenic.

[2034] Benga relied on Health Canada guidance and a study from the Wood Buffalo region of northern Alberta for its ingestion rates. Benga stated in its 2016 assessment that it relied on local consultations to gather information on Indigenous use of plants and animals in the region, such as wild licorice (*Glycyrrhiza lepidota*), bear root (*Ligusticum porter*), Labrador tea, tree lichen, yarrow (*Achillea millefolium*), berries, mushrooms, trout, moose (*Alces alces*), deer (*Odocoileus* spp.), and elk (*Cervus canadensis*). However, ingestion rates were based on recommendations from Health Canada as well as a study by Wein et al. (1990) that reported consumption of country foods near Wood Buffalo National Park.

[2035] The applicability of some specific food items and the ingestion rates used by Benga is uncertain, as country foods and ingestion rates can differ among Indigenous groups and regions in Canada. For example, it is unlikely that Treaty 7 or Métis Nation members making use of the project area would be consuming caribou, as there are no caribou in southern Alberta. Nevertheless, caribou are specifically included as food in Benga's assessments in the Tenth and Eleventh Addenda.

[2036] The proportion of plant-based versus fish ingestion rates is one of the factors resulting in the dominance of vegetation ingestion in determining hazard quotients, and Benga's plant ingestion rates may be overestimated. Although Benga stated that it updated ingestion rates in the Tenth Addendum by using the results of the 2016 *First Nations Food, Nutrition and Environment Study*, the ingestion rates presented in tables in the Tenth and Eleventh Addenda do not appear to have been adjusted. For example, in the *First Nations Food, Nutrition and Environment Study* the mean berry and plant ingestion rate for adults is 18.5 g/day for adults (adjusted for toddlers to 6.5 g/day). This rate is much lower than that presented in the tables in the Tenth and Eleventh Addenda, in which "plant" and "root vegetable" ingestion rates are 67 and 105 g/day for toddlers, respectively. In contrast to the lack of adjustment for plant ingestion, Benga adjusted fish ingestion rates downward using the *First Nations Food, Nutrition and Environment Study* from the original 95 g/day for toddlers to 23 g/day.

[2037] It is not known whether the use of the original 95 g/day rate for fish consumption would change the relative dominance of vegetation ingestion in determining hazard quotients for the metals in Table 19-2. The worked example of human exposure to arsenic from food provided in Equation 17 in the Twelfth Addendum indicates that the concentration of metals in fish could be considerably higher than in vegetation, depending upon the metal-specific bioaccumulation factors. For example, the concentration of arsenic in root vegetables is 0.00000000534 mg/kg while the concentration in fish is 0.0071 mg/kg. The use of a higher ingestion rate for fish may therefore have increased the incremental lifetime cancer risk.

[2038] Benga noted in the Eleventh Addendum that selenium hazard quotients exceeded the target of 0.2 for multimedia exposure in the end-pit lake, Blairmore and Gold Creeks, and the Oldman Reservoir. Benga stated that these results are driven by the drinking water pathway in the end-pit lake (where fish were assumed to be absent), and by predicted concentrations in fish tissue at the other locations. Unlike the case of metals with hazard quotients greater than 1.0, the selenium risk is not driven by ingestion of soil and vegetation, but by ingestion of fish. The selenium hazard quotient for exposure to Blairmore

Creek water was 0.57, which is lower than the baseline hazard quotient of 0.59 due to Benga's assumption of the ameliorating effect of sulphate on selenium uptake into fish in Blairmore Creek.

[2039] The selenium hazard quotient for exposure to Gold Creek water was 0.97; the baseline hazard quotient at this location was 0.71. Elevated sulphate was not predicted to occur in Gold Creek; therefore, there would be no amelioration of uptake into fish. The selenium hazard quotient in the Oldman Reservoir was 0.25, with a baseline hazard quotient of 0.23. Benga concluded that given the conservatism of the fish tissue model and that concentrations are below drinking water guidelines, selenium is not considered a risk. However, Benga's assumption that a person would consume fish from each location 365 days per year for their entire lifetime is conservative.

[2040] The risk from exposure to methylmercury is also driven by fish consumption. Benga used multiple levels of conservatism in its assessment, including a method to estimate methylmercury from total mercury based on lake systems; a maximum available bioaccumulation factor of 2 670 000, which applies to trophic level 4 (top predator) fish, whereas fish from trophic levels 3 and 4 are traditional food items; and the additive contribution of maximum predicted air concentrations at the maximum point of impingement. Benga concluded that methylmercury is not a human health concern.

[2041] In summary, our confidence in Benga's conclusion that baseline concentrations and vegetation ingestion are the dominant factors driving hazard quotients is low because

- baseline data are limited to the LSA, sample sizes are small, and the relative contribution of baseline to hazard quotients is not consistent across all results greater than 0.2;
- there is no congruence between calculated concentrations and baseline concentrations in plants;
- the applicability of some of the food types to Indigenous people living in the region is questionable; and
- vegetation ingestion rates were not adjusted down but fish ingestions rates were.

[2042] We note that the risk to human health from selenium is predicted to be driven by fish consumption and that concentrations in water and fish are likely to be underestimated. However, Benga used relatively conservative assumptions regarding daily exposure over a lifetime. We find that, while it is unlikely that fish consumption would result in a risk to human health, the margin of safety associated with this statement may not be as large as stated by Benga. We find that adverse effects on human health from project-related methylmercury exposure due to consumption of fish are unlikely.

Benga did not consider human consumption of groundwater from wells in surficial deposits

[2043] Benga's approach to groundwater assessment and the potential for effects to municipal and domestic water wells is discussed in the chapter on groundwater quantity, flow, and quality. Benga stated that monitoring wells and the few industrial wells within the LSA indicate that wells completed in bedrock formations (shale or sandstone) had low head and limited available yield. Domestic water wells installed in bedrock within the RSA were therefore not considered in the human health risk assessment. This statement does not apply to wells in surficial deposits, which would represent groundwater under the influence of surface water.

[2044] Table B8 in Consultant Report 3 of the EIA shows that water from monitoring wells, mine portals, springs, and ponds in the LSA and RSA can exceed drinking water quality guidelines for metals, particularly for aluminum, iron, and manganese. Cadmium exceeds the drinking water guideline in small south pond (within the area of and resulting from historical mining activity on Grassy Mountain). There are exceedances in monitoring wells in coal seams at shallow, middle and deep depths. Monitoring wells in mudstone also had exceedances for manganese, iron, and aluminum. A monitoring well labelled as “surficial” has exceedances for aluminum and manganese. Springs 1 and 5 have aluminum and manganese concentrations well above those used in the updated health risk assessment provided in the Eleventh Addendum. Spring 1 water has a manganese concentration between 2.1 and 2.7 mg/L.

[2045] Benga stated that exceedances of manganese, aluminum, and iron in groundwater are common and the results “don’t raise a whole lot of concern” (CIAR 931, PDF p. 91). Benga acknowledged that it cannot comment further on aluminum concentrations “without actually doing a proper assessment” (CIAR 931, PDF p. 91). Benga stated that it has high confidence that no users of groundwater within the confines of the project would be exposed to a health risk, and that this confidence is driven by its ability to control the source of contaminants, monitor water quality, and capture and treat contaminants. Benga acknowledged that it did not include information about the use of springs by Ms. Gilmar, whose lands are adjacent to the proposed mine and Gold Creek.

[2046] The Oldman Watershed Council noted an instance in which a drinking water well had to be shut down in Sparwood, B.C., because of selenium contamination. The council also identified exceedances of selenium guidelines in groundwater monitoring wells near Blairmore in areas affected by past mines. R. Redekopp and J. Redekopp also noted the problem with drinking water wells in Sparwood. They made the point that monitoring does not prevent contamination; instead, it just confirms that it is too late and users can no longer drink the water.

[2047] If the metal concentrations in drinking water affected by groundwater discharge used in the health risk assessment were conservative, the concentrations used in the human health risk assessment would reflect groundwater quality data. This is not the case. For example, aluminum concentrations in Appendix A of the Eleventh Addendum on constituents of potential concern screening range from 0.01 to 0.04 mg/L, whereas aluminum concentrations in EIA Table B8 of Consultant Report 3 are one to two orders of magnitude higher. A well described as being “surficial” had an aluminum concentration of 8.83 mg/L. It is uncertain how the conclusions of the human health risk assessment would differ if the concentrations of metals in samples from monitoring wells, springs, ponds, and mine portals presented in Table B8 of Consultant Report 3 were used in the assessment, rather than those presented in the Eleventh Addendum.

[2048] Benga did not apply an appropriate degree of conservatism in conducting its analysis. This is discussed further in the surface water quality and groundwater chapters. The seepage capture rates Benga used for water that has been in contact with waste rock are highly optimistic. Moreover, these rates exceed examples (on the record) of capture rates typical for similar mines. The effectiveness of treatment in the saturated backfill zone will influence the quality of seepage water. There remains uncertainty in the geology and groundwater pathways underlying the project. By Benga’s own admission, the groundwater model for the project area is simplistic and makes a number of assumptions that expert witnesses found questionable. While Benga proposes further testing and characterization, the uncertainty regarding

groundwater pathways and flow rates compounds the overall uncertainty associated with Benga's assertion of a 95 per cent capture rate.

[2049] In summary, we are not confident that Benga would be able to effectively detect, locate, capture, and mitigate enough contaminated water to reduce effects below levels that adhere to Canadian drinking water quality guidelines.

Assessment of risk from cumulative multimedia exposure was for additive toxicity only

[2050] Receptors are potentially exposed to both individual chemicals and chemical mixtures originating from chronic inhalation and multimedia exposures (oral and dermal), which have similar critical effects pathways (e.g., liver, kidney, neurological, and lung). Evaluating additive risk is more than a chemical-by-chemical process. It specifically examines the potential for human health risk due to cumulative exposure to all contaminants of potential concern from all pathways (including water-based pathways).

[2051] Hazard quotient and cumulative incremental lifetime cancer risk results were calculated assuming Indigenous receptor characteristics. They represent the most sensitive receptor group based on their assumed lifetime exposure within the LSA and RSA. They also have a higher assumed ingestion rate of traditional and country foods (fish, wild game, and vegetation) compared with other receptor groups. Hazard quotients and cumulative lifetime cancer risks for all other receptors at the same locations would inherently be lower. It was conservatively assumed that the Indigenous receptor lived at, and harvested food from, all the human health risk assessment receptor locations, including the RSA maximum point of impingement locations. Risks for non-threshold substances were assessed based on the incremental contribution of the project. The potential cumulative incremental lifetime cancer risks were assessed based on exposure to project emissions only.

[2052] In the Eleventh Addendum, Benga noted that no additive hazard quotients for the project case were greater than 1.0 and no incremental lifetime cancer risk results exceeded 1 in 100 000. Benga stated that application-case exceedances were driven "almost entirely" by the baseline case and therefore were driven by background concentrations through oral (multimedia) exposure. Additive hazard quotients for the baseline and application cases were greater than 1.0 for the end-pit lake, Blairmore Creek, Gold Creek, and Oldman Reservoir. The end-pit lake was the only location where the project case produced a greater-than-marginal increase from the baseline, specifically for additive effects on the liver. Benga did not provide an explanation for this result, which is not consistent with Benga's statement that results were driven by background concentrations through oral exposure. As the lake does not exist, the only baseline oral exposure at the end-pit lake would be inhalation. Benga acknowledged that management considerations for the end-pit lake are warranted. It indicated that measured concentrations at the time of end-pit lake creation should be used to revisit human health risks.

[2053] Benga stated that reviews by the European Commission and the Organization for Economic Cooperation and Development have generally concluded that assumption of additivity is reasonable and that, in most studies, synergistic effects are not observed. Benga stated that combinations of contaminants of potential concern have not been studied in enough detail to understand the mechanisms involved in synergistic effects. These statements apply to both air and water exposure.

[2054] We questioned Benga regarding cumulative risks from multiple contaminants. In response, Benga stated that, with respect to exposure to combined contaminants in air, its five-year dataset captures conditions that occur simultaneously. Benga explained that, to the extent that conditions occur simultaneously (e.g., maximum dust and maximum NO₂), and to the extent that it captured any upwind sources in background concentrations, that information is captured in the air quality assessment and is passed to the health risk assessment. In its response regarding the health risk assessment, Benga returned to the theme of conservatism as well as exceedances due to background levels. Benga stated that predicted concentrations are small compared with background levels, which supports its expectation of minimal effects. Benga also explained that if the effect of a chemical was similar to, but not necessarily the same as, other chemicals it was still assessed as part of the group of chemicals that could cause additive effects.

[2055] In their final argument, Health Canada listed the following cumulative human health issues that remain unaddressed:

- a lack of total project dust considerations from all sources, not just coal
- a lack of cumulative exposure from all media (including project dust and re-suspended dust combined)
- a lack of consideration of all exposure groups (including current and future residents living on or near the project area and exposure routes)
- a lack of analysis of the health effects of coal and mixtures that include coal
- a lack of accounting for all contaminants of potential concern as they move through and between all impacted media (i.e., mass balance accounting)

[2056] Prior to the hearing, the Louis Bull Tribe provided a submission stating that the greatest concerns of members were cumulative effects and incremental impacts on the health and abundance of resources provided under Aboriginal and treaty rights.

[2057] Cumulative risk means the combined risks from aggregate exposures to multiple stressors. Stressors do not have to be chemicals—they can also be physical (e.g., noise) or biological (e.g., bacteriological). Effects can be direct or indirect. A valid assessment of combined risks is not limited to simply adding them; rather, the assessment should examine the ways stressors can interact. Benga's assessment does not address cumulative health risks from people's real-world exposure to a diverse and dynamic combination of chemical and nonchemical stressors, such as a combination of exposure to dust and other contaminants in drinking water.

[2058] We recognize the absence of regulatory guidance for conducting holistic cumulative health risk assessments in Canada. To date, Canadian guidance is from a classical toxicological point of view that identifies contaminants with common toxicological mechanisms and which, as Benga pointed out during the hearing, recommends assuming additive toxicity. Benga's approach to cumulative risk was to focus on the assessment of additive risks from groups of chemicals with similar critical effects and target organs. Benga relied upon the conservatism used in the rest of the risk assessment. Benga then added a level of conservatism by assuming additive effects will occur even if the mode of action of each chemical in the toxicity group is not identical.

[2059] The level of conservatism specific to the assessment of additive effects appears to be appropriate, with two exceptions. Benga's approach to additive effects of multimedia exposure does not include an updated assessment of the toxicity group for lung tumours (benzo-a-pyrene, arsenic, beryllium, cadmium, hexavalent chromium, and nickel). The results for the inhalation-only pathway for this toxicity group showed a project-related incremental lifetime cancer risk of 1.5 in 1 million. The updated risk assessment, which includes water-based pathways, does not present additive risks for lung tumour toxicity. This is notable because of the results of the updated assessment of arsenic. Arsenic is in the lung tumour toxicity group. The incremental lifetime cancer risks from arsenic alone at Blairmore and Gold Creeks and the end-pit lake range from 1.9 in 100 000 to 2.75 in 10 000.

[2060] Benga's discussion of additive toxicity focuses on results that show that all project-related hazard quotients are less than 1.0. It did not discuss the result showing that the project produces an increase in the hazard quotient for effects on liver from 3.8 to 4.8 at the end-pit lake location. Benga's rationale for considering additive effects only, and not synergistic effects, would be more persuasive if a specific examination of the potential for synergism among the particular contaminants of potential concern had been conducted and reported. For example, participants noted that the combination of dust plus other contaminants is cause for concern. Health Canada noted the lack of consideration of coal dust as a complex mixture and the lack of mass balance accounting for all contaminants of potential concern as they move between exposure media (e.g., air and soil). A reasonable question to ask is whether the combination of respiratory irritants and carcinogens might be synergistic.

The overall margin of safety in the human health risk assessment is difficult to determine

[2061] Benga stated that the risk results in the Eleventh Addendum were not indicative of a potential risk of adverse human health effects. Its position was due to conservative assumptions Benga applied to the air dispersion modelling and groundwater and surface water transport modelling, and conservative assumptions within the human health risk assessment itself. Conservatism in Benga's air and water modelling is discussed in the chapters on air quality, groundwater, and surface water quality. For the purposes of the human health risk assessment, the air quality modelling predictions were considered reasonably conservative, with some concerns related to the baseline air quality data and uncertainties around dust emission estimates. Surface water quality modelling was not found to be consistently conservative. The limited site-specific data and simplifying assumptions used in the groundwater modelling create uncertainty about how well the model represents reality, and undermines confidence in the predictions.

[2062] Conservative assumptions for exposure included

- people will be exposed for their lifetime (80 years);
- Indigenous hunting and food collection areas assumed to be locations where Indigenous people reside;
- Indigenous people assumed to be living at all 13 receptor locations;
- exposure occurs seven days per week, 365 days per year, including dermal (skin contact) exposure;
- no transformation processes for metals or organic contaminants of potential concern occur;

- contaminants of potential concern in food are 100 per cent bioavailable (i.e., they are fully taken up from the gut into the body);
- all food eaten is from the study area and wild game spend their entire lifespan in the study area;
- 73 per cent silica in coal;
- diesel particulate matter exposure occurs through all five media (air, water, soil, food, and consumer products) when exposure “only exists in a single medium (air)”;
- chronic exposure occurs at the maximum point of impingement for air quality parameters;
- maximum available bioaccumulation factors (confirmed specifically for methylmercury); and
- ingestion rates for traditional foods that are “considerably higher” than rates reported in *the First Nations Food, Nutrition and Environment Study*.

[2063] Conservative assumptions for effects included

- comparison of results with a hazard quotient of 0.2 instead of 1.0 to account for exposures from background sources not included in the risk assessment;
- comparison of NO₂ concentrations with the more conservative Canadian Ambient Air Quality Guidelines, applied to all of the one-hour maximum predicted nitrogen dioxide concentrations;
- conservative derivation of the toxicity reference value for PM₁₀;
- use of conservative toxicity reference values, some of which are below the Health Canada tolerable daily intake values and/or reference no-observed-adverse-effect levels rather than lowest-adverse-effect levels;
- assuming additive interactions between chemicals producing similar effects on the same organs; and
- metabolism of organic chemicals taken up by plants and animals does not take place.

[2064] In the Eleventh Addendum, Benga argued that a comparison with a hazard quotient of 0.2 is “overly conservative,” and that, as stated in human health risk assessment guidance from Health Canada, a hazard quotient greater than 1.0 does not necessarily indicate a potential risk. Benga stated that an additional assessment of the assumptions built into the human health risk assessment is required to determine whether potential risks of adverse health effects are indicated. Benga stated that it could not specify the overall margin of safety produced by its conservative assumptions. However, because many conservative assumptions are layered on top of one another, particularly for multimedia exposure, the predictions can be reasonably considered conservative.

[2065] We asked Health Canada whether a target hazard quotient of 0.2 was overly conservative. Health Canada replied that it recommends a hazard quotient of 0.2 because individuals are exposed in everyday life through drinking water, food, and consumer products. Health Canada stated that a quotient of 0.2 can be applied to exposure to both everyday life exposures and other exposures. They stated that 0.2 would be considered conservative if a specific substance was found in only one medium and not all exposure media.

[2066] Health Canada stated that it is difficult to say whether there is sufficient conservatism or protection to human health in the human health risk assessment; some of the methodological problems that Health Canada has identified may not necessarily capture all the risks to human health. Some of these problems include: the use of surrogate data to identify contaminants of potential concern instead of site-specific analysis; metals or substances bound to coal dust that are not assessed in the exposure; the assumed low bioavailability of attached metals and other substances, which is not supported by adequate characterization; and the use of a hazard quotient of 1.0 when actual background exposures are not assessed, although a hazard quotient of 0.2 is more appropriate.

[2067] The key conservative assumptions contributing to a sufficient margin of safety (and precaution) in estimates of exposure are those that maximize the duration and frequency of exposure. Maximum exposure consists of 80 years of continuous residential exposure seven days per week, 365 days per year, with all drinking water and food coming from the study area. The assumption of 100 per cent bioavailability and the use of maximum bioaccumulation factors also contribute to the margin of safety. The assumption that chronic inhalation exposure occurs at the maximum points of impingement for air quality parameters contributes further to the margin of safety. For the purposes of the human health risk assessment, the air quality modelling predictions were considered reasonably conservative. Benga's approach to the choice of individual toxicity reference values also appears to be conservative.

[2068] The conservatism of predictive water quality modelling is neither consistent nor reliable, as discussed in the chapter on surface water quality. Health Canada questioned the conservatism of Benga's assessment of diesel particulate matter. Health Canada does not agree that the approach used by Benga is adequate for determining human health risk. Assessing only known carcinogenic contaminants of potential concern does not acknowledge that current science considers diesel particulate matter a mixture when determining impacts on human health. Health Canada suggested that Benga characterize the carcinogenicity of diesel particulate matter using one of the Health Canada-recommended approaches to inform mitigation measures for the reduction of diesel exhaust. Benga argued that Health Canada's recommended approach was not appropriate.

[2069] Health Canada was not satisfied with Benga's assessment of the risks from coal dust exposure. In its hearing submission, Health Canada recommended Benga use site-specific analyses to characterize the contaminants of potential concern associated with the sources of dust generated by the project. Alternatively, Benga could provide site-specific coal-analysis data to demonstrate the appropriateness of the surrogate data used to date. Benga was also encouraged to use a site-specific analysis of contaminants of potential concern as model inputs for the human health risk assessment. Benga did not specifically respond to Health Canada's recommendations in its hearing submissions or final argument. Benga concluded that the contribution of baseline exposure to hazard quotients is much greater than the contribution of the project. But it relied on limited baseline data to make this conclusion. The limitations of baseline data have been identified by ECCC for NO₂ and by Health Canada for dust and for soil, berry, and plant-leaf data.

[2070] Given the uncertainties discussed above, the overall margin of safety (and precaution) inherent in the risk assessment was difficult to evaluate. However, it is likely that the highly conservative assumptions for duration and frequency of exposure still produce an overestimate of risk from single

chemicals, particularly via the air pathway for which air quality modelling is reasonably conservative. Water-based exposure pathways do not have a similar margin of safety because of the lack of conservatism in water quality modelling. The selenium risk estimate is most affected by the lack of conservatism in water quality modelling. Because hazard quotients for selenium are already greater than 0.2, the margin of safety for the risk from selenium is of particular concern.

[2071] The predicted risk to human health is highest at the end-pit lake. The level of conservatism in the predicted water quality of the end-pit lake is questionable. In turn, this produces uncertainty regarding the conservatism inherent in the hazard quotients. However, the highly conservative assumptions regarding lifetime exposure at the end-pit lake may, on balance, indicate that risk from exposure to the end-pit lake is likely to be low. We agree with Benga's conclusion that management considerations are warranted for the end-pit lake. But we note that Benga has not provided the design details or mitigation measures that would reduce or prevent human exposure.

[2072] Regarding cumulative risk, the margin of safety can only be evaluated for Benga's approach to additive risks from chemicals within toxicity groups with similar modes of action and target organs. The results show small contributions of the project to additive risk relative to baseline. But this result is dependent on the reliability of the baseline data. Benga does not discuss the result for the end-pit lake, which shows that the additive risk to liver increases from the baseline hazard quotient of 3.8 to 4.8 when the project is added. As Benga does not recalculate incremental lifetime cancer risk for the lung tumour toxicity group using its updated arsenic calculations, the margin of safety with respect to this group is questionable.

[2073] The margin of safety for the cumulative risk from aggregate exposures to multiple stressors cannot be evaluated because Benga does not present a holistic understanding of cumulative risk. As noted above, no Canadian regulatory guidance exists for such holistic cumulative risk assessments.

Mitigation of human health risks relies on effective mitigation for air emissions and achieving targets for water diversion and treatment

[2074] The effectiveness of mitigation of air emissions is discussed in the air quality chapter. Although we determined that Benga proposed reasonable combustion emission controls and technologies, uncertainty remains around the fugitive dust predictions and mitigation measures. While Benga proposed reasonable coal-dust mitigation measures for rail-car loading and conveyor transport adjacent to the town of Blairmore, the coal dust mitigations associated with mining and storage at the mine site remain uncertain due to wind speed considerations. At the hearing, the mitigation of dust received particular attention. The experience in Sparwood, as described in the *Sparwood Livability Study*, is that dust remains a primary concern despite Teck's suppression efforts.

[2075] The effectiveness of mitigation of water quality issues is discussed in the surface water quality chapter. Three key water quality mitigations drive human health risk via project-related water discharges. They include the capture of water in contact with waste rock, the treatment efficiency in the saturated backfill zone, and the assumption that there will be a metals treatment plant. The key mitigation measures for discharges to Gold Creek consist of the capture of contact water and mitigation of seepage to groundwater which, in turn, discharges to Gold Creek. Although the risk assessment results use predicted water quality, which has been mitigated by a metals treatment plant, Benga did not plan to

implement a metals treatment plant at the beginning of the project. The chapter on surface water quality provides details.

[2076] The predicted risks to human health at the end-pit lake are the highest of any of the receptor locations, yet Benga recommended no mitigation measures. During the hearing, Benga said that it could consider the quality of the rock at the location chosen for the end-pit lake and move the lake to a slightly different location. We do not agree that consideration of end-pit lake mitigation can be deferred, given the nature and extent of risks to human health and potential important trade-offs among mine sequencing, site water management, and end-pit lake design and function. This is discussed in the surface water quality chapter.

[2077] Benga has not demonstrated that it has considered the design requirements of the end-pit lake in a way that achieves “multiple unsupervised uses,” which Benga stated would be the intent of the design. As noted by the Livingstone Landowners Group, the behaviour of end-pit lakes can be complex and has a profound influence on site-wide water balance. Furthermore, the group pointed out that there can come a critical decision point in mine sequencing when flexibility in end-pit lake design is lost.

Monitoring would provide a basis for validating predictions in the human health risk assessment

[2078] Benga’s commitments to environmental monitoring, including its commitment to country food monitoring, would provide valuable data with which to validate the human health risk assessment. Benga’s air quality monitoring plan and aquatic effects monitoring plan are reviewed in the chapter on air quality and the chapter on fish and aquatic habitat, respectively. Benga recognized that uncertainties remain with respect to the project’s potential impacts on human health. It made a commitment to monitor air and water and contaminants of potential concern associated with the project. Where necessary, Benga said the monitoring results will be used to take additional mitigation measures to minimize risks to human health.

[2079] Benga did not address the fact that human health risks were estimated on the basis of the implementation of a metals treatment plant, which Benga does not plan to put in place at the beginning of the project. Even with that assumption, hazard quotients greater than 1.0 are predicted for several metals, and there are incremental lifetime cancer risks from arsenic in Blairmore Creek, which Benga’s most recent assessment now rates as a “low” risk (increasing from none to “very low” to “low”).

The project is predicted to contribute to an increased, but not significant, risk to human health

[2080] Benga’s human health risk assessment is a screening-level assessment, which generally use consistently conservative assumptions to eliminate contaminants of potential concern from further consideration for mitigation. If a hazard quotient is well below 1.0 (or 0.2 for multimedia exposure) even for people exposed to maximum predicted concentrations 24 hours per day, seven days per week, 365 days per year for 80 years, we can be confident that adverse health effects should not be expected and further mitigation to reduce exposure is not required for those contaminants of concern.

[2081] In some cases, screening-level assessments indicate that a risk is primarily due to baseline concentrations prior to the proposed project or activity. This is particularly common for metals in soils in mineralized areas or areas with high baseline levels of human activity (such as traffic). However, how confident one can be in concluding that the risk is dominated by baseline conditions is directly related to

the quality and quantity of the baseline data. If a screening risk assessment does not make use of consistently conservative assumptions and/or if baseline data are not sufficiently representative of local and regional conditions, then confidence that risks can be screened out can drop. This, in turn, reduces confidence that proposed mitigation will address all risks to human health.

[2082] Benga’s human health risk assessment contained examples of limited baseline data and non-conservative assumptions that were then adjusted down. Benga’s updated water quality modelling results were not used for the assessment until it responded to undertakings during the hearing. Even then, Benga only recalculated the risks presented by two contaminants of potential concern, both of which resulted in increases in risk. The human health risk assessment did, however, incorporate some conservative assumptions, including duration and frequency of exposure. The assessment relied on work completed by others that was found to be subject to limitations in the case of baseline soil or vegetation data, or not sufficiently conservative in the case of water quality modelling.

[2083] It is difficult to determine whether the screening risk assessment can screen out contaminants of potential concern. It is also difficult to confirm whether any additional mitigations are required beyond those already built into air and water quality modelling. We note that Health Canada concluded that limitations remain regarding the reliability of the proponent’s predictions of potential risks to human health. This conclusion is due to existing uncertainties of the assessment of risk to human health and additional information provided at the hearing.

[2084] When, in 2016, Benga applied criteria for an evaluation of significance to its original health risk assessment, it concluded that predicted emissions due to project activities were not significant for the potential risk of adverse human health effects. This conclusion was made notwithstanding hazard quotients that exceeded 1.0 for exposure to NO₂, PM₁₀, and PM_{2.5} within the project footprint and in Coleman and Blairmore. Benga did not apply criteria for evaluation of significance to any of its subsequent risk assessments.

[2085] In the Tenth Addendum, Benga concluded that air emissions from the project would not pose a risk of adverse health effects at locations accessible to the general public. It attributed exceedances of the hazard quotient target of 0.2 for multimedia exposure to baseline contributions. In its updated health risk assessment in the Eleventh Addendum, which included water-based pathways of exposure, Benga concluded that there was no potential for adverse human health effects because of a combination of the high contribution of natural background metal concentrations and conservatism, which produced “margins of safety.”

[2086] In the Twelfth Addendum, after providing worked examples of calculations for arsenic and fluoranthene risks in response to IR 7.1, Benga made small adjustments to input parameters for fluoranthene and discovered an input error specific to arsenic. Neither of these adjustments changed the overall conclusion of the predicted risk via air-borne pathways. However, the incremental lifetime cancer risk from arsenic exposure via water-based pathways was about 200 times higher than that from air-based pathways (e.g., 1.04×10^{-7} from air deposition versus 2.05×10^{-5} from water-based pathways in Blairmore Creek). Benga concluded that there would be a “very low” risk of adverse health effects with long-term exposure to surface water in Blairmore and Gold Creeks. Benga acknowledged that there was “a higher potential” for adverse health effects from long-term exposure to end-pit lake water.

[2087] Benga's recalculated risks of exposure to arsenic and copper in Blairmore Creek using the results of updated water quality modelling were higher than the originally calculated risks, but by less than an order of magnitude. Benga did not recalculate the risks for any other contaminants of potential concern. Benga described the hazard quotients and incremental lifetime cancer risk for Blairmore Creek as representing a low potential risk of adverse health effects.

[2088] Our confidence in the results of the human health risk assessment for the project is low. This viewpoint is based on Benga's non-conservative assumptions, its provision of limited baseline data, and inconsistent risk predictions over the course of the review process. However, even with all of the uncertainties in the assessment, we find that adverse project-related effects on human health would be unlikely due to the conservative exposure assumptions used in the assessment. It is highly unlikely an individual would be exposed to maximum concentrations of contaminants of potential concern from the project 24 hours a day, seven days a week for a lifetime. We also accept that, for some contaminants of concern for which the hazard quotients exceed 1.0, the risks are largely the result of background (existing) concentrations, and the project makes a negligible or minor contribution to health risk.

[2089] Notwithstanding our finding that adverse project-related health effects are not likely, two issues warrant further discussion. The project is predicted to result in increased hazard quotients for selenium in Blairmore Creek, Gold Creek, the end-pit lake, and the Oldman Reservoir. Although predicted hazard quotients are greater than 0.2 but less than 1.0, the assumptions related to capture and treatment of selenium used in the assessment were not conservative. Therefore, concentrations of selenium reaching water bodies could be higher than Benga predicted. It is possible that the resulting hazard quotients could also be higher than predicted. Fish consumption dominates the risk to human health for selenium. While we recognize that hazard quotients greater than 1.0 do not necessarily imply a health risk, and the potential for an adverse health effect still appears to be low based on the conservative (lifetime) exposure assumptions, the potential for increased risk to human health cannot be eliminated.

[2090] The end-pit lake is predicted to contain water with elevated concentrations of a number of contaminants of potential concern, including arsenic, aluminum, cadmium, cobalt, lead, and thallium. Benga acknowledged that there was a higher potential for adverse health effects from long-term exposure to end-pit lake water. Nevertheless, Benga did not propose any specific mitigation measures to manage the risk of human exposure. While it is unlikely that human receptors would be exposed to end-pit lake water on a long-term and continuous basis, exposure to arsenic is a concern as it is a non-threshold contaminant with no known safe level of exposure.

[2091] Our assessment of the significance of project effects to human health is as follows:

- **Magnitude:** very low to low. The predicted increase in health risk resulting from the project is very low to low for most contaminants of potential concern at all modelled locations except the end-pit lake, where increased risk from arsenic, cobalt, and thallium is moderate (application-case hazard quotients are at least 10 times those of baseline case hazard quotients).
- **Geographic extent:** local. Most predicted increases in health risk are limited to the LSA, although there may be some increased risks beyond the LSA (i.e., the Oldman Reservoir).

- **Duration:** long to persistent. Exposure to some contaminants of potential concern would end when mining operations and reclamation activities cease (air emissions). However, exposure to other contaminants may extend into and beyond the closure period (discharges to water bodies resulting from metals leaching).
- **Frequency:** continuous. Frequency would be continuous during construction and operations periods.
- **Reversibility:** reversible in the medium- to long-term for exposure related to air emissions. Exposure to air emissions would cease when operations and reclamation activities conclude; however, other effects may continue through closure.
- **Ecological or social context:** neutral. The Crowsnest Pass area has experienced historical and current development that has impaired air quality (e.g., NO₂, dust/particulate matter), but trends are stable and within regulatory and policy thresholds.
- **Confidence:** low. Confidence is low based on use of non-conservative assumptions, limited baseline data, and changing risk predictions over the course of the review process.

[2092] Given the very low to low magnitude and local extent of predicted increases in health risk associated with the project, we conclude that the effects are not significant.

20. Land and Resource Use

[2093] The terms of reference for the EIA required Benga to

- describe current land uses in the proposed project area, including those related to oil and gas development, agriculture, forestry, tourism, and outdoor recreational activities;
- identify any land-use policies or resource management initiatives, including any constraints to development, and discuss how the project would be consistent with the intent of these initiatives;
- describe all Crown land and Crown reservations, unique sites or special features, and any potential access control issues and restrictions;
- describe land use clearing activities, outline fire control planning, and describe changes to existing topography; and
- identify the potential impact of the project on these land uses.

[2094] The project footprint would be on both private land and provincial Crown lands, with about 55 per cent of the land privately owned by Benga. The project footprint currently accommodates a number of land and resource use activities, including oil and gas, forest management, agriculture, and outdoor recreational pursuits. Benga would need to comply with provincial legislation for public land, including the *PLA* and its regulations, as well as land use policies such as the *SSRP* and the *Coal Development Policy for Alberta*.

Existing regional plans and policies

[2095] Benga explained that the project would fall within the southwest limits of the *SSRP*. Alberta established the *SSRP* in accordance with the *Land-use Framework* under the *Alberta Land Stewardship Act* to set the stage for “robust growth, vibrant communities, and a healthy environment within the region over the next 50 years.” One of the desired outcomes of the plan was to grow and diversify the region’s economy. The *SSRP* placed an emphasis on striking a balance between agriculture, oil and gas, forestry, and tourism opportunities. Benga noted that the *SSRP* did not restrict the development of coal mining.

[2096] Benga suggested that it had identified and addressed any environmental issues and concerns with its proposed mitigation measures, and the project was therefore consistent with the *SSRP*. Some participants expressed concerns regarding the project’s effects on regional land use plans. The Coalition’s expert, Mr. C. Wallis, identified the priority set out in the *SSRP* to maintain intact native grasslands. The M.D. of Ranchland stated that the project would go against the goals of the *SSRP*. They stated that the duty of the M.D. of Ranchland is to “protect the pristine and largely untouched” area, and that the project would have negative impacts on ranchers, native grasslands, and water, both on and off the proposed project footprint.

[2097] Benga stated that Alberta adopted the *Coal Development Policy for Alberta* to guide the development of coal resources while ensuring environmental protection and satisfactory reclamation of any disturbed lands. Under the policy, provincial lands were classified into one of four categories: Category 1 lands were those on which the province would not permit any coal exploration or commercial development; Category 2 and 3 lands allowed the province to permit limited exploration under strict

control; and Category 4 lands were those for which the province may permit exploration under appropriate control and for which the province may allow surface mining, subject to proper assurances to protect the environment and reclaim disturbed lands.

[2098] Benga stated that a majority of the project footprint was located on lands classified as Category 4, with a small portion to the south within Category 1 lands, and a very small area in the northwest within Category 2 lands. It noted that project development on Category 1 lands would not include open-pit mining, but would instead contain parts of the access road, overland conveyor, and rail loadout. Benga further noted that none of the lands were environmentally significant. It asserted that development of the access road, overland conveyor, and rail loadout within the Category 1 area did not conflict with the intent of the *Coal Development Policy*.

[2099] Overall, Benga stated that the project would not conflict with the intent of the various land use policies and regional planning initiatives in effect for the area, as the intent of these policies and planning initiatives is to help inform land use decisions. Benga contended the allowance of multiple uses in the existing regional plans supported a balance between the economy and the environment.

[2100] Mr. F. Bradley, a fourth-generation resident, expressed the view that responsible coal development is possible, provided the project follows the right environmental conditions and mitigation strategies. He noted that tourism and recreation play important roles in the local economy. But he also expressed support for the economic opportunities the project would bring to the Crowsnest Pass. He noted that the project conforms with the *Coal Development Policy* and stated that we should consider the application on its own merits, not in relation to other proposed coal projects in the area.

[2101] In May 2020, the Government of Alberta rescinded the 1976 *Coal Development Policy for Alberta*. Several participants at the hearing expressed concern about rescission of the policy and its implications for coal development in the region. We also received a large number of public comments expressing concern regarding rescission of the policy and the potential implications with regards to the proposed project. In February 2021, subsequent to the close of the record for the hearing, Alberta reinstated the Coal Policy. The reinstatement of the *Coal Development Policy* did not affect our decision because of our conclusion that the project was not in the public interest as a result of its environmental effects.

[2102] We agree with Benga's conclusion that existing land use policies and regional plans do not restrict development of this project, subject to proper assurances respecting protection of the environment and reclamation of disturbed lands.

Public lands applications

[2103] Benga submitted *PLA* applications for Crown dispositions, including two mineral surface leases for the mining and conveyor, as well as two licences of occupation for the rail loadout infrastructure. Alberta manages public lands through Crown reservations that identify and manage resources or values on the landscape. Applicants wishing to develop on public lands must identify and review the requirements of the Crown reservation associated with those specific lands to ensure the proposed activity is permitted.

[2104] Benga identified that some Crown reservations requiring clearance (i.e. consent) were still outstanding at the time of the hearing. These included:

- CNT 190002 – Livingstone–Porcupine Hills Land Footprint Management Plan,
- PNT 900426 – Greenhill Mine Complex,
- DHR 000001 – Village of Lille,
- PNT 900430 – Waste disposal/reclamation site,
- PNT 090084 – Multiple resource concerns – Potential for foothills fescue grassland, and
- PNT 090087 – Multiple resource concerns – Potential for foothills fescue grassland.

[2105] During the hearing, Benga provided documentation of the consent it had obtained for CNT 190002 from AEP. In its final argument, Benga noted that it had endeavored to obtain clearance for the outstanding protective reservations from AEP, but that issuance of the outstanding consents was not within its control. Benga stated that were the project approved, it assumed that AEP would clear the outstanding Crown reservations.

Landowner concerns

[2106] Landowners adjacent to the project, as well as some landowners not immediately adjacent, participated in the review as members of the Coalition. They expressed a number of concerns about the potential impacts of the project on their interests, including potential adverse effects on water quality and springs, increased dust, and safety/emergency services. We explore these concerns in other chapters. Adjacent landowners also expressed concerns about the potential for the project to negatively affect their property values.

[2107] Benga implemented a voluntary program to purchase the property of adjacent landowners for values that it stated were at a significant premium above market value. It submitted letters of offer that it had made to the Watmoughs, Donkersgoeds, Ms. Gilmar, and Mr. Emard. Benga's expert witness, Mr. B. Gettel, asserted that an increase in employment, job opportunities, and population from the project would tend to increase property values. The Coalition did not agree with Benga that the offers made to landowners were at a significant premium. They were of the view that the approval of the project would devalue the adjacent landowners' properties and, in some cases, make their lands totally worthless, especially where access to their properties would be lost.

[2108] Mr. Redekopp, a member of the Coalition and a licensed realtor for 30 years, has lived in the Crowsnest Pass area full time since 2010. He stated that the number of listings in the area was highest during a recreation boom in 2007, and that recently there had been another boom in the market as buyers looked for recreational properties. He indicated that recent potential buyers have told him that they would not commit to any purchase until they were sure that the proposed mine would not proceed. He suggested that a number of potential outcomes of the project could deter potential property buyers in the area.

Landowner access

[2109] Landowners adjacent to the project also expressed concerns about access to their properties. Benga has allowed landowners adjacent to the proposed mine site to access their properties by the Grassy Mountain Road, which is largely on its privately owned land. It notified these landowners that such access could only occur when safe to do so, and that, when the mine was constructed, this access would no longer be available. Although there is a registered easement in place granting access, this only applies to the northeast quarter section of 24-008-04-W5M, not the entire Grassy Mountain Road.

[2110] Benga installed gates that restricted access to Grassy Mountain Road, and by extension the landowner properties, although it provided keys to each of the adjacent landowners. These landowners had concerns with respect to the ability of medical and emergency response vehicles to use the Grassy Mountain Road.

[2111] Benga stated that although Grassy Mountain Road is the most convenient way to get to the private lands adjacent to the project area, alternative routes exist from the north via Highway 40, or from the south. Benga did not accept that it should be responsible for locating and providing a new alternative access road for the adjacent landowners.

[2112] Members of the Coalition, particularly the Watmoughs, Donkergoeds, Mr. Emard, and Ms. Gilmar, expressed concern about loss of access to their adjacent properties if the project were approved and if restrictions on the use of the Grassy Mountain Road were imposed. These landowners indicated that existing alternative access routes would not be adequate or viable.

[2113] The Coalition indicated that, although alternative access trails do exist, they are not comparable to Grassy Mountain Road. The route from Highway 40 in the north is lengthy, and the southern section consists of old logging trails that are not passable without the use of vehicles equipped with four-wheel drive. If the landowners were to access their properties from the south, they would have to drive through a residential area and up the trail system through the historic site of Lille. These trails are not roads and improvements would have to be made to ensure comparable access to their properties.

[2114] During the hearing, we heard extensive disagreement between Benga and the Coalition about whether existing access agreements and easements guaranteed access to the adjacent landowners' properties along Grassy Mountain Road.

Conclusion

[2115] We find that existing land use plans for the area do not prevent development of a new coal mining project on Grassy Mountain. On the issues of impacts on property values and access to the adjacent landowner properties via the Grassy Mountain Road, we find that these issues are moot because we are denying the applications for the project under the *Coal Conservation Act*. Similarly, because the project is being denied, we find there is no longer a need for the public land dispositions applied for, and accordingly we deny those applications.

21. Historical Resources

Benga conducted an assessment of historical resources

[2116] Historical resources in Alberta are protected under the *Historical Resources Act* and defined as:

“Any work of nature or of humans that is primarily of value for its palaeontological, archaeological, prehistoric, historic, cultural, natural, scientific, or esthetic interest including, but not limited to, a palaeontological, archaeological, prehistoric, historic, or natural site, structure or object.”

[2117] The *Historical Resources Act* is administered by the Historic Resources Management Branch of Alberta Culture, Multiculturalism and Status of Women. Approval from the Minister is required before most paleontological sites, or historical resources sites, can be disturbed. The Ministry issues permits, reviews permit reports, and determines if any additional work or mitigation measures are needed before a project can proceed. Final clearance and requirements are issued through the Historic Resources Management Branch.

[2118] Benga’s project is also subject to the requirements of *CEAA 2012*, as specified in section 5(1) including “(c) with respect to aboriginal peoples, an effect occurring in Canada of any change that may be caused to the environment on... (ii) physical and cultural heritage, ...or (iv) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.”

[2119] The project is subject to permitting and authorization by DFO under the *Fisheries Act* and *SARA*, and by NRCan under the *Explosives Act*. As a result, we considered effects under section 5(2) of *CEAA 2012* in the context of the federal authorizations required for the project.

[2120] Our assessment of effects on paleontological, archaeological, and historical resources that are not related to Indigenous culture follows below. For our assessment of paleontological, archaeological, and historical resources related to Indigenous culture, please see the chapter on the effects on Indigenous traditional use of lands and resources, culture, and asserted rights.

[2121] Benga stated it assessed the project under a *Historical Resources Act* requirement for a historic resource impact assessment of archaeological and palaeontological resources, including the assessment of historical structures and remains. Benga conducted its assessment of the project effects on historical resources in the LSA, which was defined as the mine permit boundary. Benga completed historical assessment field work, including deep testing in specific locations, for all areas with high historical resource potential. Benga’s assessment for the project recorded the archaeological and historical resources of the area, including those associated with past mining activities, such as the Greenhill Mine and the Village of Lille.

[2122] Benga identified 32 previously documented historical resources sites within the LSA in its pre-field work overview study. Benga stated that ten of the larger sites are within or directly adjacent to the proposed project footprint. Benga’s 2015 field survey documented 40 historical resource sites, 24 of which were previously known sites, and 16 of which were newly identified. Benga stated that development of the project would not affect the majority of these sites because they are outside the

project footprint. However, Benga noted that the potential exists for historical resources that lie partially or within the project footprint to be affected.

[2123] Benga stated that Alberta Culture, Multiculturalism and Status of Women recommended 17 historical resource sites for further historical resources work or *Historical Resources Act* clearance. Benga stated it would continue to work on fully documenting the 17 sites and obtain the necessary authorizations under the *Historical Resources Act* prior to undertaking any development that may affect these resources.

[2124] The proposed mitigation is appropriate to address the effects to historical resources

[2125] Benga stated that changes to historical resources could result from construction and operation activities, such as blasting, earthworks, and mining. These activities could have effects on unique sites and special features associated with the area of the project footprint. Benga assessed the overall effects on historical resources from project activities to be of low magnitude, local geographic extent, long duration, and occasional in frequency. Benga stated that the effects on historic resources would be irreversible.

[2126] Benga stated there would be no negative cumulative effects associated with the project on historical resources. It based this statement on the assumption that there would be no further spatial expansion of the current mine plan, and that no other proponent would be able to access and develop undisturbed land within the LSA.

Effects on fossil resources

[2127] Benga identified four important palaeontological sites within the LSA that contained Mesozoic Era fossil remains. It stated that there is a high potential to encounter fossil resources during mining operations in the pit extension and the south rock disposal areas. Benga reported finding fossil resources that were associated with several features of the project. These include the rail infrastructure areas, the access road, the construction camp, the overland conveyor, and the coal-handling and processing plant and related infrastructure. Benga stated that the impacts on these palaeontological fossil sites would be managed in compliance with the *Historical Resources Act*, with guidance from the Historic Resources Management Branch. This includes a palaeontological monitoring program in areas of high palaeontological potential during construction, and periodic monitoring during operations.

Effects on the Greenhill Mine

[2128] Benga identified the Greenhill Mine and its infrastructure, located in the southern end of the LSA, as an important historic site. The site contains the most complete groupings of early 20th century coal-mining structures in Alberta and is listed as a Registered Historic Resource. Benga stated that the site is important to the Euro-Canadian history of the Crowsnest Pass. Benga indicated that the eastern rail line loop passes through the site area and construction of the loop will directly affect some of the non-structural remains of the site. However, it will only affect those parts of the site that are classified as non-unique, and the disturbance is considered not significant. Benga noted that the rail loop has been designed to avoid all remaining structures that are part of the mine site.

[2129] Benga stated that all structures at the Greenhill Mine site would be documented and recorded in accordance with the *Historical Resources Act*. As well, concerning public access to structures related to the Greenhill Mine, Benga stated that it would adhere to the guidelines for New Development in Proximity to Railway Operations (Railway Association of Canada and the Federation of Canadian Municipalities 2013). These structures would be on the inside of the rail loop that would be fenced off but accessible to the public by request. Benga stated that, for structures outside of the rail loop, a roadside interpretive pull-off would be developed.

Effects on the Village of Lille

[2130] Benga stated that the Village of Lille was designated a Provincial Historic Resource in 1978 and is considered one of the most historically significant sites in the Crowsnest Pass. Benga acknowledged that development must be avoided in that area. Benga stated the project's southeast area, overlaps with the western half of the Lille townsite. Benga stated that no development related to mining was planned for this quarter section of the area, and it would not be affected by the project.

[2131] Benga confirmed in the EIA that there would be no new access through Lille. The *Historical Resources Act* requirements also specify that final plans must confirm there will be no new access through the village and indicate that any impacts on the Village of Lille would require Ministerial approval. During the hearing, Benga stated that landowners, including Ms. Gilmar, Mr. Emard, and the Donkersgoeds, could use alternative routes to their properties. Benga suggested the possibility of accessing their property from the south, through the Gold Creek valley and past the townsite of Lille, in the event the Grassy Mountain Road was no longer available for use.

[2132] Landowners, including members of the Coalition and Livingstone Landowners Group, expressed concerns with using the Lille route as an alternative on the east side of Grassy Mountain. They stated that if a permanent road was constructed, it would open up the Lille area to off-road vehicles and increase the traffic exponentially. Mr. D. Rothlin said he was concerned that the Village of Lille could lose its status as a historic site if a road was constructed through the townsite.

Mitigation and assessment of effects

[2133] Benga indicated in the EIA that mitigation measures would reduce or eliminate the potential impact from the proposed project's construction and operations on historical resources. Benga later stated it would mitigate potential effects on historical resources by adhering to the approved project-specific *Historical Resources Act* requirements for the historical resources identified adjacent to the project or on the footprint.

[2134] In addition to the mitigation described above specific to fossil resources, the Greenhill Mine, and the Village of Lille, Benga stated that monitoring during project development may be required at a limited number of historic sites in the project footprint. This monitoring would search for, record, and collect historical materials that may be exposed by construction and land development that were not discovered during early site investigations.

[2135] We find that the work that Benga has conducted with respect to historical resources is acceptable. We accept Benga's assessment that effects on historical resources within or adjacent to the project footprint will be mitigated by: undertaking additional study, implementing proposed mitigation where required, and following requirements related to authorizations under the *Historical Resources Act* prior to development of the project. Were the project to be approved, Benga would be required to submit further information and studies related to historical resources as part of the subsequent regulatory requirements under the *Historical Resources Act*.

22. Indigenous Traditional Use of Lands and Resources, Culture, and Rights

Regional and historical context

[2136] The project lies within Treaty 7 territory, in the headwaters of the Oldman watershed. For Indigenous groups and peoples, the Crowsnest Pass represents an important harvesting and cultural landscape, and is a traditional travel corridor. Indigenous groups emphasized the importance of protecting the Oldman watershed for these purposes.

[2137] Specifically, the project is within the traditional territory of the Blackfoot confederacy, which includes the Káínai First Nation (Blood Tribe), Piikani Nation, and Siksika Nation. The Blackfoot Confederacy used the Crowsnest Pass and surrounding areas of southwestern Alberta for millennia before the arrival of Europeans. Blackfoot histories, ethnographical data, archaeological data, linguistic data, and other information support Blackfoot occupation and use of their traditional territories in southwestern Alberta.

[2138] The project is also within the traditional territories asserted by the Stoney Nakoda and Tsuut'ina Nations. Métis peoples have worked and lived in the Crowsnest Pass area since at least the 1800s, and traded with other Indigenous groups on both sides of the Rocky Mountains. Two British Columbia-based groups, the Ktunaxa Nation and the Shuswap Indian Band, used and moved through the Crowsnest Pass in both pre-and post-contact times.

[2139] Additionally, the four Alberta-based nations who are signatories to Treaty 6—the Ermineskin Cree, Louis Bull Tribe, Samson Cree Nation, and Montana First Nation, collectively referred to as the Maskwacis Nations—have a broad traditional territory and ties to the project area. The Foothills Ojibway First Nation, which identifies as a non-treaty, non-status First Nation, also claims traditional territory on the eastern slopes of the Rocky Mountains, but not in the project area.

[2140] Indigenous groups noted that, over the last 120 years, they have experienced changes to the landscape resulting from coal mining. Moreover, cumulative impacts from industry operations that include not only mining but also transportation and logging have gradually decreased their trust of the land and water-based resources, and reduced the area available for traditional land use.

[2141] Indigenous groups discussed the more recent landscape changes, and the specific environmental effects related to the project. They also discussed the historical context of colonization of the prairies, and how Euro-Canadian colonization resulted in the decimation of Indigenous communities due to a series of smallpox epidemics. They described how settlement-era policies affected all Indigenous groups.

The Buffalo Treaty

[2142] The cultural importance of bison (buffalo) was another theme addressed by Indigenous groups, as was the central role of the Crowsnest Pass and the project area to bison hunting. Bison were abundant and harvested in the Crowsnest Pass until their extirpation in the late 19th century. Colonial pressure related to the bison's demise and the area's ongoing importance for potential bison restoration were mentioned by several groups.

[2143] A number of Indigenous groups, including the Ktunaxa Nation and the Treaty 7 Indigenous groups, signed *The Buffalo: A Treaty of Cooperation, Renewal and Restoration* (the Buffalo Treaty) in 2014. The over-arching objective of the Buffalo Treaty is to “honor, recognize, and revitalize the time immemorial relationship” Indigenous peoples have with the bison. The Buffalo Treaty speaks both to the re-establishment of the bison as a wild species as well as to the maintenance of the cultural connection between bison and Indigenous groups by perpetuating all aspects of their culture related to bison, including customs, practices, harvesting, beliefs, songs, and ceremonies.

[2144] A discussion of the potential for the reintroduction of bison to the project area can be found in the chapter on wildlife. Information about specific Indigenous group’s historic connection to bison is discussed in the sections below.

The panel’s mandate

[2145] We are required to evaluate two distinct, but interrelated, issues with respect to the effects of the project on Indigenous peoples. First, under section 5 of *CEAA 2012*, we are required to assess whether the project would cause changes to the environment that would affect

- current use of lands and resources for traditional purposes;
- physical and cultural heritage;
- any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance; and
- health and socioeconomic conditions.

[2146] Second, as part of our terms of reference, we are required to consider the adverse impacts of the project on asserted or established Aboriginal and treaty rights. The terms of reference state:

A. Aboriginal Rights

The Joint Review Panel shall consider and include in its report the effects of the Project on asserted or established Aboriginal or treaty rights, to the extent the Joint Review Panel receives such information as provided in Part III. The Joint Review Panel must invite Indigenous groups and peoples to provide information related to:

- the nature, scope, location and extent of asserted or established Aboriginal or Treaty rights that could be impacted by the Project,
- the potential adverse environmental effects and the potential impacts that may be caused by the Project on asserted or established Aboriginal or Treaty rights,
- any potential adverse effects that may be caused by the Project on the health, social or economic conditions of Indigenous people,
- any measures proposed to avoid, mitigate or accommodate the potential adverse environmental effects of the Project and the potential adverse impacts on asserted or established Aboriginal or Treaty rights,

- cumulative environmental effects and cumulative impacts to asserted or established Aboriginal or Treaty rights and related interests,
- historic, current and intended future uses of lands and resources, and
- information on determining thresholds for significance of environmental effects as defined under s. 5 of *CEAA 2012*, and for severity of impacts to asserted or established Aboriginal or Treaty rights, including Indigenous perspectives and criteria.

The Joint Review Panel may also receive information in this regard provided by the proponent, government bodies, the public and other interested parties.

The Joint Review Panel shall summarize in its report the information provided regarding the manner in which the Project may adversely impact asserted or established Aboriginal or Treaty rights, and where appropriate, may summarize information received on the perspectives of Indigenous groups or peoples on the potential infringement that the Project may cause on asserted or established Aboriginal or Treaty rights.

The Joint Review Panel may use this information to make conclusions and recommendations that relate to the manner in which the Project may adversely impact asserted or established Aboriginal or Treaty rights as described by Indigenous persons or groups and may incorporate any Indigenous perspective and Traditional Aboriginal Knowledge that it has received into its report. The Joint Review Panel should describe its rationale for how it came to its conclusions.

The Joint Review Panel, based on its assessment of the environmental effects of the Project, may recommend measures to mitigate any potential adverse environmental effects that may be caused by the Project that could adversely impact the asserted or established Aboriginal or Treaty rights that were identified.

The Joint Review Panel shall not make any determinations as to:

- the validity of asserted or established Aboriginal or Treaty rights asserted by an Indigenous group or peoples or the strength of such claims;
- the scope of the Crown's duty to consult an Indigenous group;
- whether the Crown has met its respective duties to consult or accommodate in respect of rights recognized and affirmed by section 35 of the Constitution Act, 1982; or
- any matter of Treaty interpretation.

[2147] To accomplish this, we

- summarize the information we received from the proponent, governments, and Indigenous groups about the manner in which the project may adversely impact asserted or established Aboriginal or Treaty rights; and
- summarize the perspectives of Indigenous groups or peoples on the potential infringement that the project may cause on asserted or established Aboriginal or Treaty rights.

[2148] We use these summaries to make conclusions and recommendations that relate to the manner in which the project may adversely impact asserted or established Aboriginal or treaty rights to the extent that we received this information.

[2149] A number of Indigenous groups participated in the review through written submissions, traditional land-use assessments, and hearing submissions and presentations. Benga, through its engagement with Indigenous groups, provided information as well. The governments of Alberta and Canada also provided information.

[2150] We conducted the two assessments, a *CEAA 2012* section 5 assessment and another on impacts on the asserted or established Aboriginal and treaty rights, for each of the Indigenous groups listed below, to the extent we had information to do so. We completed our assessment based on this information, regardless of whether participants withdrew, came to an agreement with Benga, participated in the public hearing, or supported or opposed the project.

- Káínai First Nation (Blood Tribe)
- Piikani Nation
- Siksika Nation
- Stoney Nakoda Nations
- Tsuut'ina Nation
- Métis Nation of Alberta – Region 3
- Ktunaxa Nation
- Shuswap Indian Band
- Samson Cree Nation
- Louis Bull Tribe
- Ermineskin Cree Nation
- Montana First Nation
- Métis Nation British Columbia
- Foothills Ojibway First Nation

[2151] Our terms of reference also mandated us to invite Indigenous groups and peoples to provide information related to the following:

- The nature, scope, location, and extent of asserted or established Aboriginal or treaty rights that could be impacted by the project
- The potential adverse environmental effects and the potential impacts that may be caused by the project on asserted or established Aboriginal or treaty rights

- Any potential adverse effects that may be caused by the project on the health, social, or economic conditions of Indigenous people
- Any measures proposed to avoid, mitigate, or accommodate the potential adverse environmental effects of the project and the potential adverse impacts on asserted or established Aboriginal or treaty rights
- Cumulative environmental effects and cumulative impacts to asserted or established Aboriginal or treaty rights and related interests
- Historical, current, and intended future uses of lands and resources
- Information on determining thresholds for significance of environmental effects as defined under section 5 of *CEAA 2012*, and for severity of impacts to asserted or established Aboriginal or treaty rights, including Indigenous perspectives and criteria

[2152] In addition to the information received from Indigenous groups before the hearing, the Shuswap Indian Band, the Ktunaxa Nation, and the Stoney Nakoda Nations provided information to us in their hearing submissions.

[2153] In this chapter, and throughout the report, we consider that Indigenous perspectives informed by traditional knowledge constitute an important component in understanding potential effects on the environment and potential impacts of the project on asserted or established Aboriginal or treaty rights. We also consider evidence of both tangible and intangible impacts on Indigenous peoples, and recognize that these two are often interrelated.

[2154] To assess the potential effects of the project or the manner in which the project may adversely impact asserted or established Aboriginal or treaty rights, we accept the rights being asserted. In keeping within our mandate, we make no determinations about the validity of the asserted Aboriginal and treaty rights or the strength of such claims. Nor do we make any determinations about treaty interpretation. Further, we do not assess the adequacy of Crown consultation, or whether the Crown has met its duties to consult or accommodate.

The panel's approach to assessing project effects and impacts on Aboriginal and treaty rights

[2155] We recognize in completing the two tasks identified that they are related, but distinct. The effects assessment under section 5 of *CEAA 2012* is intertwined with our mandate to assess the potential adverse impacts of the project on asserted or established Aboriginal and treaty rights. The Government of Canada noted this “overlap” between potential impacts on Aboriginal and treaty rights and *CEAA 2012* section 5 effects in their hearing submission.

[2156] Given the interrelatedness of these two tasks, we undertake our assessment as follows. Our approach begins with the pathways of effects from project-related activities to the biophysical environment. We then explore the connection between the biophysical environment and the conditions needed for the continued use of lands and resources for traditional purposes, maintenance of physical and cultural heritage, and the improvement and maintenance of Indigenous health and socioeconomic conditions. We then take into consideration Aboriginal and treaty rights as asserted by individual groups and the factors that support the practise of those rights and a community's way of life. Finally, we use our

assessment of effects on *CEAA 2012* section 5 factors, in combination with our assessment of cumulative effects, to understand the extent to which the exercise of rights has already been impacted, and the further potential impacts on rights from the project.

[2157] In each assessment, we first present information received from Indigenous groups, Benga, and governments before we assess the effects on current use of lands for traditional purposes, physical and cultural heritage, and health and socioeconomic conditions. We provide specific findings and conclusions of significance for each Indigenous group. Our assessment of effects under *CEAA 2012* section 5 then informs our broader assessment of potential impacts on rights. Our confidence in our assessment was highest for those groups for which we had the most information: the Káínai First Nation, Piikani Nation, and Siksika Nation. Our confidence was moderate for our assessment of all other groups. We indicate where we received minimal information from a particular Indigenous groups and our assessment was limited as a result.

[2158] For our assessment of current use of lands and resources for traditional purposes, we follow an approach consistent with the Agency's *Technical Guidance for Assessing the Current Use of Lands and Resources for Traditional Purposes under the Canadian Environmental Assessment Act, 2012*. We adopt Benga's Indigenous valued components and consider the effects of the project on hunting, trapping, fishing, plant gathering, and trails and travelways in our assessment of current use of lands and resources for traditional purposes. For each of the Indigenous valued components, we look at the changes to access as well as changes to use, in terms of quality and quantity of resources, the quality of experience that could affect the ability of a group to successfully use an area, and the potential for ongoing and future use.

[2159] For physical and cultural heritage and other related matters, we use the Agency's *Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site or Thing that is of Historical, Archeological, Paleontological or Architectural Significance under the Canadian Environmental Assessment Act, 2012*. We consider Benga's Indigenous valued components, but combine cultural and spiritual components with physical and cultural heritage components in our assessment of physical and cultural heritage. We recognize that Benga has identified both non-Indigenous and Indigenous historical resources valued components. Indigenous historical resources are tied to Indigenous culture or history. This assessment incorporates information on the effects of the project on any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance to Indigenous groups.

[2160] No explicit Agency guidance is available for the health and socioeconomic conditions related to Indigenous peoples. We rely therefore on the assessments of the effects of the project in the chapters on human health and social and economic effects as well as information received from Indigenous groups.

[2161] For our assessment of cumulative effects for each Indigenous group, we rely on the qualitative discussion of cumulative effects provided by Benga as well as information on historical and cultural context received from Indigenous groups.

[2162] In the chapter on the panel's approach to determining the significance of effects, we defined six criteria to assess the significance of biophysical valued components. These magnitude criteria do not work effectively for *CEAA 2012* section 5(1)(c) effects. Below we provide an alternative definition for

magnitude criteria. The other five criteria (geographic extent, duration, frequency, reversibility, and ecological and social context) were applied as set out in the chapter on the panel's approach to determining the significance of effects. Our basis for the definitions of magnitude criteria is our acceptance and use of the Agency's *Interim Guidance: Assessment of Potential Impacts on the Rights of Indigenous Peoples*, which contains useful concepts and language related to the magnitude of impacts. We adopted the definitions below and modified them to use language more appropriate to the 5(1)(c) effects of the project.

Definitions of magnitude of project effects

- **Low:** No or few effects on areas of cultural importance. No or minimal effect on access for practising of cultural activities. The Indigenous group has only minor concerns about effects from the project on the health or integrity of the resources and/or places they use.
- **Moderate:** Some effect(s) on areas and/or practices of cultural importance. The effect may impede or alter access to practising cultural activities. There may be a loss of habitat or availability of culturally important species. The disturbance may be of a physical or sensory nature (e.g., noise, dust, and visual quality).
- **High:** Considerable effect(s) on areas and/or practices of cultural importance. Multiple effects could occur in one area of high importance. There would be a loss of habitat or availability and a reduction in the quality of culturally important species. Access to areas required to practise cultural activities would be disrupted or limited. The disturbance may be of a physical or sensory nature (e.g., noise, dust, and visual quality) or may affect law, knowledge, customs, and/or spiritual and cultural practices.

Assessing potential impacts on the exercise of Aboriginal and treaty rights

[2163] We rely on the guiding principles presented in the Agency's *Policy Context: Assessment of Potential Impacts on the Rights of Indigenous Peoples* to assess the effects of the project on asserted or established Aboriginal and/or treaty rights. We apply the step-wise methodology presented in the Agency's *Interim Guidance: Assessment of Potential Impacts on the Rights of Indigenous People*. We note that both documents closely reflect the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine*, which was developed collaboratively in 2018 by the Agency and the Mikisew Cree First Nation during the review of the Teck Frontier Oil Sands Mine Project.

[2164] In August 2020, prior to the hearing, we stated our intention to use the above-noted guidance, developed under the 2019 *Impact Assessment Act*, to guide our assessment of impacts of the project on asserted or established Aboriginal and/or treaty rights. We sought the views of Indigenous groups on using this guidance; however, we did not receive any responses from Indigenous groups, or Benga, on this matter.

[2165] Table 22-1 provides the criteria we apply to assess the potential impacts of the project on the exercise of Aboriginal and treaty rights. The criteria definitions are found in the Agency's *Interim Guidance: Assessment of Potential Impacts on the Rights of Indigenous People*. We use the descriptions of the level of impact for each criterion, as described by the Agency's guidance, with two exceptions. The intergenerational transfer of knowledge is an important indicator of the duration and reversibility of

an effect, in the context of current and traditional land use. As a result, for the duration criteria, we include language concerning intergenerational transfer of knowledge taken from the *Methodology for Assessing Potential Impacts on the exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine*. As well, our definitions for likelihood reflect those found in the chapter on the panel's approach to determining the significance of effects.

[2166] We apply all the criteria in Table 22-1 to each Indigenous group, to the extent that we received this information. Where we received little to no information relevant to a particular criterion, our assessment does not consider this criterion in any depth.

Table 22-1: Criteria for determining the severity of impacts

Criteria	Criteria definition
Cultural well-being (magnitude)	Low: No or little indication that there would be an impact on areas of cultural importance. The impact is not likely to impede practise of cultural activities. The Indigenous group has only minor concerns about impacts from the project or on health or integrity of the resources and/or places used to practise rights.
	Moderate: There may be an impact on areas and/or practices of cultural importance. The impact may impede or alter access to practise cultural activities. There may be a loss of habitat or availability of culturally important species. The disturbance may be of a physical or sensory nature (e.g., noise, dust, or visual quality).
	High: There would likely be an impact on areas and/or practices of cultural importance. Multiple impacts could occur to one area of high importance. There would likely be loss of habitat or availability and reduction in the quality of culturally important species. Access to areas required to practise cultural activities would likely be disrupted or limited. The disturbance may be of a physical or sensory nature (e.g., noise, dust, or visual quality) or may affect law, knowledge, customs, and/or spiritual and cultural practices.
Geographic extent	Low: The impact could occur over a small spatial extent relating to the exercise of rights. Impacts are not expected within area of preferred or exclusive use.
	Moderate: The impact could occur over a moderate spatial extent relating to the exercise of rights. Impact may occur within areas of preferred use.
	High: The impact could occur over a large spatial extent relating to the exercise of rights. Impacts are expected within areas of preferred use or high value.
Duration, frequency, reversibility	Low: The impact lasts less than 5 years (i.e., approximate duration of construction phase). The impact would be confined to one discrete period during the life of the project. The impact may be reversed in the short term. The impact allows intergenerational transfer of knowledge and the current use of lands and resources for traditional purposes to continue into the future.
	Moderate: The impact may last up to one generation. The impact would occur at sporadic, intermittent intervals (daily, weekly, or monthly), and throughout the operation and decommissioning of the project. The impact may be reversed within one generation. Transfer of knowledge between generations may be interrupted for a moderate period of time by the project; however, practices may be resumed broadly within one generation.
	High: The impact is likely to persist over multiple generations. The impact would occur constantly during, and potentially beyond, the life of the project. The impact cannot be reversed either in whole or in part. The intergenerational transfer of knowledge would be interrupted for an extended time period and may not be reversed either in whole or in part.

Criteria	Criteria definition
Health	<p>Low: The Indigenous community has minor to no concerns about impacts from the project on health. The project is not likely to pose environmental effects on health, including effects on country foods.</p>
	<p>Moderate: There may be an impact on physical, mental, emotional, and/or spiritual aspects of health on an individual and/or broader community basis. The environmental effects from the project are tied to food or cultural species important to traditional diets, and socioeconomic effects related to food security. The exercise of rights is altered due to quantifiable and/or perceived effects from the project.</p>
	<p>High: There are extensive environmental effects from the project tied to food or cultural species, and related socioeconomic considerations. The group has serious concerns about impacts on holistic and/or traditional models of health. Perception of effects to health interferes with, alters, and/or stops the exercise of Aboriginal rights. The project is likely to impact health on a community-wide level.</p>
Cumulative impacts	<p>Low: The project or activity would be in an area with few existing impacts and there is little development in the community's territory. The project is not likely to have cumulative effects.</p>
	<p>Moderate: The project may interact with one of only a few preferred areas where rights can still be practised. There are other land uses, including proposed or existing projects, in the community's territory that impact the practise of rights. The project may cause environmental effects on a species that is culturally important that is also a federally or provincially listed species.</p>
	<p>High: The project may interact with the only area where a particular right can be practised. The project may cause significant effects on a culturally important species that is also a federally or provincially listed species at risk. The rights that may be impacted by the project are not currently practised in the preferred manner because of conservation issues, lack of access, or government policies or programs. There are many historic, current, or proposed projects in the area, and a high level of existing disturbance.</p>
Governance	<p>Low: There is a high level of cooperation between the proponent and Indigenous community. The community has formally indicated to the Crown that risks from the project are acceptable or have been accommodated. The project and activities take place in areas designated by the community for development and align with land or water use plans.</p>
	<p>Moderate: Indigenous community has expressed concern about impacts of the project. The community has stated that some impacts remain after mitigation and/or accommodation. The community has indicated that the project may not be compatible with certain aspects of their land use plans or application of traditional laws and governance.</p>
	<p>High: The project would likely prevent or restrict use of areas of title. The project may interfere with traditional land management and governance regimes. The community has indicated that the project is not compatible with their land use plans, application of traditional laws or future aspirations, and that no mitigation or accommodation would be able to offset the impacts. The community has stated the culture would not withstand the impact.</p>
Impact inequity	<p>Low: Subgroups of the population are resilient enough to withstand impacts of the project and maintain the exercise of their rights. The impacts would be temporary and would allow intergenerational transfer of knowledge and exercise of rights to continue into the future. Potential benefits resulting from the project would flow between all segments of the community.</p>
	<p>Moderate: Transfer of knowledge between generations may be interrupted for a moderate period of time by the project. Vulnerable subgroups of the population are likely to experience a higher impact on their ability to exercise rights. Impacts may be reversed within one generation. Some benefits may accrue to subgroups.</p>

Criteria	Criteria definition
	High: Subgroups of the population would be disproportionately impacted by the project and experience little to no benefit. Intergenerational transfer of knowledge would be interrupted for an extended period and may not be reversed either in whole or in part.
Likelihood	Low: A potential impact has a very low or low probability of occurring and is not expected to occur.
	Moderate: A potential impact has a moderate probability of occurring, could occur, but may or may not occur.
	High: A potential impact has a high or very high probability of occurring and is expected to occur.
Severity	Low: Impacts are likely to be minor in scale, short in duration, infrequent, small in spatial extent, reversible, or readily avoided or reduced; cultural well-being is minimally disrupted; no or few effects to health and/or country foods; few (or no) existing or proposed developments or historical impacts in the group's territory; project and activities in alignment with group's development, land or water use plans; subgroups of the population are resilient enough to sustain impacts and maintain exercise of rights; mitigation should allow for the practise of the right to continue in the same of similar manner as before any impact.
	Moderate: Impacts are likely to be medium in scale, moderate in duration, occasionally frequent, and possibly/partially reversible; spatial extent affects preferred-use areas or disrupts interconnectedness and/or knowledge transfer; cultural well-being is impeded or altered; impacts on individual and/or community holistic health, including perceptions of impacts; project interacts with a few preferred areas where rights can be practised with some historical, existing, or proposed development and/or disturbance; project may not be compatible with aspects of land use plans or application of traditional laws and governance; vulnerable subgroups are likely to experience greater impacts on ability to exercise rights; mitigation may not fully ameliorate impacts but should enable the Indigenous group to continue exercising their rights as before, or in a modified way.
	High: Impacts are likely to be major in scale, permanent/long-term, frequent, possibly irreversible and over a large spatial extent or within an area of exclusive/preferred use; cultural well-being is disrupted, impeded or removed; project interacts with only areas where a right may be exercised and with many historical, existing, or proposed developments and/or disturbance; decision making associated with governance and title adversely affected; subgroups would be disproportionately impacted by the project and experience no to little benefit; mitigation is unable to fully address impacts such that the practise of the right is substantively diminished or lost.

Government approach and assessment

Government of Alberta

[2167] The Government of Alberta's consultation with Indigenous peoples is managed by the Aboriginal Consultation Office (ACO), which is housed within Alberta's Ministry of Indigenous Relations. Pursuant to certain ministerial orders,³ the AER is directed, for certain applications, to work with the ACO and request advice from the ACO about Alberta's consultation with Aboriginal peoples and whether actions are required to address potential adverse impacts from those applications on existing rights of Aboriginal

³ Energy Ministerial Order 105/2014, Environment and Sustainable Resource Development Ministerial Order 53/2014; Energy Ministerial Order 39/2016, and Environment and Parks Ministerial Order 16/2016.

peoples or traditional uses as defined in the Government of Alberta’s consultation policies. Pursuant to the ministerial orders and section 21 of *REDA*, as a panel of AER hearing commissioners, we have no jurisdiction to assess the adequacy of Crown consultation associated with the rights of Aboriginal peoples as recognized and affirmed under Part II of the *Constitution Act, 1982*. We therefore sought advice from the ACO about the adequacy of Alberta’s consultation with Indigenous peoples and necessary actions to mitigate the impacts of the projects on the rights of Indigenous peoples.

[2168] Benga was advised by ACO to consult with the Káinai First Nation (Blood Tribe), Piikani Nation, Siksika Nation, Stoney Nakoda Nations (including Bearspaw First Nation, Chiniki First Nation, and Wesley First Nation), and Tsuut’ina Nation. Alberta did not require consultation with the Métis for the project.

[2169] The ACO observed the public hearing and provided us with its assessment of consultation adequacy for the Treaty 7 groups. The ACO’s conclusions on the adequacy of consultation are discussed in the section on Treaty 7.

Government of Canada

[2170] The Government of Canada stated it takes a “whole of government” approach when consulting Indigenous peoples about the potential adverse impacts of a project on the exercise of Aboriginal or treaty rights in the context of environmental assessments. The Agency stated that, in its capacity as the Crown Consultation Coordinator, it supports and facilitates the integration of consultation activities into the review process to the extent possible.

[2171] The Agency, in its capacity as the Crown Consultation Coordinator, submitted a preliminary assessment of potential impacts on asserted or established Aboriginal and/or treaty rights on behalf of the Government of Canada. The Agency stated that it encouraged Indigenous groups to provide submissions directly to the panel and noted that its assessment should not replace our consideration of all relevant submissions made during the environmental assessment. The Agency stated that the Government of Canada would use our report to inform its ongoing consultation with Indigenous groups, as well as their assessment of potential impacts of the project on Aboriginal or treaty rights.

[2172] The Government of Canada’s preliminary assessment of potential impacts on asserted or established Aboriginal or treaty rights included the Agency’s methodology, a preliminary assessment, and recommendations for mitigation measures. The Agency described treaty rights as those derived from agreements between the signatory Indigenous nations or groups and the Crown, and noted that treaty rights are more prescriptive than Aboriginal rights. Groups that do not have a treaty still have constitutionally protected rights under section 35 of the *Constitution Act, 1982*. The Agency confirmed that its assessment did not contain any determination of rights for the identified Indigenous groups because consultation in the context of environmental assessments is not a rights determination process.

[2173] The Agency applied the methodology developed collaboratively in 2018 by the Agency and the Mikisew Cree First Nation during the review of the Teck Frontier oil sands project to conduct its preliminary assessment. The Agency also referred to the methodology in its *Interim Guidance: Assessment of Potential Impacts on the Rights of Indigenous Peoples* in the submission. The Agency

stated that it invited Indigenous groups to discuss the appropriateness of applying this methodology, but that no discussions occurred.

[2174] The Agency stated that the project was likely to have adverse biophysical environmental effects that may have implications for the current use of lands and resources for traditional purposes, in addition to potential impacts on the exercise of Aboriginal and/or treaty rights. The Agency assessed the potential impacts of the project on Aboriginal and/or treaty rights on hunting and trapping, plant gathering, cultural and spiritual values, fishing, and water. The Agency noted that impacts on rights may be broader than environmental effects as they can extend to potential impacts on culture, knowledge transfer, language, and experience.

[2175] The Agency stated that its preliminary assessment for the five Treaty 7 First Nations and the Ktunaxa Nation was based entirely on information provided by those Indigenous groups. Each of the Treaty 7 groups and the Ktunaxa were assessed separately, but because the Agency came to the same conclusions for each group, they were treated collectively in the submitted report.

[2176] In addition to those groups, the Agency stated that the federal government was consulting with Métis rights holders, the four Maskwacis Treaty 6 First Nations, the Shuswap Indian Band, and non-treaty Indigenous groups whose asserted or established Aboriginal and/or treaty rights could be impacted by the project. The Agency stated that these other Indigenous groups had not provided the Agency with sufficient information to assess the impact on their rights. The Agency stated that once the environmental assessment process was complete, the Government of Canada would continue to engage with communities to identify potential impacts of the project on their rights.

Benga's approach and assessment

[2177] This section provides an overview of Benga's approach to working with Indigenous groups, and an overview of the approach and overall conclusions contained in Benga's assessment of the effects of the project on Indigenous peoples. This section also lists the mitigation measures Benga proposed to address these effects, and describes Benga's commitment to continue working with Indigenous groups. We provide our overarching views on Benga's approach here.

[2178] Where Benga's assessment applies to all Indigenous groups, as is the case with the conclusions on Indigenous health, socioeconomics, and cumulative effects, we provide a more detailed assessment of Benga's approach and results in this section to avoid unnecessary duplication. Our conclusions on individual Indigenous groups are in the group-specific sections of this chapter for all other effects.

Engagement with Indigenous groups

[2179] Benga stated it undertook extensive consultation and engagement efforts with Indigenous groups and described the letters of no concern / non-objection submitted by the Káinai First Nation, Piikani Nation, Siksika Nation, Stoney Nakoda Nations, Tsuut'ina Nation, and the Métis Nation of Alberta as evidence of the success of these efforts. Benga said it signed agreements with all of those groups containing terms, commitments, and additional mitigation measures it was prepared to implement. Benga reported it made a number of "Basic Indigenous Commitments" that were central to those agreements, including:

- Benga will consult with Indigenous communities to develop final monitoring and mitigation plans;
- Benga will work with Indigenous communities to develop reclamation plans that reflect traditional knowledge;
- Benga will implement a community-based monitoring program directed by Indigenous communities and implemented through Indigenous monitors;
- Benga will regularly provide project updates, environmental information, mitigation plans, and related reports to the Indigenous communities;
- Benga will develop communication protocols that allow for exchange of information, including complaints and concerns about the project; and
- Benga will continue to administer an access management plan to allow Indigenous groups to access Benga lands in the area when it is safe to do so.

[2180] Benga also committed to implementing these commitments with the Ktunaxa Nation and the Shuswap Indian Band, until such time that agreements are signed superseding those commitments. We have not assessed the adequacy of Benga's engagement or consultation efforts. We note that Benga came to agreement with all Treaty 7 First Nations and said it is working with others. Although we do not know specifics of the individual agreements, it is helpful to understand the Basic Indigenous Commitments they may be based on.

Current use of lands and resources and physical and cultural heritage

[2181] To carry out the assessment of project effects on Indigenous groups, Benga stated it followed the Agency's *Technical Guidance for Assessing the Current Use of Lands and Resources for Traditional Purposes under the Canadian Environmental Assessment Act, 2012* and the *Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site or Thing that is of Historical, Archeological, Paleontological or Architectural Significance under the Canadian Environmental Assessment Act, 2012*, in addition to other AER and Agency guidance.

[2182] For Indigenous valued components, Benga defined "not significant" as predicted to be within the range of natural variability and below guideline or threshold levels. Benga considered natural variability to relate to the availability of other similar opportunities to conduct traditional activities in the region. Benga defined "significant" as predicted to cause irreversible changes to the sustainability or integrity of a population or resource.

[2183] Benga considered additional elements in determining significance:

- potential environmental effects of the project and determination of significance described in the assessment of environmental biophysical valued components
- a potential effect of the project on the ability to continue to exercise Indigenous interests including treaty rights
- the extent to which mitigation measures can reasonably address potential effects

[2184] Likelihood, or the probability of an environmental effect occurring, was considered only if it was established that a residual effect was significant.

[2185] Benga reported that Indigenous knowledge was used to identify valued components, define spatial and temporal boundaries, collect baseline information, identify potential effects, and develop proposed mitigation and monitoring measures. Benga noted that, due to the qualitative and, at times, intangible nature of information provided by Indigenous groups, professional judgement was applied to the determination of significance in some cases.

[2186] Benga noted that several Indigenous groups undertook more comprehensive studies of traditional knowledge or traditional use that were used for internal purposes. Not all information was shared in the summary studies provided to Benga to respect confidentiality, intellectual property, and cultural sensitivity.

[2187] Benga selected hunting, trapping, fishing, plant gathering, trails and travelways, cultural and spiritual values, and Indigenous physical and cultural heritage as the Indigenous valued components. Benga noted that the valued component of Indigenous physical and cultural heritage includes consideration of any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance.

[2188] For Indigenous valued components, Benga defined the LSA for the project as the zone-of-influence of the project beyond which it expects the potential environmental effects of the project to be non-detectable. Maps provided by Benga generally delineate the LSA as the extent of the mine permit boundary. Benga adopted the grizzly bear RSA for application to Indigenous valued components, because it was the broadest study area used in the assessment for biophysical valued components that interacted with Indigenous valued components. The temporal boundaries of Benga's assessment included a construction time of about two years, operation over 23 years, and reclamation and closure activities for an additional 15 to 20 years.

[2189] Benga described the interconnection between tangible values and intangible values by stating that resources such as plants, fish, and wildlife have always been important for food and subsistence, that the gathering of these resources in specific areas has important cultural and spiritual considerations, and that intergenerational knowledge of ceremonies, legends, and practices is shared while harvesting. Benga noted that the knowledge shared is often place-specific and relies on maintaining the integrity of the cultural landscapes.

[2190] Benga initially expressed concern with completing an assessment of how the project may affect Indigenous cultural and spiritual practices, ceremonies, and intergenerational transfer of language, knowledge, and culture, describing the assessment as "a form of cultural misappropriation" (CIAR 300, PDF p. 3). Once we clarified that the information requested was required under *CEAA 2012*, Benga sought input from the Indigenous communities during the course of consultation for the project and provided the most affected Indigenous groups with a draft assessment for comment and validation. Benga provided additional information about the potential intangible cultural and spiritual effects of the project in the Eleventh Addendum. Benga stated that, by definition, intangible effects are those that cannot be

objectively measured or evaluated, and that effects on culture or personal mental well-being can be subjective, differ among groups or individuals, and be difficult for third parties to understand.

Primary effects

[2191] Benga stated that the primary project effects on Indigenous valued components, before mitigation, would be loss of Crown land, which would result in loss of and access to preferred hunting, trapping, fishing, and plant-gathering locations, as well as trails and travelways. These effects would also change how these activities are experienced due to noise and other project-related disturbances. The project may intersect or be in proximity to sacred, gathering, and habitation sites identified by some Indigenous groups. Benga stated that the consequences would be the loss of opportunities for traditional activities, the loss of intergenerational knowledge-transfer opportunities, and the change in use of, or access to, sacred, gathering, or habitation sites.

[2192] Benga committed to implementing mitigation measures that reduce project effects on Indigenous valued components and associated biophysical valued components. This would, by extension, mitigate effects on Indigenous activities.

[2193] At a summary level, Benga proposed the following actions in terms of mitigation, monitoring, and follow-up for Indigenous valued components:

- An Indigenous environmental stewardship committee would be established to provide advice on land use values and sites of cultural, spiritual, and traditional importance as they arise.
- An Indigenous monitoring program would be implemented, which would include monitoring of a suite of culturally defined environmental attributes, including archaeological sites of historical and cultural significance.
- Benga would continue to work with Indigenous groups to improve the access management plan to grant access to non-operational areas of Benga land and Crown land used for the project. In addition, Benga agreed to allow Indigenous groups access to approximately 700 ha of privately owned Benga lands along the Grassy Mountain Road for certain activities such as harvesting and gathering.
- Benga committed to continuing to work with Indigenous communities to develop the final management plans in coordination with regulatory proceedings, project approvals, and engineering and design schedules.
- A cultural site discovery contingency plan would be developed and implemented for culturally important sites identified during construction or operations.
- If avoidance of any traditionally used features is not possible, Benga would work with affected Indigenous groups to develop and plan for mitigation of the site.
- Benga would support a cultural competency program for its employees and contractors. Other monitoring and follow-up activities would be considered by Benga as they are brought forward by Indigenous groups.
- Benga committed to working with Indigenous communities to implement protocols or to restrict access by others when harvesting is taking place through the access management plan.

[2194] In addition, Benga made the following commitments:

- It would adhere to the approved project-specific *Historical Resources Act* recommendations as they pertain to identified resources on Grassy Mountain adjacent to or within the project footprint.
- Sites of cultural and sacred importance within 100 m of a project activity and outside the project footprint would be flagged or marked prior to land disturbance, where identified by Indigenous groups.
- It would work with Alberta Culture and Tourism (now Alberta Culture, Multiculturalism and Status of Women) and the Indigenous community to develop and plan mitigation measures for identified traditional knowledge/use features if avoidance is not possible.
- It would adhere to pertinent best management practices, as outlined in the *Guidelines for the New Development in Proximity to Railway Operations*, to mitigate potential rail-yard impacts. Disturbance of any further remains within the proposed rail loadout area would be mitigated with controlled excavations to remove the remains.
- Design details would be revised such that two culturally significant sites on the southern end of the proposed coal-processing plant and near the proposed road (DjPo-98 and DjPo-130) would be avoided, protected, and preserved. Access to these sites would be controlled through the access management plan.

[2195] Benga stated that the mitigation measures would be implemented through commitments made in the agreements with Indigenous groups, regulatory approvals, and/or project-specific policies and procedures. Monitoring and adaptive management would be an important part of ensuring that mitigation measures were effective.

[2196] Benga stated that, for Indigenous groups who identified interests in the project area, residual effects on hunting, trapping, fishing, plant gathering, and trails and travelways would remain after the implementation of mitigation measures. Benga stated that there would also be a residual effect on cultural and spiritual values and physical and cultural heritage. Benga predicted residual effects for the Káinai Nation, Piikani Nation, Siksika Nation, Stoney Nakoda Nations, Tsuut'ina Nation, Ktunaxa Nation, Samson Cree, and the Métis Nation of Alberta – Region 3. Benga characterized the residual effect for each group based on the criteria of magnitude, geographic extent, duration, frequency, reversibility, and ecological and social context. Specific information on Benga's characterization of residual effects is presented in the individual sections on Indigenous groups.

[2197] We find that Benga's approach to the assessment of the effects of the project on current use of lands and resources and physical and cultural heritage was reasonable. We provide our assessment, as it applies to individual Indigenous groups, in the group-specific sections of this chapter.

Cumulative effects

[2198] Benga stated that the cumulative effects assessment provides a qualitative discussion of potential cumulative effects on Indigenous valued components that have residual adverse effects. Benga stated that the cumulative effects assessment spanned pre-industrial development through the project life cycle. Benga stated that the grizzly bear RSA comprised the area within which the valued components affected by the project could also be affected by past, present, or future projects. To establish which other projects

or activities might interact cumulatively with the effects of the project Benga considered the views of individual Indigenous groups. But Benga applied the cumulative effects assessment to all Indigenous groups collectively.

[2199] Benga acknowledged that, since European settlement, cumulative effects from development, change in land use, settlement, and access have already resulted in significant adverse effects on hunting and trapping. However, Benga noted that the project footprint overlapped historical disturbances, and that contributions of the project and future development to cumulative effects were predicted to be small. Benga stated that the project was expected to act cumulatively with other past, existing, and future physical activities, with potential effects on Indigenous valued components.

[2200] Benga concluded that the overall project contribution to cumulative effects on hunting and trapping, fishing, plant gathering, and trails and travelways was low, largely because the project overlapped with existing historical disturbances and access restrictions. Benga said that plants harvested for traditional use would re-establish following reclamation. Benga also stated that its progressive reclamation would improve land use capability and access. Benga characterized the cumulative effect on those Indigenous valued components as low in magnitude and not significant.

[2201] Benga noted that the project would interact with other past, present, and future physical activities that disturb sacred, gathering, or habitation sites and affect access to physical and cultural heritage. Benga concluded the project's contribution to cumulative effects on physical and cultural heritage would be low because of its commitment to identify and protect sites of importance and to develop a cultural site discovery contingency plan. Benga characterized the cumulative effect on physical and cultural heritage and cultural and spiritual values as low in magnitude and non-reversible, with a regional geographic extent, medium duration, and continuous frequency.

[2202] Benga stated that the project could contribute to cumulative effects on cultural and spiritual values through reduction or loss of access to important sites and indirect effects due to avoidance of areas and conflicts with other land users. Benga noted that the project would interact with other past, present, and future physical activities in the region to further disrupt the transmission of traditional knowledge to future generations. Benga characterized the cumulative effect on cultural and spiritual values as low in magnitude and non-reversible, with a regional geographic extent, long-term duration, and continuous frequency.

[2203] We find that Benga's qualitative discussion of cumulative effects on current use of lands and physical and cultural heritage, including cultural and spiritual values, was reasonable. However, because Benga applied this cumulative effects assessment collectively to all Indigenous groups, we were not provided with the group-specific context needed to determine the extent to which an individual Indigenous group still has the ability to harvest, practise culture, or exercise rights in their traditional territory. This hampered our ability to evaluate the significance of cumulative effects on many Indigenous groups.

[2204] In the chapter outlining the panel's approach to determination of significance, we recommend that the Agency direct proponents to provide a pre-industrial (historical) baseline in their EIA reports to facilitate consideration of past effects in the cumulative effects assessment. This pre-industrial baseline

would provide the necessary context related to the cumulative effects assessment for *CEAA 2012* section 5 effects as well as effects on Aboriginal and treaty rights.

Health

[2205] Benga did not provide any baseline information about the health status of Indigenous people. Benga stated it was not aware of any meaningful studies that provided statistics on Indigenous health in the project area. When questioned about how Benga could monitor community health in the absence of baseline data, Mr. Houston responded that it was difficult to make a direct correlation between the project and community health statistics. He also noted that, because the nearest Indigenous community was more than 50 km away, direct health effects would be felt on an individual basis by those conducting activities close to the project. From a community perspective, he noted that broader health effects, such as social or psychological effects, would be more likely to affect the community. Mr. Houston stated that the best approach to determining whether the project was negatively affecting the health of a community was to maintain ongoing communications. But he acknowledged it was a difficult topic to address.

[2206] Benga's human health risk assessment summarized the health status of residents in the region, incorporated air- and water-based pathways, and used assumptions related to modelling exposure of Indigenous people. Benga identified human receptors as those potentially affected by the project and included consideration of Indigenous residents. The human health risk assessment used Indigenous resident receptors for the quantitative exposure and risk modelling, as they were expected to have the maximum potential for contaminant exposure as a result of use of the land and water and consumption of country foods.

[2207] Benga was asked to provide baseline information on the use of country foods by each Indigenous group that could be affected by the project, within the LSA, RSA, and an extended RSA that encompassed the Oldman Reservoir. Benga was also asked to include Indigenous knowledge about the most sensitive rights-based receptors. Benga replied that sufficiently concise information was obtained through the consultation process, which supported development of a reasonably robust assessment of plants and animals used by Indigenous groups in and around Grassy Mountain. Benga noted that specific information about traditional food sources, such as type, quantity, and area used for hunting and harvesting, is personal and sensitive. Benga stated that additional surveys or questioning would impose unnecessary burdens on the local population without adding substantially more detail to the assessment.

[2208] The human health risk assessment considered areas in the human health LSA (the end-pit lake at closure, Blairmore Creek, and Gold Creek), and the human health RSA (Crownsnest River and the Oldman Reservoir) and assessed the maximum chemical concentrations predicted by the air quality assessment within these locations. Further discussion related to the human health risk assessment can be found in the chapter on human health.

[2209] Benga stated that the human health risk assessment assessed potential physical impacts on human health associated with predicted chemical exposure through consumption of traditional foods. In this assessment, Benga concluded that there would be no significant effect of the project on the health of Indigenous groups resulting from the consumption of traditional foods or other exposure pathways. Benga did not conduct a cumulative effects assessment specific to Indigenous health, as its human health risk assessment included Indigenous residents as receptors in the assessed cumulative effects on human health.

[2210] We examined effects on Indigenous health through the lens of the human health risk assessment, given that no baseline health information about the health status of Indigenous people was presented, and evidence on the broader health effects of the project on Indigenous communities is limited. Uncertainties associated with the level of conservatism in Benga's modelling of selenium concentrations in water and subsequent uptake into aquatic food chains are discussed in the chapter on surface water quality.

[2211] Our findings with respect to selenium, as discussed in the chapters on human health, surface water quality, and fish and aquatic habitat, have implications for the use of the downstream environment by Indigenous peoples. We find that the risk to human health from selenium is predicted to be driven by fish consumption, and that selenium concentrations in the water and fish in Blairmore Creek, Gold Creek, and the Oldman Reservoir are likely underestimated. Specifically, at elevated concentrations in fish eggs, selenium may result in developmental abnormalities in fish, and could affect larval survival. Evidence from the Kooocanusa Reservoir indicates that the bioaccumulation of project-related selenium in fish egg and ovary tissue in westslope cutthroat trout, bull trout, mountain whitefish, and other small-bodied fish species in the Oldman Reservoir may occur, and over time the resulting concentrations may reach levels that would cause adverse effects in fish. The potential implications of this finding on human health are discussed below.

[2212] Based on our conclusions in the health chapter, we find that adverse effects on human health from exposure to other contaminants, including project-related methylmercury, due to consumption of fish are unlikely, and further discussion is not required here.

[2213] While additional information would have helped us assess the effects of the project on Indigenous health, Benga's inclusion of an Indigenous receptor was helpful in ensuring that individuals who would be most exposed to contaminants of potential concern from the project were considered. In addition, we find that many of the assumptions related to exposure of Indigenous receptors used in the health risk assessment were conservative and protective, particularly the 80-year lifetime of exposure.

[2214] Specific areas of uncertainty and insufficient information include

- Benga did not provide specific baseline information on the use of country foods for each Indigenous group that may be affected by the project, within the LSA, RSA, or the Oldman Reservoir;
- Benga's reliance on a study from the Wood Buffalo region of northern Alberta for Indigenous-use ingestion rates is questionable and results in uncertainty about the risk to Indigenous peoples from consumption of country foods;
- the lack of community-specific information on consumption of country foods;
- it is unclear how the predicted risk to human health would change if Health Canada's fish-ingestion rate for toddlers of 95 g/day was used instead of 23 g/day;
- the applicability of some of the specific food items and ingestion rates used by Benga is problematic as country foods and ingestion rates can be expected to differ among Indigenous groups and regions;
- we are not confident in Benga's conclusion that baseline concentrations and vegetation ingestion are the dominant factors driving hazard quotients as the risks posed by selenium, unlike other metals, are not driven by ingestion of soil and vegetation, but by ingestion of fish; and
- The concentration of selenium used to estimate exposure is uncertain.

[2215] Regardless of the uncertainties noted above, we find that Benga’s assumption that Indigenous receptors live in the LSA year-round, eating country foods, and experiencing a continuous exposure duration of 80 years, leads to a conservative assessment of Indigenous health. We find that, while it is unlikely that fish consumption would result in a risk to human health, the margin of safety associated with this statement may not be as large as stated by Benga. Regardless, Benga’s assumption that a person would consume fish from each location 365 days per year for an entire lifetime is conservative. See the discussion on overall level of conservatism in the human health chapter for further information.

[2216] We find that the project is not expected to result in residual adverse health effects on Indigenous peoples. However, as discussed in the individual Indigenous group assessments, for Indigenous peoples who use the project area and downstream watershed—including the Crowsnest River and Oldman Reservoir—the presence of contaminants may decrease their confidence in the quality of water used for fishing or other traditional activities.

Socioeconomic conditions

[2217] Benga provided a socioeconomic impact assessment that included “traditional (Aboriginal Groups) land use” as a valued component. As discussed in the chapter on social and economic effects, this general assessment did not differentiate among Indigenous groups. In the EIA, Benga identified disturbance to Indigenous commercial activity or recreational use as a potential effect on socioeconomic conditions, and provided conclusions for specific Indigenous groups. In its updated Indigenous assessment submitted in the Tenth Addendum, Benga did not assess socioeconomic conditions.

[2218] Benga stated that the type of socioeconomic effects experienced by a particular Indigenous community depended on several factors, including the size of the development, proximity to traditional and reserve lands, engagement strategies taken by industry and government, and ability of individuals and communities to cope with external disturbances. Benga stated that the distribution of effects was not equal among all Indigenous people, and that those with education, employment, strong support systems, and internal resiliency would likely cope better with, and obtain more benefits from, change.

[2219] The RSA for socioeconomics consisted of an Alberta portion and a British Columbia portion. Benga described the RSA as the area in which socioeconomic effects were expected to be detectable. This RSA was for general socioeconomic effects and not specific to Indigenous socioeconomic effects. To enhance the positive effects and minimize the negative effects of the project on Indigenous groups, Benga proposed to undertake progressive reclamation while considering traditional land use, promote cultural diversity awareness for Benga’s employees and contractors, and support community-specific projects.

[2220] Benga expressed interest in creating Indigenous employment opportunities and stated that its project would bring good, well-paying, full-time jobs to the Indigenous people of the area. Benga stated that the project was expected to employ nearly 400 people for more than 20 years. This would allow Benga to work with Indigenous communities to systematically build capacity, train new employees, and provide Indigenous communities with work experience. Benga stated that it would not commit to specific Indigenous hiring targets, but it did expect to hire Indigenous workers. Benga committed to offering increased contracting opportunities for qualified local Indigenous businesses and employment opportunities for qualified local Indigenous workers.

[2221] Benga stated that discussions about employment, contracting, and training were confidential commercial negotiations. Benga confirmed that it had signed agreements with all of the Treaty 7 First Nations and a protocol was in place with the Métis Nation of Alberta. Through these arrangements, they developed communications protocols that include communicating contracting, employment, and training opportunities. Benga stated that it would work with communities to determine whether any Indigenous hiring and training information would be made public.

[2222] Benga concluded that there would be a low-magnitude residual effect on traditional land use and Indigenous culture from a socioeconomic perspective. Benga characterized the residual effect as having negative effects on traditional land use, while new economic opportunities would have both positive and negative social and cultural implications. Benga concluded that the effect would be not significant, but added that the assessment of significance was regional and did not address the significance of any one effect as it may be experienced by individuals or groups. Benga stated that the socioeconomic effects of the project would differ among Indigenous groups, with different factors determining how each one would be affected by the project.

[2223] When questioned on whether the overall effects of the project on Aboriginal socioeconomic conditions were positive or negative, Mr. Houston said:

“So I think based on our extensive discussions with the communities, especially the ones closest to the project, mixed is a good way to put it. They are obviously looking forward to the economic uplift that a project like this can bring to their community. Jobs, contracts, education, and all that comes with that.

“At the same time, concern about the loss of traditional—traditional way of life, the loss of the—the opportunities to teach the traditional ways of life to—to young and—and obviously there are concerns. Concerns about the environmental effects of the project. So all—all of that is a fabric of concerns, opportunities” (CIAR 771, PDF pp. 231–232).

[2224] Benga stated that achieving a net positive effect for Indigenous communities depended on making the economic opportunities a reality, implementing its commitments to protect the environment, and continued consultation. Benga stated that the Indigenous valued component of socioeconomic conditions was scoped out and not carried forward to the cumulative effects assessment because the assessment found no adverse residual effects on this valued component.

[2225] We accept Benga’s overall conclusions related to residual effects on traditional land use and Indigenous culture from a socioeconomic perspective, to the extent that it applies to Treaty 7 groups and the Métis Nation of Alberta in a regional context. We agree with Benga’s characterization that the new economic opportunities arising from the project are likely to have both positive and negative social and cultural implications. We also agree that the socioeconomic effects would be experienced differently by each Indigenous group, and by individuals within each group.

[2226] A few Indigenous groups reported that they were looking forward to the economic benefits the project could provide. We view the signing of agreements with Benga as an indication that these groups were interested in benefitting from the project. We received little information from Indigenous groups about how the positive gains from the project could lead to negative social effects. However, we

acknowledge that industrial projects often produce both positive and negative effects on Indigenous groups' socioeconomic conditions.

[2227] Our overall views relating to the socioeconomic impacts of the project can be found in the chapter on social and economic effects. We agree that the project would provide well-paying local jobs and have a positive impact on the regional economy during its operation. Overall, we find the project would have positive but modest economic impacts. However, we also find that neither Benga nor individual Indigenous groups provided information about the project's potential socioeconomic effects, either positive or negative, on specific communities. As such, we were unable to complete an assessment of the effects of the project on the socioeconomic conditions for individual Indigenous groups.

Rights

[2228] The guidelines for an environmental impact statement required Benga to document the following with respect to Aboriginal or treaty rights:

- each group's potential or established rights (including geographical extent, nature, frequency, timing), including maps and data sets (e.g., fish catch numbers) when this information is provided by a group to the proponent or available through public records
- the potential adverse impacts of each of the project components and physical activities, in all phases, on potential or established Aboriginal or treaty rights
- the measures identified to mitigate or accommodate potential adverse impacts of the project on the potential or established Aboriginal or treaty rights
- the effects of changes in the environment on Aboriginal peoples or potential adverse impacts on potential or established Aboriginal or treaty rights that have not been fully mitigated or accommodated as part of the environmental assessment, including the residual and cumulative effects

[2229] Benga's initial EIA assessed the project-specific effects on current use, and discussed generally how the cumulative contribution of the project could impact Aboriginal and treaty rights. Benga stated that this addressed the potential impacts of the project on Aboriginal rights. At our request, Benga later provided an updated assessment of the project on Indigenous groups. The updated assessment focused on current use and presented additional information and views from Indigenous groups on Indigenous rights, land use, and culture.

[2230] Though components of Aboriginal rights were included within the Indigenous interests that were assessed, Benga did not update the discussion of the impacts of the project on Aboriginal and treaty rights. Benga stated that, in determining the significance of effects, an additional element it considered was the potential effect of the project on the ability of Indigenous peoples to continue to exercise Indigenous interests, including treaty rights. Benga also noted that it considered the *Methodology for Assessing potential impacts on the exercise of Aboriginal and Treaty rights of the Proposed Frontier Oil Sands Mine*, among other guidance, to inform its assessment of potential effects of the project on valued components.

[2231] Benga also provided us with summary tables of the information received from Indigenous groups. These summary tables included each Indigenous groups' views about their asserted or established Aboriginal and/or treaty rights and the potential adverse impacts of the project on those rights. Benga did not make explicit determinations on the severity of the project's potential impacts, nor of the project's cumulative contribution, on Aboriginal or treaty rights. Benga presented a broad discussion on how the cumulative effects of development and changes in land use since European settlement have affected traditional land use in the RSA.

[2232] We find that Benga presented sufficient information on each group's potential or established rights where this information was available. While Benga's approach to presenting information and assessing effects to Indigenous peoples under *CEAA 2012* section 5 was reasonable, Benga could have worked with Indigenous groups to provide a clearer understanding of the potential impacts of the project on Aboriginal or treaty rights.

Treaty 7

[2233] Background treaty information, and information applicable to all Treaty 7 groups, is provided in this section to avoid duplication, and was applied to our assessments for each Treaty 7 group in their respective sections. Treaty 7 was signed in 1877, marking an agreement between the Government of Canada, three Blackfoot nations (the Káínai First Nation, Siksika Nation, and Piikani Nation), Tsuut'ina Nation, and the Stoney Nakoda Nations. The treaty provides reserve lands, health and education services, the right to hunt and trap in their territories, and recurring annuities to members.

[2234] Following the signing of Treaty 7, Indigenous groups explained that there was a "pervasive and long-term system of repression and control under the *Indian Act*." This included an amendment that prohibited Aboriginal ceremonies and dances, and introduced policies such as residential schools and a travel pass system that resulted in "controlling and assimilating First Nations members into the Euro-Canadian culture and way of life" (CIAR 68, Package 1, PDF p. 455). Indigenous groups noted that, from their perspective, "the difference between the intent of the Treaty and its implementation was stark" (CIAR 68, Package 1, PDF p. 455).

[2235] Southwestern Alberta, including the Crowsnest Pass, is the traditional territory of the Blackfoot Nation. The area in and around the proposed project has important Blackfoot place names. In Blackfoot, *ogimoko* is grass and Grassy Mountain is *Ogmiko Mistak*. Grassy Mountain is also known as *Matoyihko Yiistak* in Blackfoot.

Benga's conclusions on current use of lands and resources for Treaty 7 groups

[2236] Benga concluded that residual effects on the current use of lands and resources, and physical and cultural heritage for Treaty 7 groups were not significant, providing mitigation measures were implemented and successful. Benga stated that overall, the project was not expected to measurably change the Káínai, Siksika, Stoney Nakoda, or Tsuut'ina's ability to continue traditional practices. The project was expected to change traditional practices for the Piikani, at least for the duration of the project. Overall, Benga did not expect the project to measurably change any Treaty 7 group's ability to recognize its physical and cultural heritage.

[2237] Benga did not provide a specific conclusion for any Treaty 7 group's health and socioeconomic conditions, but concluded in general that there would be no residual adverse effects on Indigenous health and socioeconomics.

Hunting and trapping

[2238] Benga characterized effects for hunting as moderate in magnitude and sensitive for the ecological and social contexts for the Káínai, Piikani, Siksika, and Stoney Nakoda. The magnitude was moderate and the ecological and social context was resilient for Tsuut'ina.

[2239] Benga characterized effects for trapping as moderate in magnitude and sensitive for the ecological and social context for the Káínai; low in magnitude with an unknown ecological and social context for the Piikani; and low in magnitude and sensitive for the ecological and social context for the Siksika. Benga predicted no residual effects on trapping for the Stoney Nakoda and Tsuut'ina.

[2240] Benga characterized the geographic extent, duration, frequency, and reversibility as the same for all Indigenous groups for whom residual effects were predicted for hunting and trapping. The geographic extent was characterized as local. Residual effects would extend beyond the mine footprint but would be limited to the LSA. The duration was long-term. Reclamation would require time to return the ecosystem to a condition that supports wildlife habitat, and access restrictions would apply beyond the life of mine in some areas. The frequency was continuous. Loss of hunting opportunities would be continuous throughout construction and operation. The effects were considered reversible because reclamation would re-establish natural processes and ecosystems that support hunted species, and access would be restored following the access management plan. Implementation of the access management plan, the conservation and reclamation plan, the wildlife mitigation and monitoring plan, and regional efforts would improve conditions for traditional land use such as hunting and trapping. Benga's specific reasons for the characterizations of magnitude and ecological and social context varied by Indigenous group and are presented in more detail in later sections.

Fishing

For fishing, the characterizations of geographic extent, duration, frequency, and reversibility were similar for all Indigenous groups for whom residual effects were predicted. The geographic extent was considered local. Residual effects would extend beyond the mine footprint but would be limited to the LSA. The duration was long-term. Access restrictions would apply beyond the life of the mine in some areas that may affect access to fishing locations. The frequency was continuous. Loss of fishing opportunities would be continuous throughout construction and operation. The effects would be reversible because reclamation and offsetting were planned and expected to maintain the fish population, and access would be restored following the access management plan.

[2241] Benga's specific reasons for the characterizations of magnitude and ecological and social context varied by Indigenous group and are presented in more detail in later sections. Benga characterized the effects on fishing as moderate in magnitude for the Káínai Nation, Piikani Nation, Siksika Nation, and Stoney Nakoda Nations. Benga characterized effects to fishing as low in magnitude for Tsuut'ina. Benga characterized effects on fishing as sensitive for the ecological and social context for the Piikani and Siksika, while for the Káínai, Stoney Nakoda, and Tsuut'ina they were characterized as resilient.

[2242] Benga stated that it was aware of fishing opportunities in Blairmore Creek and Gold Creek. Benga stated that, while Indigenous people have historically fished for westslope cutthroat trout, it was not aware of any instances of Indigenous people fishing for westslope cutthroat trout in Blairmore Creek or Gold Creek currently, but could not rule out the possibility.

Plant gathering

[2243] For plant gathering, the characterizations of geographic extent, duration, frequency, and reversibility were similar for all Indigenous groups for whom residual effects were predicted. The geographic extent was characterized as local. The residual effects would extend beyond the mine footprint, but be limited to the LSA. The duration was long-term. Reclamation would require time to return the ecosystem to a condition that supports wildlife habitat, and access restrictions would apply beyond the life of mine in some areas. The frequency was continuous. Continuous mine disturbance (loss of vegetation, access restrictions, noise, and visual) would occur throughout the life of the mine. The effects would be reversible because reclamation was expected to re-establish natural processes and ecosystems that support traditional use plants, and access to plant-gathering locations would be re-established after mine closure.

[2244] Benga's specific reasons for the characterizations of magnitude and ecological and social context varied by Indigenous group and are presented in more detail in later sections. Benga characterized effects for plant gathering as moderate in magnitude and sensitive for the ecological and social context for the Káínai, Piikani, Siksika, Stoney Nakoda, and Tsuut'ina.

Trails and travelways

[2245] Benga characterized the geographic extent, duration, frequency, and reversibility similarly for all Indigenous groups for whom residual effects were predicted for trails and travelways. The geographic extent was considered local. Residual effects would extend beyond the mine footprint but would be limited to the LSA. The duration was long-term. Reclamation would require time to return the ecosystem to a condition that supports wildlife habitat and access restrictions would apply beyond the life of the mine in some areas. The frequency was continuous because mine disturbance (loss of vegetation, access restrictions, noise, visual) would occur throughout the life of the mine. The effects would be non-reversible where trails and travelways were lost because when a trail is inaccessible it would not be maintained or used, resulting in the potential loss of the knowledge or loss of the physical trail or travelway.

[2246] Benga's specific reasons for the characterizations of magnitude and ecological and social context varied by Indigenous group and are presented in more detail in later sections. The characterizations for magnitude and ecological and social context varied by Indigenous group. Benga characterized effects for trails and travelways as moderate in magnitude and resilient for the ecological and social context for the Káínai, Piikani, Siksika, Stoney Nakoda, and Tsuut'ina.

[2247] Benga's assessment of physical and cultural heritage is specific to each Indigenous group and presented separately in later sections.

ACO conclusions on adequacy of consultation for Treaty 7

[2248] On October 23, 2020 the ACO provided the AER with preliminary assessments of consultation adequacy for the Kainai Nation, Siksika Nation, Piikani Nation, Tsuut'ina Nation, and the Bearspaw, Wesley, and Chiniki First Nations (collectively the Stoney Nakoda Nations). The ACO's preliminary assessment was the same for each group.

[2249] The ACO advised that, while the Indigenous groups did provide comments about potential site-specific impacts of the project on their treaty rights and traditional uses, they also provided letters of no concern, indicating that Benga had adequately addressed their project-specific concerns. The ACO stated that the Treaty 7 groups also provided a number of "broad concerns," although the ACO found that the concerns were either not site-specific or outside ACO policy and guidelines.

[2250] Accordingly, the ACO determined that consultation was adequate pending the outcome of the hearing process. Following the hearing on December 3, 2020, the ACO provided us with copies of the hearing report and final consultation adequacy decision for each group. The ACO said that the groups did not provide any additional evidence of adverse impacts attributable to land and resource management decisions by Alberta in connection with the project, and therefore advised that consultation was adequate.

Agency preliminary conclusions on rights for Treaty 7 and the Ktunaxa Nation

[2251] The Agency provided information on behalf of the Government of Canada on the five Treaty 7 First Nations and the Ktunaxa Nation. They also noted a historical relationship between the Treaty 7 Nations and the Ktunaxa Nation.

[2252] The Agency described water as an element of spiritual importance for all Indigenous groups. The Agency stated that project activities had a high likelihood of disturbing water bodies, which could have "important consequences" for how members practise their rights. If the project were to compromise the quality of water, Indigenous groups could be hesitant to use and enjoy waterways in the area. The Agency stated that Treaty 7 groups in general had observed a negative trend in the quality of the water. An inability to trust the quality of water resources could result in avoidance of the exercise hunting, fishing, and gathering rights, which could disproportionately affect younger generations who learn these practices on the land, as well as those with compromised health. The Agency's preliminary assessment was that the project could have a moderate to high impact on the exercise of Aboriginal or treaty rights related to water resources.

[2253] In their assessment of hunting and trapping, the Agency stated that Indigenous groups estimated that "80 % of the regional study area is already inaccessible for traditional land use due to the presence of private land and protected or fenced areas" (CIAR 542, PDF p. 540). The Agency stated that the project would result in a direct loss of wildlife habitat, leading to reduced wildlife populations; increased pressure on hunting, trapping, and fishing; and restricted access to land for traditional purposes. They stated that a lack of continuity in access to hunting preferred species, or a decrease in the availability, variety, and sustainability of such species could impact their ability to maintain their way of life and ways of their ancestors. The Agency's preliminary assessment was that the project could have a potentially low to moderate impact on the exercise of Aboriginal or treaty rights to hunt and trap.

[2254] The Agency noted that Treaty 7 groups and the Ktunaxa Nation identified many plant species of spiritual and cultural importance at Grassy Mountain. Reduced access to the project area could change the availability of plant species of importance, impacting the ability of communities to exercise their rights. The Agency noted the project could affect access to plants and cause sensory disturbances for plant gathering activities and reduce the opportunity of Indigenous groups to practise an activity intrinsic to their way of life. The Agency stated that project activities would have a high likelihood of disturbing plant habitats, and the disturbance would potentially be long-term in duration, but low in frequency as it would occur primarily during construction. These changes would cause modification of harvesting behaviours on the land that are likely and long-lasting. The potentially irreversible nature of the effects would interfere with the ability of groups to harvest culturally important or medicinal plants. The ability to transfer knowledge related to plant gathering could disproportionately affect specific members. The Agency's preliminary assessment was that the project could have a potentially low to moderate impact on the exercising of Aboriginal or treaty rights related to plant harvesting.

[2255] The Agency stated that the project would affect the cultural and spiritual relationship between Indigenous groups and fish. Fishing by Indigenous groups in the region has been disrupted since coal mining began in the area in the 1900s. Due to industrialization in the region, fishing is not as intensive as it once was. The physical footprint of the project's water management infrastructure and open pits would cause permanent changes to fish habitat, including contamination, alteration, and fragmentation. The loss of riparian areas might also reduce and modify fish habitat. This could also affect the westslope cutthroat trout, a species listed as threatened. The Agency stated that the project's effects would span the entire Crowsnest area watershed, with Blairmore and Gold Creeks affected the most. The Agency noted that the success of reclamation efforts cannot be guaranteed once fish habitats are destroyed, particularly for endangered species such as westslope cutthroat trout.

[2256] Some Indigenous groups raised westslope cutthroat trout as a concern, but did not provide any information to indicate they fish for westslope cutthroat trout in the project area. The Agency stated that project activities would have a high likelihood of disturbing fish habitats and ecosystems. The impact would be long-term and of low reversibility and could affect the traditional way of life of all Indigenous groups exercising rights in the area. Effects from the reduced quantity and quality of fish could be felt disproportionately by certain community members. The Agency's preliminary assessment was that the project could have a potentially moderate to high impact on the exercise of Aboriginal or treaty rights to harvest fish. The moderate to high rating for the severity of impact on fishing reflected the fact that the waterways affected by the project are considered critical habitat.

[2257] The Agency described how important the Grassy Mountain area was to Indigenous groups being able to express their cultural and spiritual values. The area is the site of several archaeological features and historical resources. Groups identified the close proximity of Crowsnest Mountain as a concern, as the project could affect community stewardship associated with the mountain. The Agency noted that for Indigenous groups, real or perceived contamination of traditional lands, water, plants, and animals due to development, could directly affect how and where traditional practices are carried out. This, in turn, can affect the cultural values associated with those practices. Sensory disturbances could also affect the continuity of cultural and spiritual traditions. The loss of heritage structures would be

permanent, and intergenerational transmission of cultural and spiritual traditions would be interrupted for at least two generations.

[2258] The impact on intergenerational knowledge transfer means that younger generations could experience a lack of opportunities to learn about their cultural and spiritual traditions. The Agency noted that the use of and sense of connection to this portion of Indigenous groups' traditional territory could change permanently, interfering with the ability of groups to govern and express their culture in accordance with stewardship values. In addition, the limited availability of Crown land within the project area is already reducing Indigenous groups' abilities to maintain some aspects of their traditional occupancy. The Agency's preliminary assessment was that the project could have a potentially moderate impact on the exercising of Aboriginal or treaty rights related to cultural and spiritual values.

Káínai First Nation (Blood Tribe)

[2259] The Káínai First Nation (Blood Tribe) is a member of the Blackfoot Confederacy and a party to Treaty 7 (1877). The Káínai's traditional territory in southern Alberta includes the Crowsnest Pass and surrounding areas. The Káínai have reserve lands bordered by the Oldman River, the St. Mary River, and the Belly River. There are two reserves and the main Káínai community is located on the Blood 148 reserve. The registered population is approximately 12 500.

[2260] Prior to the arrival of European settlers in southern Alberta in the late 19th century, the economy of the Káínai First Nation was based primarily on the acquisition of naturally occurring resources. It was also based on commodity exchange with European fur traders who had been present in the area for at least 100 years. Groups of Indigenous people moved seasonally to areas such as the Grassy Mountain area to take advantage of abundant plant and animal resources. The Káínai procured resources for ceremonial, medicinal, or food purposes, or traded them with neighbouring groups or Europeans.

[2261] The Káínai report *Blood Tribe / Káínai Traditional Knowledge and Use Assessment, Grassy Mountain Coal Project, December 2018* is subject to a confidentiality order that can be found on the public registry. We report only information that is publicly available on the registry, even where further detailed information was contained within the document.

[2262] The Káínai provided letters of no concern on July 10, 2019, and August 23, 2019. They stated that they did not object to the project on the basis that Benga had adequately addressed their project-specific concerns. The Káínai did not provide any further information to us and did not participate in the public hearing. The information used in our analysis below was submitted prior to the Káínai signing an agreement with Benga and submitting their letters of no concern.

Current use of lands and resources for traditional purposes

[2263] The Káínai's traditional knowledge study identified a number of concerns with Benga's methodology. The Káínai stated that Benga offered conclusions about the significance of residual effects that were not consistent with Káínai definitions of significance, because Benga considered project effects to be significant if they could not be reversed post-closure.

[2264] The Káínai questioned whether Benga seriously considered traditional knowledge in the EIA. They stated that traditional knowledge was not consistently or systematically considered in the selection of valued components or choice of spatial and temporal boundaries, and that Benga relied on industry standards and best practices. The Káínai also stated that there was insufficient discussion of their current access to the project areas for traditional purposes.

[2265] The Káínai stated that Benga focused too much on effects on the biophysical valued components (i.e., wildlife loss), and the subsequent effect on Káínai activities. The Káínai noted that other factors such as access, preference for particular species, purpose of harvest (subsistence vs. ceremony), and the desirability of consuming items harvested in proximity to the mine, had been overlooked.

Hunting and trapping

[2266] Traditionally, Káínai members have travelled seasonally during an annual cycle of hunting and gathering. While they do less so now, the Crowsnest Pass remains an important location in that cycle. The Káínai noted the extent to which their traditional territory had shrunk due to the loss of land cover to anthropogenic activities. This substantially reduced the opportunities and locations to hunt, fish, and gather in the region, and led to access issues. The Káínai noted that they do not hunt or fish in national or provincial parks or ecological reserves, making those areas inaccessible for traditional land use. The Káínai noted that private land, which makes up much of the southern and eastern portions of the RSA, is also restricted for traditional harvesters.

[2267] The Káínai stated that in addition to their traditional occupancy of the project area, their members continue to visit for traditional purposes. Káínai members provided sworn affidavits and a confidential traditional knowledge report that provided specific locations in the immediate project area where Káínai members travel, hunt, gather, and fish. They also participated in a project site tour, during which they identified several traditional use or knowledge sites within the mine permit boundary, including seven that overlap the final mine design.

[2268] The Káínai First Nation stated that, while their members do not use the LSA and RSA as extensively to hunt as they did in the past, the area continues to be a source of wildlife hunted for ceremonies, sacred bundles, and subsistence purposes. Káínai members hunt, or have hunted, in the following areas: Forestry Trunk Road, which provides access to the western portion of the project traditional land use RSA and LSA; Gold Creek valley; and Blairmore Creek valley. The Káínai value the project area and the habitat it provides for game, including elk, mule deer, bighorn sheep, moose, and bear. They stated a preference for mule deer in the mountains over grain-fed deer on the prairies. Although there are no registered fur-management areas within the project area, the Káínai may trap in the project area for subsistence and ceremonial purposes. The Káínai identified many species of subsistence use within the project area, including beavers, muskrats and golden and bald eagles.

[2269] The Káínai identified eagles as a culturally significant species, noting that they trap golden eagles to use their feathers in ceremonial headdresses and clothing. Eagles are so significant that February is eagle month in Blackfoot culture. Their members use specialized trapping methods to obtain eagle feathers on Bluff Mountain, and possibly on Grassy Mountain prior to mining in the area. The Káínai raised concerns that project-related effects on eagles could interfere with traditional trapping of eagles

because the project could reduce the availability of nesting areas for eagles, and cause sensory disturbances that could displace eagles from the project footprint.

[2270] The Káínai were concerned that the project would have direct and indirect effects on wildlife and wildlife habitat, causing the long-term loss of hunting areas. The Káínai noted that the project could affect migratory patterns of wildlife in the area, or that chemicals or pollutants from the project could affect the health of wildlife. They described changes in population among species, noting that otters, wolverines, fishers, bison, and trumpeter swans used to be found in Blackfoot territory. The Káínai submitted a cumulative effects assessment for elk and mule deer. The assessment concluded that, over the next 50 years, traditional land use opportunities for elk and mule deer would decline by 10 per cent and 7 per cent, respectively, due to expansion of development activities, including the project. The Káínai raised concerns that Benga's access restrictions would limit their access to hunting sites, but increase access and use by non-Indigenous hunters and recreational users.

[2271] Benga acknowledged Káínai members hunt in the project area, and noted that trapping may occur in and around the area for subsistence and ceremonial purposes. Benga concluded there would be a residual effect on the Káínai due to a reduction in hunting and trapping opportunities and engagement. Benga characterized this effect as moderate in magnitude because this change would occur in the project area, but not in the RSA. Benga characterized the ecological and social context as sensitive because past activities have already placed hunting and trapping at risk. It recognized that hunted species that occur in the project area remain important sources of food for members of the Káínai Nation.

Fishing

[2272] The Káínai raised a concern about the effect the project would have on fish habitat and water quality and quantity, including the potential for contamination of downstream waterways. The Káínai said they use the project area, the surrounding waterways, and the downstream rivers for fishing. They were concerned the project could affect their members' ability to fish within the project area and downstream of the project. Pike, brown trout, whitefish, walleye, westslope cutthroat trout, rainbow trout, bull trout, suckers, and squaw (northern pikeminnow) were identified as species that had been fished in the Grassy Mountain area by Káínai members. The Káínai specifically raised concerns about westslope cutthroat trout and bull trout because both are already endangered.

[2273] In terms of water quality, the Káínai noted the potential cumulative effects, stating that the project could reduce the suitability of affected waterways for traditional use activities, and negatively affect the health of fish and other wildlife. The Káínai stated that the project's contribution to the deterioration of fish habitat and declining numbers of fish could have adverse effects on their ability to fish for food in the project area. The Káínai stated that any leaching or spills from project activities would prove catastrophic.

[2274] Benga noted that Káínai members fish for subsistence purposes in the Crowsnest River watershed and the Oldman River watershed north of the project. Benga acknowledged that the Káínai identified fishing interests in the project area, and expressed an interest in westslope cutthroat trout. But Benga indicated that the Káínai did not identify specific species or locations within the project area.

[2275] Benga predicted that there would be a residual effect on fishing for Káínai due to the loss of access to fishing locations, leading to a reduction in fishing opportunities and success during construction and operations. Benga also noted that there would be sensory disturbances within the mine permit area. Benga characterized the magnitude of the effect as moderate because of the predicted change in the ability of Káínai to fish. Benga stated that the ecological and social context was resilient because the Káínai primarily fish outside the LSA, in the Crowsnest River and Oldman River watersheds north of the LSA.

Plant gathering

[2276] The Káínai First Nation stated that they regularly harvested plants and other materials for traditional practices within the project area. The main focus of their project site tour was the medicinal and ceremonial importance of alpine plants. The Káínai identified several hundred plant species in the area around Grassy Mountain that are used as food and for medicinal and spiritual practices. They eat Saskatoon berries, blueberries, choke cherries, and wild raspberries; they use, for ceremonial and medicinal purposes, various species of sweet pine, juniper, sweetgrass, bitter root, kanick kanick (tobacco mix), red willows, willow berries, willow bark, rose hip, echinacea, and husks; and lodgepole pines serve as tipi poles.

[2277] The Káínai noted that the presence of all these traditional plants was an indication of the high potential value of the area for plant gathering, and that the vegetation in the project area is unique compared with vegetation around the Káínai reserves. They said that some of the vegetation is sourced specifically in the LSA and RSA for ceremonial purposes.

[2278] The Káínai stated that the physical removal of lands with high traditional use potential, rare plant communities, and old-growth forests suggests that the project would have a negative effect on the availability, quantity, and quality of traditional resources members harvest. The Káínai said the project would cause the loss of ecosites that support a wide variety of traditional use plants, and potentially introduce non-native invasive species. The Káínai stated the project could also lead to a decline in the use and enjoyment of plants of cultural and ceremonial significance.

[2279] The Káínai expressed concern about whether traditional plant species could be reclaimed, noting that they know of no proven method for this reclamation. The Káínai also raised concern about access restrictions due to the project interfering with their members' ability to enter the project area to harvest. The Káínai expressed an interest in obtaining any lodgepole pine cleared from the project site, as well as continued access to ceremonial plants in and around Grassy Mountain.

[2280] The Káínai provided us—in their confidential traditional knowledge study—information on the locations of traditional plants within the project area as well as their ceremonial and subsistence uses.

[2281] Benga predicted a residual effect on plant gathering for the Káínai due to a reduction in harvesting opportunities as well as sensory disturbance within the mine permit area. Benga characterized the effect as moderate in magnitude because the Káínai identified habitat and species for plant gathering in the proximity of the project. Benga characterized the ecological and social context as sensitive because plant gathering is easily disrupted, and past and present activities have put traditional land uses at high risk.

Trails and travelways

[2282] Káínai members did not provide specific information about traditional trails and travel corridors, but spoke generally about navigation through the mountains. Sites within the RSA have been used for camping and hunting along trade routes, and the project could restrict access to certain locations. They detailed natural phenomena and the night sky as navigational tools used for travel. The Káínai raised several concerns related to access and noted that changes in access would reduce their ability to exercise their Aboriginal rights.

[2283] Benga stated that the project would intersect or be in proximity to identified trails or travelways used by the Káínai, and that some sites associated with trails and travelways were fully or partially within the mine permit boundary. Benga predicted a residual effect on trails and travelways due to restrictions on use or access during construction and operations, sensory disturbances, and changes in use within the mine permit area. Benga characterized these effects as moderate in magnitude, and the ecological and social context as resilient. Benga noted that, because the Káínai could use alternative routes to travel between cultural and spiritual sites and resources in their traditional territory, they were not sensitive to disruption from the project.

Monitoring and mitigation

[2284] In meetings with Benga, the Káínai First Nation expressed an interest in active involvement in Benga's monitoring program. Prior to submitting their letters of no concern, they presented a series of recommendations to us related to mitigation and monitoring. The Káínai requested quarterly reports on the environmental impacts of the project, a binding commitment to turn over privately owned lands within the permit mine area to the Káínai First Nation or Blackfoot Confederacy upon final mine closure and reclamation, and funding support prior to construction and clearing of vegetation for a Káínai cultural camp within the project footprint.

[2285] The Káínai also stated an interest in being part of ongoing vegetation and reclamation monitoring programs for the life of the project. The Káínai asked for the opportunity to harvest timber, food, and medicinal plants from the project footprint prior to construction and clearing of vegetation.

[2286] The Káínai proposed the following mitigation measures for observed sites within their traditional land use study LSA:

- a buffer zone of 100 m around a number of identified sites
- further information provided by Benga on any additional archaeological field research, excavations, and mitigations measures
- protection of site DjPo-37 from future development (see Table 22-2)
- mapping and designation of rock art sites on Bluff Mountain

[2287] In a meeting with Benga, Káínai requested that the proponent negotiate access and road use agreements to mitigate the potential blocking of access to Káínai harvesting areas in Blairmore Creek and around Bluff Mountain. The Káínai noted that arranging for continued access to the northern portions of the LSA would likely be required to offset loss of access to other areas as a result of the project. The Káínai noted that negotiating access to Crown portions of the project area and maintaining access to allow

for hunting in the future are priorities for the Nation. Káínai also stated that access to reclaimed areas needs to be established.

Panel analysis and findings

[2288] We find that the evidence demonstrates that the Káínai First Nation uses both the LSA and RSA to conduct traditional activities. The project area continues to be important to Káínai for hunting and subsistence purposes. The project would cause the loss of wildlife habitat and would inhibit access for Káínai members for hunting.

[2289] It is unclear if the Káínai fish in Blairmore and Gold Creeks. Káínai stated that they fished in the Crowsnest River watershed both upstream and downstream of the project area. The Káínai also specifically raised a concern about the project's effects on westslope cutthroat trout and the Oldman watershed. We agree with the Government of Canada that the presence of contaminants may decrease Indigenous peoples' confidence in the quality of water in the project area and downstream watershed. This may affect fishing, other traditional use activities, and the intergenerational transfer of knowledge.

[2290] The evidence demonstrates that the Káínai have and continue to use the project area to gather plants, which is the traditional activity of most importance to Káínai members in the project area. The project would cause the loss of ecosites supporting a wide variety of traditional use plants, including those harvested by the Káínai. Furthermore, we acknowledge the Káínai's concerns about whether Benga would be able to successfully reclaim traditional plant species. As noted in the chapter on vegetation and wetlands, we find that, while there would be a temporary loss of areas of traditional plant potential during the construction and operations phases of the project, most traditional plant species would remain available within the LSA.

[2291] The Káínai were concerned about their traditional trapping of eagles. As noted in the wildlife chapter, we do not expect the project to have an adverse effect on flyways or populations of bald or golden eagles, and therefore we do not anticipate any impacts on the Káínai's ability to trap them.

[2292] The Káínai did not provide specific information about trails and travel corridors, but given the evidence that they do harvest in the project area, it is reasonable to expect that the project would affect their travel and movement. This is in line with Benga's conclusion that the project would have a residual effect on trails and travelways for the Káínai.

[2293] We acknowledge the Káínai's concern about access. We accept Benga's commitment to an access management plan as reasonable mitigation to facilitate Indigenous group use of undisturbed areas within and adjacent to the project footprint, where it is safe to do so. However, during construction and operation, much of the project footprint would not be accessible for use by Indigenous groups. Given this, we find the access management plan may not fully mitigate the concern, as access for traditional purposes would still be restricted. However, the project would not prevent access to the Gold or Blairmore Creek valleys, outside of the mine permit boundary.

[2294] The project would also lead to sensory disturbances for the Káínai while hunting and gathering in the LSA and RSA. The project would interrupt their ability to harvest for both subsistence and ceremonial purposes in the LSA, and could affect traditional knowledge transfer in the area.

[2295] The Káínai submitted letters of no concern to the project, stating that their project-specific concerns were addressed. There is also a confidential agreement between Benga and the Káínai. We respect the Káínai's ability to work directly with Benga to address potential effects of the project on their traditional activities. We find that, even with implementation of Benga's proposed mitigation and the existence of an agreement between Benga and the Káínai, the project would have a residual effect on the Káínai's current use of lands and resources for traditional purposes. This is consistent with Benga's conclusions.

[2296] The residual effects can be characterized as follows:

- **Magnitude:** moderate. The project will disrupt access to areas required by the Káínai for harvesting. The disturbance could affect their connection to the land and cultural practices.
- **Geographic extent:** local. Most project effects would be limited to the LSA. However, some sensory effects (e.g., noise, dust, and visual quality) will likely extend beyond the LSA to the RSA.
- **Duration:** long. The direct effects would last for the life of the project, but persistent effects are possible due to the loss of transmission of knowledge.
- **Frequency:** periodic. During the project life, the frequency will be periodic, affecting Káínai members in proximity to the project footprint. Access restrictions would be continuous during the project life.
- **Reversibility:** reversible. The effects would diminish after a number of decades. The biophysical effects on species related to hunting and gathering are reversible. We expect that hunted species will return after operations. We also expect that traditional plant species will be available post-closure, but it could take a few generations for full reclamation, and reclamation is uncertain. The loss of trails and travelways is irreversible.
- **Ecological and social context:** negative. The Káínai demonstrated that historical pressures have contributed to a declining ability to use their traditional territory.

[2297] We find that the project would result in residual adverse effects on the Káínai First Nation's current use of lands and resources for traditional purposes in the LSA and RSA. The effects would not be significant.

Physical and cultural heritage

[2298] The Káínai First Nation's relationship to the land and resources lies at the heart of their traditional way of life, identity, and culture. The Káínai described a deep cultural and spiritual connection to the project area, which has a song associated with it. They stated that Crowsnest Mountain is tied to Blackfoot myths, folklore, and traditional religion, and is still used for ceremonial and religious purposes. Vision quests, a spiritual exercise that is an important element of Blackfoot culture, have often been conducted in Crowsnest Pass.

[2299] During ground-truthing studies, Káínai elders and technicians identified and recorded 24 traditional knowledge or traditional use sites, seven of which overlap the final mine design. This included three sites with physical remains, including a vision quest site, lodge area, and campfire ring. Benga

stated that all of these sites were more than 500 m outside of direct disturbance related to the project. The Káínai's confidential traditional knowledge and use assessment also specified sites within the project area that were culturally significant due to the presence of knives and arrowheads, camps, a bison jump site, tipi rings, iniskim (buffalo rocks), stone cairns, and pre-contact travel and trade routes. In conversations with Benga, the Káínai stated that the pre-contact camp site (DjPo-98) was of particular concern. The Káínai's discovery of tipi rings and erratic boulders during the field work suggested the potential for additional archaeological or historical resources significant to Káínai culture. They also noted natural springs in the project area.

[2300] Work completed by Benga to satisfy the requirements of the *Historical Resources Act* identified ten sites of importance to the Káínai and other Treaty 7 groups. Benga committed to avoiding certain sites and adhering to the approved project-specific *Historical Resources Act* recommendations for mitigation. Sites recorded under the *Historical Resources Act* and identified as of importance to the Káínai and other Treaty 7 groups are listed in Table 22-2.

Table 22-2: Sites of importance to Indigenous groups from information provided by Benga in the Tenth, Eleventh, and Twelfth Addenda

Site	Description	Importance (source)	Additional information
DjPo-37	Settlement	Identified by Káínai First Nation (CIAR 251, Package 4, PDF p. 181)	Blairmore Dairy. No effects are expected. Alberta Culture, Multiculturalism and Status of Women did not require additional studies and was recommended for clearance under the <i>Historical Resources Act</i> .
DjPo-63	Pre-contact campsite	Identified by Káínai First Nation (CIAR 251, Package 4, PDF p. 185)	Site DjPo-63 is within the footprint for the rail and load-out, and will be directly affected. Alberta Culture, Multiculturalism and Status of Women recommended clearance under the <i>Historical Resources Act</i> for this site. Benga committed to adhering to the approved project-specific <i>Historical Resources Act</i> recommendations for mitigation.
DjPo-98	Pre-contact campsite	Identified by all Treaty 7 First Nations (CIAR 251, Package 4, PDF p. 29)	Alberta Culture, Multiculturalism and Status of Women recommended excavation and removal of objects, if avoidance was not possible. However, Benga later committed to revising some design details such that culturally significant sites DjPo-98 and DjPo-130, on the southern end of the proposed coal-processing plant and near the proposed road, respectively, are preserved. As these sites are close to the project, access will be managed along the main access road using the access management plan to ensure that access is safe and coordinated with other project activities.
DjPo-130	Pre-contact	Identified by all Treaty 7 First Nations	Alberta Culture, Multiculturalism and Status of Women recommended excavation and

Site	Description	Importance (source)	Additional information
	campsite	(CIAR 251, Package 4, PDF p. 29)	removal of objects, if avoidance was not possible. However, Benga later committed to revising some design details such that culturally significant sites DjPo-98 and DjPo-130, on the southern end of the proposed coal-processing plant and near the proposed road, respectively, are preserved. As these sites are close to the project, access will be managed along the main access road using the access management plan to ensure that access is safe and coordinated with other project activities.
DjPo-184	Pre-contact campsite	Identified by Káínai First Nation (CIAR 251, Package 4, PDF p. 185)	Site DjPo-184 is within the footprint of the south disposal area, and will be directly affected. Alberta Culture, Multiculturalism and Status of Women recommended clearance under the <i>Historical Resources Act</i> for this site. Benga committed to adhering to the approved project-specific <i>Historical Resources Act</i> recommendations for mitigation.
DjPo-214	Pre-contact campsite	Identified by Káínai First Nation (CIAR 251, Package 4, PDF p. 181)	Site DjPo-214 is within the footprint of the overland conveyor. The site will be affected by conveyor support structures, specifically pilings and footings. Alberta Culture, Multiculturalism and Status of Women indicated additional studies are required for this site if avoidance is not possible. Benga committed to adhering to the approved project-specific <i>Historical Resources Act</i> recommendations for mitigation.
DjPo-216	Pre-contact campsite	Identified by Káínai First Nation (CIAR 251, Package 4, PDF p. 181)	Site DjPo-216 is within the footprint of the South Disposal Area, and will be directly affected. Alberta Culture, Multiculturalism and Status of Women indicated that additional studies are required for this site if avoidance is not possible. Benga committed to adhering to the approved project-specific <i>Historical Resources Act</i> recommendations for mitigation.
DjPo-217	Pre-contact campsite	Identified by Káínai First Nation (CIAR 251, Package 4, PDF p. 185)	Site DjPo-217 is within the footprint of the South Disposal Area, and will be directly affected. Alberta Culture, Multiculturalism and Status of Women indicated that additional studies are required for this site if avoidance is not possible. Benga committed to adhering to the approved project-specific <i>Historical Resources Act</i> recommendation for mitigation.

Site	Description	Importance (source)	Additional information
DjPo-219	Pre-contact campsite	Identified by Káínai First Nation (CIAR 251, Package 4, PDF p. 181)	Site DjPo-219 is within the footprint of the south disposal area, and will be directly affected. Alberta Culture, Multiculturalism and Status of Women indicated that additional studies are required for this site if avoidance is not possible. Benga committed to adhering to the approved project-specific <i>Historical Resources Act</i> recommendations mitigation.
DkPo-07	Pre-contact stone feature, cairn	Identified by Siksika Nation and Káínai First Nation (CIAR 251, Package 4, PDF pp. 240 and 185)	Site DkPo-7 is within the footprint of the south disposal area, and will be directly affected. Alberta Culture, Multiculturalism and Status of Women indicated that additional studies are would be required for this site if avoidance is not possible. Benga committed to adhering to the approved project-specific <i>Historical Resources Act</i> recommendation for mitigation.

[2301] The Káínai noted that they value wildlife as more than sources of sustenance, and have traditional beliefs that wildlife can embody spiritual powers that humans can access. The Káínai identified several wildlife species of ceremonial importance in their traditional use study.

[2302] The Káínai stated that the removal of lands used by their members adversely impacts their ability to transmit their culture to future generations, and diminishes the future use and enjoyment of sites of cultural importance. The Káínai noted that the mine footprint would destroy both documented and undocumented sites of archaeological, historical, cultural, or spiritual significance. The Káínai also stated that disturbance or destruction of sites of archaeological, historical, ceremonial, spiritual, or cultural importance would have negative effects on members' psychological well-being, cultural sustainability, and use and sense of connection to portions of their traditional territory. The cumulative loss of access to lands has altered their traditional occupancy patterns, and their access to areas of physical and cultural heritage have been diminished by industrial and other anthropogenic developments. The Káínai requested a ceremony in advance of ground disturbance, and Benga stated it was supportive of this idea.

[2303] Benga concluded there would be a not significant residual effect on physical and cultural heritage for the Káínai Nation due to the loss of access and sensory disturbance within the mine permit area. Benga also predicted there would be residual effects on cultural and spiritual values for Káínai Nation due to the loss of or access to culturally or spiritually important sites during construction and operation of the project, as well as a change in the values associated with cultural or spiritual sites for the Káínai.

[2304] Benga stated that the effects on the linked valued components such as lands and resources, historical resources, noise, and access would synergistically change use or access to physical and cultural heritage. Benga also stated that these effects could change the value and importance of those sites and the relationship the Káínai have with them. Benga characterized the effect as moderate in magnitude because the Káínai identified physical and cultural heritage sites within the LSA and RSA and because the Káínai

stated that the project area was highly significant and culturally important. Benga characterized the geographic extent as local and the duration as long-term. The frequency was characterized as continuous for cultural and spiritual values, but regular for physical and cultural heritage because disturbance to unique sites and features and experience with land use could result in loss of knowledge of cultural heritage. Benga stated that the effect would be non-reversible because the loss of heritage and cultural sites and features and experience in engaging in land use could result in loss of the knowledge of cultural heritage. The ecological and social context was characterized as sensitive because the Káínai identified the LSA as significant for traditional material culture and the loss of heritage sites and features, or loss of engagement in land use, could affect cultural identity, human well-being, and intergenerational transfer of knowledge. The Káínai demonstrated a historical and spiritual connection to the project area, as evidenced by the number of traditional and physical heritage sites in the project area.

Panel analysis and findings

[2305] We recognize that existing levels of use and disturbance associated with industrial and non-Indigenous land users have affected the integrity of many cultural sites and landscapes of importance to Káínai. Practising traditional activities is fundamental to the Káínai's cultural and spiritual values and intergenerational knowledge is shared through such practices. The LSA and RSA are reportedly one of the few remaining places where Káínai members can carry out cultural activities.

[2306] The project would result in the loss of, or loss of access to, culturally and spiritual important sites. These losses would adversely affect the experience, and reduce the ability of Káínai members to engage in traditional cultural activities, limiting their ability to share knowledge with younger generations. Benga's cultural site contingency plan would address archaeological and heritage finds, but we are uncertain if the plan would fully mitigate the effects. We understand that Benga and the Káínai have entered into an agreement; this cooperative relationship may provide a mechanism to address issues of importance to Káínai. Even with implementation of Benga's proposed mitigation, the project would have an adverse residual effect on Káínai physical and cultural heritage, including direct effects on potential archaeological or cultural sites, and indirect effects related to the cultural connection to their traditional territory. The project would result in considerable effects on areas of cultural importance to Káínai and have a residual effect of high magnitude on physical and cultural heritage.

[2307] The effect can be characterized as follows:

- **Magnitude:** high. The project would result in considerable effects in areas of cultural importance. The disturbance would be both physical and sensory in nature and could affect spiritual and cultural practices. Multiple effects would occur to an area of high importance for harvesting and cultural activities.
- **Geographic extent:** local. Most project effects on physical heritage would be limited to the LSA. However, some sensory effects (e.g., noise, dust, and visual quality) that can affect cultural activities and experience would likely extend beyond the LSA to the RSA.
- **Duration:** persistent. The effects on the cultural and spiritual connections to the land and intergenerational would persist well after operations cease.
- **Frequency:** continuous. The effects would occur throughout the mine life.

- **Reversibility:** irreversible. The loss of a cultural connection cannot be repaired once the mine is closed.
- **Ecological or social context:** negative. Historical pressures have contributed to a declining ability for Káínai to access their traditional territory for cultural purposes.

[2308] We find that the project would result in residual adverse effects on the Káínai First Nation's physical and cultural heritage in the LSA and RSA. The effects would be significant and are likely to occur.

[2309] We also find that, even with implementation of Benga's proposed mitigation, the project would have a residual effect on structures and sites, such as cairns, ceremonial sites, and campsites that are of historical, archaeological, paleontological, or architectural significance to the Káínai.

[2310] The residual effects can be characterized as follows:

- **Magnitude:** moderate. Specific sites of importance to the Káínai would be lost due to the project, although the site identified as being of particular concern (DjPo-98) would not be destroyed.
- **Geographic extent:** local. Only resources within the LSA would be affected.
- **Duration:** medium for the sites that would not be destroyed because access to those sites would be restricted during construction and operations, but available post-closure; persistent for sites that are destroyed.
- **Frequency:** periodic. Known historic sites would be removed throughout construction and operation of the project. A number of potential unknown sites could be found intermittently but repeatedly over the assessment period.
- **Reversibility:** reversible, upon cessation of activities for sites that were not destroyed; irreversible for sites that were removed, as they cannot be replaced.
- **Ecological or social context:** negative. Historical pressures have contributed to a declining ability of the Káínai to access their traditional territory for cultural purposes.

[2311] We find that the project would result in a residual adverse effect on sites in the LSA that are of historical, archaeological, palaeontological, or archeological significance to the Káínai First Nation. The effect would be not significant.

Health

[2312] The Káínai First Nation reported practising subsistence harvesting, including hunting, fishing, and plant gathering, in the LSA and RSA. They said they fished in the Crowsnest River watershed both upstream and downstream of the project area, and identified plant gathering as the most important traditional activity in the project area. The Káínai stated that while their members no longer use the LSA and RSA as extensively to hunt as they did in the past, the area continues to be a source of wildlife hunted for ceremonies, sacred bundles, and subsistence purposes. They provided limited information about potential social or psychological effects on the community.

[2313] The Káínai had concerns about coal dust and its effects on the wildlife that they harvest because they believe it may cause illness from consuming contaminated wildlife. They were concerned that particulate matter from the mine may settle in nearby communities, including Nanton and Cardston, but did not provide any other evidence about health. They also have concerns about the effects of the project on downstream water quality in the Oldman watershed. A summary of Benga's evidence on health for Indigenous groups appears earlier in this chapter in the section on Benga's approach and assessment.

Panel analysis and findings

[2314] The Káínai provided clear evidence of their use of the LSA and RSA for harvesting, including hunting and plant gathering, and their use of the Crowsnest River watershed both upstream and downstream of the project area for fishing. As such, our findings as discussed in the Health section of Benga's approach and assessment apply to the Káínai. We find that the project is not expected to result in residual adverse health effects on the Káínai. However, even with implementation of Benga's proposed mitigation, the perception of an increased health risk resulting from potential contamination, including selenium contamination in the downstream watershed, could cause avoidance of harvesting areas. We address these effects in our assessment of current use of lands and resources.

Socioeconomic conditions

[2315] The Káínai initially expressed concern that many of the jobs created would not be long-term. Although they noted, at first, concern with potential social changes resulting from the project, they subsequently stated that they did not object to the project as Benga had adequately addressed their project-specific concerns. A summary of Benga's evidence on socioeconomics for Indigenous groups appears earlier in this chapter in the section on Benga's approach and assessment and was applied to our assessment for the Káínai.

[2316] Benga stated that several Káínai businesses operate in the vicinity of the project, but not in the area overlapped by the LSA. Benga did not expect the project to have an adverse effect on Káínai commercial activity. Benga stated that the unemployment rate for the Káínai Nation was 27.2 per cent at the time it prepared its EIA. Benga noted that the Káínai had demonstrated an interest in being involved in economic opportunities throughout the life of the project.

Panel analysis and findings

[2317] Our findings and discussion in the socioeconomic conditions portion of the section on Benga's approach and assessment in this chapter apply to the Káínai. We recognize Benga's commitment to provide Indigenous employment and procurement opportunities. We agree with Benga that the socioeconomic effects of the project would differ among Indigenous groups as different factors determine how each community would be affected by the project. The effects would also vary by group and individuals within a community.

[2318] We understand that the Káínai First Nation submitted letters of no concern, indicating their project-specific concerns have been addressed. We also understand that Benga entered into an agreement with the Káínai and we recognize that this cooperative relationship may provide a mechanism to address issues of importance to the Káínai. We expect the Káínai's involvement in proposed monitoring and in the implementation of their agreement would, at least partially, mitigate potential adverse socioeconomic impacts.

[2319] In consideration of the arrangements Benga has in place with Indigenous groups, as well as Benga’s stated objective to achieve a net positive effect for Indigenous communities, we expect the overall positive economic impact of the project would extend to the Káínai.

[2320] As Benga provided limited group-specific socioeconomic information, and the Káínai provided limited information about the potential socioeconomic effects, either positive or negative, of the project on their community, we are unable to complete an assessment of the effects of the project on the socioeconomic conditions for the Káínai First Nation.

[2321] Table 22-3 summarizes our assessment of the residual effects of the project on the Káínai First Nation.

Table 22-3. Summary of panel analysis of residual effects on the Káínai First Nation

CEAA 2012 section 5 effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Ecological or social context
Current use of lands and resources for traditional purposes	Moderate	Local, regional for sensory effects	Long	Periodic, continuous for access restrictions	Reversible in the long term, however effects to trails and travelways are irreversible	Negative
Physical and cultural heritage	High	Local, regional for sensory effects	Persistent	Continuous	Irreversible	Negative
Structure, site or thing	Moderate	Local	Medium/persistent	Periodic	Irreversible for sites that are destroyed, reversible for those that are not.	Negative
Health conditions	Residual effects are not expected					
Socioeconomic conditions	Unable to complete assessment					

Cumulative effects

[2322] The Káínai First Nation noted that they were facing pressures from cumulative effects as their traditional territory had already shrunk due to anthropogenic activities, reducing their access and locations to conduct traditional activities. They provided a cumulative effects assessment that demonstrated how much of their traditional territory had been converted to anthropogenic uses, making the project area particularly important.

[2323] The Káínai expressed concern about the project’s contribution to cumulative effects, including the loss of Crown land within their traditional territory. The Káínai estimated that a substantial portion of the RSA was already inaccessible for traditional land use due to the presence of private land, protected areas, and non-traditional land use activities, and they expressed concern that the project would further reduce their ability to access areas to practise their rights. They noted that so much land has been taken up for uses incompatible with traditional activities that few locations remain where they can hunt, fish, and gather.

[2324] The Káínai submitted a cumulative effects assessment that stated that the majority of the landscape surrounding the Káínai Reserve has been converted to anthropogenic cover types, primarily farmland. These impacts have resulted in substantially reduced opportunities for Káínai members to fish and hunt in the region, which has made the comparatively intact landscapes to the west important for traditional use. The cumulative effects report forecast that mining would be the biggest contributor to land

use footprints in the region, with the project accounting for the majority of the projected footprint growth in the study area. Overall, mining would account for a substantially smaller footprint than agriculture (80 000 fewer hectares), and a smaller footprint compared with transportation and other settlements.

[2325] The study noted how natural land cover is fragmented, resulting in habitat being substantially below natural conditions and placing mule deer, elk, and associated traditional land use at “moderate risk.” The study predicted a further decline of traditional land use opportunities by 7 to 10 per cent due to the expansion of development activities. The study concluded that any further decline in opportunities for traditional land use may be of concern given that risk to traditional land use was already “high.” The study recommended mitigation measures to establish a network of parks and sanctuaries where hunting is prohibited, buffers on selected roads, and prohibition of some forms of transportation along selected linear features.

Panel analysis and findings

[2326] We accept the Káínai’s position that a cumulative effect on traditional use and physical and cultural heritage is already taking place, and the project would add to that effect. We find the existing effect is significant. There is a cumulative effect on current use of lands and resources and physical and cultural heritage for the Káínai. These effects occur primarily as a result of past projects and activities within Káínai traditional territories.

[2327] The cumulative effects can be characterized as follows:

- **Magnitude:** high, when taking into consideration the historical context. The effects to date on the Káínai’s ability to use their traditional territory have been considerable. The project would further decrease their ability to use of the land for traditional purposes.
- **Geographic extent:** regional. There has been widespread privatization and development of lands within Káínai’s traditional territory.
- **Duration:** persistent. The effect may last indefinitely, continuing to affect the Káínai’s relationship with their traditional territory and their ability to pass on cultural traditions.
- **Frequency:** continuous, considering the effects of the project in combination with all activities, past and present.
- **Reversibility:** irreversible. The effects would contribute to existing effects that would not diminish over time.
- **Ecological or social context:** negative. Historical pressures have already contributed to the deterioration of the Káínai’s traditional territory.

[2328] We find that the project, in combination with other projects and activities that have been or would be carried out, is likely to contribute to existing significant adverse cumulative effects on the Káínai’s First Nation’s current use of lands and resources for traditional purposes and physical and cultural heritage. These cumulative effects occur primarily as a result of past projects and activities within Káínai traditional territories.

Rights

[2329] The Káínai First Nation stated that wildlife, fish, and vegetation were part of the ecosystems that formed the basis of their way of life. They noted that their way of life was guaranteed by Treaty 7 and protected by the *Constitution Act, 1982*. Consequently, they argued that adverse impacts on the ecosystems that support this way of life amounted to a prima facie infringement of the Káínai's constitutionally protected treaty rights.

[2330] The Káínai noted that the project could adversely impact their Aboriginal and Treaty 7 rights even though their reserve lands do not overlap the project boundaries. The Káínai stated that they were not limited to practising their treaty rights on their reserve, which is about 44 km from the project area. They stated that they could hunt, trap, fish, and gather on any unoccupied Crown lands in the province. The confinement of the Káínai to reserves after the signing of Treaty 7 had an impact on the Káínai's traditional way of life, most markedly through the extirpation of the bison. However, hunting wild game and harvesting berries continue to be important for subsistence.

[2331] The Káínai are signatories of the Buffalo Treaty. Bison were previously the dominant ungulate in the Crowsnest pass and were identified as a key species for hunting during the Káínai's traditional seasonal rounds. The demise of the bison effectively destroyed the traditional economy and compromised Káínai political autonomy.

[2332] The Káínai noted that they were specifically concerned about the cumulative effects of additional developments on their ability to practise their treaty rights. The Káínai noted that Treaty 7 First Nations were promised that they would benefit from the same terms as the Treaty 6 signatories, including the right to harvest "as before." The Káínai stated that most of the lands that make up Treaty 7 have already been developed for other purposes and there are progressively fewer areas where the Káínai can practise their treaty rights.

[2333] The Káínai identified the project area as one of the few remaining areas where Káínai members can still practise their treaty rights. Members already find it difficult to access traditional hunting, fishing, gathering, and camping areas. They also noted that project-related changes to wildlife (habitat loss, fragmentation, reduced connectivity, and increased mortality and morbidity) would reduce the abundance, availability and quality of big game species in the LSA and RSA. They noted that, together with access restrictions, this would likely reduce the opportunities for Káínai hunters to exercise their hunting rights in the LSA, potentially infringing upon their Aboriginal and Treaty 7 rights.

[2334] The Káínai stated that Benga had not acknowledged that hunting is protected as an Aboriginal right and is different from recreational hunting. Káínai stated that access restrictions on their hunters and trappers created a potential infringement of their rights.

[2335] The Káínai stated that they remain concerned about the impacts of the project on water quality and quantity in and around the project area, given that the project would be near the headwaters of many downstream waterways used for the practice of their rights. The Káínai noted that any leaching or spills from project activities would prove catastrophic. The project's contribution to the deterioration of the quality of fish habitat and reduced availability of fish could have adverse effects on their right to fish for

food in the project area and in downstream watersheds. Treaty rights would be impacted if the project reduced the Káínnai ability to hunt or fish.

[2336] Although the Káínnai signed a letter stating that they do not object to the project, the same letter also states that support for the project in no way “extinguishes, abrogates, or diminishes [their] Aboriginal or Treaty rights, including Aboriginal title, which are protected under section 35 of the *Constitution Act*.” (CIAR 263, PDF p. 1).

[2337] The Káínnai provided a copy of *Methodology for Assessing Potential Impacts on the exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine* (Mikisew Cree First Nation and the Canadian Environmental Assessment Agency 2018). They requested we consider it in the assessment of the impacts on the exercise of rights from the project. Benga noted it had considered the document in its submission.

[2338] Benga presented a summary of information provided by the Káínnai about their asserted or established rights, which noted the importance of the project area as a place to exercise their rights. Benga noted that the Káínnai had raised the loss of land for traditional land use and increased access restrictions as potential adverse impacts on their rights. Benga stated that they did not receive any information from the Káínnai on potential adverse impacts of the project on their ability to practise their rights. Benga described its agreement with the Káínnai as a mitigation measure to address potential impacts on rights. The Treaty 7 section provides information on the Agency’s preliminary assessment of the project’s potential impacts on rights, including those of the Káínnai Nation. A separate section is devoted to the ACO’s conclusions on the adequacy of consultation.

Panel analysis and findings

[2339] Our assessment includes the effects of the project on *CEAA 2012* section 5 factors for the Káínnai, in combination with historical and contemporary cumulative effects. This allows us to understand the extent to which the Káínnai’s exercise of rights has already been impacted, and the further potential impact on these rights posed by the project. We considered the Agency’s preliminary assessment of potential impacts on asserted or established Aboriginal or treaty Rights and the ACO reports dated October 23, 2020, and December 3, 2020.

[2340] We accept that the Káínnai identified the project area as one of the few remaining areas where their members can still practise treaty rights. We recognize the Káínnai’s concern that the project would further impede their ability to access areas to practise their treaty rights and that their members already find it difficult to access traditional hunting, fishing, gathering, and camping areas. We acknowledge that the Káínnai have signed an agreement with Benga, and submitted letters of no concern, indicating that their project-specific concerns have been addressed. We respect the Káínnai’s ability to determine for themselves the degree to which the project would impact their ability to practise their Aboriginal or treaty rights.

[2341] The potential impacts on Aboriginal and treaty rights of the Káínnai can be characterized as follows:

- **Magnitude:** moderate to high, and likely on areas of cultural importance. The Káínai described their deep connection to the project area and physical and sensory effects are likely to interrupt the Káínai's practices.
- **Geographical extent:** moderate for the exercise of rights. The impact may occur within areas of preferred use as the Káínai identified the project area as one of the few areas remaining for them to practise their rights.
- **Duration, frequency, reversibility:** high. The Káínai have demonstrated moderate use of the project area for harvesting and cultural activities. The impact would occur constantly during, and potentially beyond, the life of the project. Cumulative impacts are likely to persist over multiple generations. Any loss in the Káínai's ability to transfer knowledge cannot be reversed.
- **Health:** moderate. There could be an impact on physical, mental, emotional, and/or spiritual health because of the Káínai's use of lands and waters, as well as the downstream watershed. The environmental effects from the project are tied to food that is culturally important. The exercise of their rights may be altered due to quantifiable and/or perceived effects.
- **Cumulative impacts:** moderate. The project area was identified by the Káínai as one of only a few preferred areas where rights can still be practised. Káínai stated that most of the lands that make up Treaty 7 have already been developed for other purposes and there are progressively fewer areas where the Káínai can practise their treaty rights.
- **Impact to governance:** low. The agreement between Benga and the Káínai suggests a high level of cooperation between the two parties. We find no evidence that the project would have an impact on Káínai's governance.
- **Impact inequity:** uncertain. Insufficient information is available to determine whether subgroups of Káínai members would be disproportionately affected by the project.

[2342] Taking into consideration the evidence presented above, we find that, if the project were to proceed, it would have a moderate impact on the Káínai First Nation's Aboriginal and/or treaty rights that would have a high likelihood of occurring.

Piikani Nation

[2343] The Piikani are descendants of the Akka Piikani and members of the *Siksikatsiitapiwa*, the Blackfoot people. The Piikani emphasized that the land around Grassy Mountain has been in their territory since time immemorial and was actually called Thunder Mountain. The Piikani provided a map illustrating their traditional territory. The area extends north to the town of High River, southeast to the Little Bow River, south to the Kootenay River and the U.S. border, and west to the Rocky Mountains. The Piikani noted the area defined does not limit the use of the Piikani people to that area. The project is located approximately 57 km west of the main Piikani community of Brocket on the Piikani 147 Reserve. Piikani 147 has a land area of 430.31 km², making it the fourth-largest First Nation in Canada. The Piikani Nation currently has about 3500 members.

[2344] The Piikani Nation provided letters of non-objection to us on January 18, 2019, and March 7, 2019. The Piikani stated they did not object to the project, as they did not identify any significant traditional sites in the immediate project area and right-of-way during their traditional land use site visits. Following submission of the letters, the Piikani did not provide any further information to us and did not participate in the public hearing. The information used in our analysis below was submitted prior to the Piikani signing an agreement with Benga and submitting non-objection letters.

Current use of lands and resources for traditional purposes

[2345] The Piikani Nation stated that the project would be located on land that is currently used for traditional purposes. They said that their social and cultural fabric was based on access to traditional land and resources, and that the loss of even small amounts of traditional land could erode that fabric. The project would create a direct physical disturbance and reduce the ability of their members to take part in cultural and traditional use activities on and around Grassy Mountain (*Ksiistsiiko'om oomoiyyi*). This disturbance also has an effect on their culture, which they said could be partially, but not entirely, offset by hiring or contracting Piikani members to work at the sites.

Hunting and trapping

[2346] The Piikani Nation stated that large game continue to be harvested in the Crowsnest Pass year round, and that their members still use the Crowsnest Pass area for both spiritual purposes and hunting. The Piikani were concerned about noise and disturbance from the project on wildlife and traditional land use, and a potential increase in animal-vehicle collisions. They noted that land users and other local hunters would be familiar with the health of the environment and would be the first to observe abnormal animal behavior or the absence of normally abundant animals. They requested that Benga support a committee to hear and investigate observations by their land users about noise issues interfering with cultural and traditional land use. Benga noted that there are no Indigenous communities or residences within the noise RSA, but it agreed to develop a communications protocol with the Piikani to deal with complaints or concerns arising from the operation.

[2347] The Piikani stated that Benga's assessment failed to accurately describe the importance of fur-bearers to their culture and that the EIA failed to present an accurate list of fur-bearers, such as beavers, coyotes and ermine. These wildlife species are harvested by Piikani members for food, social, or ceremonial purposes. The Piikani noted that trapping is both a constitutional and treaty right.

[2348] Benga stated that the Piikani hunt for subsistence as well as medicinal and ceremonial purposes such as for use in bundle and sundance ceremonies. As well, Benga indicated the Piikani had identified wildlife sites used for hunting that partially or fully overlap the LSA. Benga predicted a residual effect on hunting for the Piikani because of a reduction in hunting opportunities during construction and operation of the project. This effect would be due to a loss of access to hunting locations, sensory disturbance, and changes in wildlife use within the mine permit area.

[2349] Benga characterized the residual effect as moderate in magnitude. Benga characterized the ecological and social context as sensitive because hunted species that occur in the project area are important sources of food for Piikani members, and because hunting as a traditional practice has a low resiliency due to disruptive effects on future generations. Benga predicted a residual effect on trapping for

the Piikani because of a reduction or loss of trapping opportunities and the change in trapping methods, which could affect the cultural and spiritual relationship between the Piikani and their territory.

Fishing

[2350] The Piikani Nation stated that water is a key cultural resource for traditional land uses and is critical for sustaining life on the land for their members and for traditionally harvested species. They said that the Oldman watershed, including the Crowsnest River, has important cultural and traditional uses. The Piikani raised concerns with water quality because the water from the mine flows into the Oldman River and there are endangered fish in Blairmore and Gold Creeks (i.e., cutthroat trout). They were concerned about the potential effects from spills or leaks, and the potential for release of selenium and other deleterious substances to the environment. They would like to see the development of an effective mitigation strategy to protect water and fish.

[2351] The Piikani were concerned with the potential effects on traditional land use in areas adjacent to and downstream of the project. They were concerned about losing Aboriginal fisheries as a result of the project due to physical works and changes in water quality and quantity. During a site visit in 2014, Piikani elders noted that on the rare occasions when they themselves fish, it is in streams and lakes near their reserve and primarily for sport (i.e., catch and release) due to concerns about water quality, particularly near the Oldman Dam.

[2352] Benga acknowledged that the Piikani do not heavily engage in fishing activities, and that the Piikani generally do not consume fish except when necessary for subsistence as a result of the lack of availability of preferred species. Benga predicted a residual effect on fishing for the Piikani due to the loss of access to fishing locations and increased sensory disturbance during construction and operations within the mine permit area. Benga characterized the magnitude of the residual effect as moderate because, while a change in the ability to fish in the project area is expected, the project would not affect the ability to fish in the RSA. Benga characterized the ecological and social context as sensitive because the Piikani expressed concern with changes to fish species and habitat, fishing locations, and harvesting methods.

Plant gathering

[2353] The Piikani Nation noted that they still use the Crowsnest Pass area in all seasons to gather plants. They said that plant species in the alpine at Grassy Mountain are crucial to ceremonies, healing practices, and spirituality and are particularly important because they are not found at low elevations, where most Piikani reside.

[2354] The Piikani identified species of importance to traditional use, including bearberry, sweet pine, juniper, mountain holly fern, yarrow, alpine fern, mint, saskatoons, tree lichen, lodgepole pine, willow, poplars, cottonwoods, birches, Saskatoon berry, and sage. They were concerned that contaminants associated with the project, such as selenium, would be absorbed by the willows, and requested that willows be included in baseline data collection and in monitoring programs.

[2355] The Piikani requested a timely harvest of medicinal and ceremonial plants prior to project construction. They also requested that Benga provide them the cleared lodgepole pine from the site. The Piikani noted that they use lodgepole pine to construct teepees.

[2356] Benga stated that the Piikani have identified habitat and species for plant gathering in the LSA. Benga predicted a residual effect on plant gathering for the Piikani due to a reduction in harvesting opportunities. Benga characterized the magnitude of the residual effect as moderate because a change in the Piikani's ability to gather plants is predicted in the project area. The ecological and social context was characterized as sensitive because plant gathering would be disrupted and past and present activities have put traditional land at high risk.

Trails and travelways

[2357] The Piikani Nation stated that the project would intersect, or be in proximity to, territory that is identified for trails and travelways. They identified four cultural sites associated with the trails and travelways within the LSA, but the specific locations of these sites were not disclosed.

[2358] Benga stated it anticipated that the trails and travelways connect the undisclosed cultural sites and that the project may affect access within the LSA. Benga predicted residual effects on trails and travelways as a result of the restriction in use or access to cultural heritage sites, sensory disturbances, and changes in use within the mine permit area. Benga characterized the magnitude of the residual effect as moderate because those effects would be limited to the LSA and would not extend to the RSA.

Monitoring and mitigation

[2359] The Piikani Nation recommended mitigation measures for the worst of these effects, particularly those that involve spiritual and cultural values. In meetings with Benga, the Piikani expressed an interest in active involvement in Benga's monitoring program. Prior to providing letters of non-objection, the Piikani presented a series of recommendations to us related to mitigation and monitoring.

Panel analysis and findings

[2360] We recognize that Piikani members hunt in the LSA and have concerns about wildlife health in the project area. The species that the Piikani hunt in the LSA are important sources of food. The project would reduce their ability to access hunting areas that overlap the LSA. The project would also lead to sensory disturbances due to sight and sounds from the project while hunting and gathering in the LSA and RSA. The Piikani did not identify an interest in trapping in the project area.

[2361] The Piikani Reserve lies downstream of the project, on the Oldman River, downstream of the Oldman Reservoir. The Piikani identified the Oldman River watershed as important for both cultural and traditional uses. We acknowledge their concerns about the potential for selenium and other contaminants affecting traditional land use in areas adjacent to, and downstream of, the project.

[2362] We accept that Piikani members fish in streams and lakes near the reserve, primarily for recreation due to concerns about water quality, particularly near the Oldman Dam. We recognize their concern about losing Aboriginal fisheries as a result of the project due to physical works as well as changes in water quality and quantity. We are uncertain of the Piikani's use of the Oldman watershed upstream of the Oldman Reservoir. We accept Benga's statement that the Piikani do not heavily engage in fishing activities, and that caught fish are generally not eaten, except when necessary for subsistence, as a result of the lack of availability of preferred species. However, we cannot rule out that their avoidance of fish consumption may be at least partially related to existing concerns about contamination of fish. We agree with the Government of Canada that the presence of contaminants may decrease Indigenous

peoples' ability to use and rely on water in the project area and downstream watershed. This may affect fishing, other traditional use activities, and the intergenerational transfer of knowledge.

[2363] The evidence demonstrates that Piikani members continue to rely on the LSA for the collection of traditional plants that are not found at low elevations where most Piikani reside. The project would have adverse effects on the harvesting of these plants. The project would cause the loss of ecosites supporting a wide variety of traditional use plants, including those harvested by the Piikani. As noted in the chapter on vegetation and wetlands, most traditional plant species would remain available within the LSA, although a temporary loss of areas of traditional plant potential can be expected during construction and operation of the project.

[2364] We find that the project would reduce access to some trails and travelways used by the Piikani within the LSA. We agree with Benga's conclusion that the project would have a residual effect on trails and travelways for the Piikani. However, alternative routes would be available for the Piikani to use when travelling between cultural and spiritual sites and resources within their traditional territory.

[2365] We note that the Piikani submitted letters of non-objection to the project, indicating that their project-specific concerns had been addressed. Benga and the Piikani also came to a confidential agreement. We respect the Piikani's ability to work directly with Benga to address potential effects of the project on their traditional activities. We find that, even with implementation of Benga's proposed mitigation and the existence of an agreement between Benga and the Piikani, the project would have a residual effect on the Piikani's current use of lands and resources for traditional purposes. This is consistent with Benga's conclusions.

[2366] The residual effects can be characterized as follows:

- **Magnitude:** moderate. The project may impede or alter the Piikani's ability to practise harvesting and cultural activities. The effects may be physical or sensory in nature.
- **Geographic extent:** local. Most project effects would be limited to the LSA; however, some sensory effects (e.g., noise, dust, and visual quality) will likely extend beyond the LSA to the RSA.
- **Duration:** long. The direct effects would last for the life of the project, but persistent effects due to the loss of transmission of knowledge are possible.
- **Frequency:** periodic. During the project life, the frequency would be periodic, affecting Piikani members in proximity to the project footprint. Access restrictions would be continuous during the project life.
- **Reversibility:** reversible. The effects would diminish over a number of decades. The species harvested by Piikani would be expected to return to the project site following operations, and they would still be able to access and harvest in the areas they use following cessation of project activities. We also expect that traditional plant species would be available post-closure, but full reclamation could take a few generations and reclamation is uncertain. The loss of trails and travelways is irreversible.
- **Ecological and social setting:** negative. Existing historical pressures have contributed to a declining ability of the Piikani to use their traditional territory.

[2367] We find that the project would result in residual adverse effects on the Piikani Nation's current use of lands and resources for traditional purposes in the LSA and RSA. The effects would not be significant.

Physical and cultural heritage

[2368] The Piikani Nation stated that the Oldman River watershed is culturally significant and used for traditional harvesting, spiritual activities, camping, and as a travel corridor. The Oldman River, Crowsnest Mountain, Napi's Playground, Crowlodge Mountain and Creek, Chief Mountain, Little Bow River, Sweetgrass Hill, and Porcupine Hills feature prominently in their stories, particularly those involving Napi (the Creator). These areas also serve as important harvesting locations. The Piikani said that, although some of their members live quite a distance from the project area, the stories are relevant because they are interconnected through travel and time to the Piikani way of life. The Piikani creation story is linked to the mountains, and therefore they had camp sites and sacred spaces in the flat places in the mountains.

[2369] The Piikani noted that warrior societies at one time protected these places and that "the land is understood as a storybook" (CIAR 313, PDF p. 69). They noted that Crowsnest Mountain is a sacred site for ceremonial and religious purposes and is part of Blackfoot myths and tradition. They noted the importance of Crowsnest Pass as an area with important historical and spiritual vision quest sites. Vision quest sites are sacred places, where Piikani members stay for an extended period for spiritual purposes. They are often found in isolated environments at a higher elevation with a view, such as a mountain. Piikani elders and knowledge holders spoke at length with Benga during the site tour, ground-truthing sessions, and workshops about the centrality of spirituality in their culture and way of life.

[2370] The presence of traditional trails, campsites, spiritual sites, and offerings suggest that, even though the LSA and RSA support a relatively high level of use by non-Indigenous people, it is one of the few remaining places the Piikani can carry out cultural activities. They identified potential changes in access as a key concern. During ground-truthing, the Piikani elders and technicians identified and recorded 44 traditional knowledge or traditional use sites. The Piikani also stated that a traditional land use study completed in 2015 identified 52 sites of cultural significance, 27 of which overlapped the final mine design. Another 17 sites are within 500 m of the project. This included three sites with physical remains and navigational tools. Three other sites are related to ceremonial locations. The remaining sites that overlap the mine footprint are related to traditional knowledge. Site-specific locations were not disclosed to protect confidentiality. One site identified as particularly important for ceremonies is on top of Grassy Mountain. Benga said plans were underway to hold a ceremony to relocate the site.

[2371] The Piikani emphasized their deep connection to the land and the animals, and noted that cultural, spiritual, and ceremonial teachings were inextricably bound. They said it was important that cultural and spiritual values not be lost even when they can no longer access these sites or harvest the animals. The Piikani continue with their traditional practices today and share what they know with their youth. This includes knowledge about plants and especially medicinal plants, harvesting skills, symbology and the meaning behind symbology, travel and navigation, and ceremonies. They identified the seasonal round as critical to the cultural and spiritual knowledge that is passed down through generations. This includes seasonal animal behaviour and what it says about conditions and ecological functioning.

[2372] The Piikani noted that a number of springs are located in the study area and said it is not unusual for such sites to have spiritual value. They said the lands adjacent to the project footprint have cultural significance and continue to be used for traditional purposes. No details about the locations of these lands were provided.

[2373] Benga concluded there would be a not significant residual effect on physical and cultural heritage and cultural and spiritual values for the Piikani Nation due to loss of access, and sensory disturbance within the mine permit area. Benga stated that hunting, fishing, and plant gathering all have important cultural and spiritual implications for the Piikani and that the Grassy Mountain area is used by the Piikani for ceremonies. When Benga engaged with the Piikani, four sacred sites and three habitation sites were identified as partially or fully overlapping the LSA. One additional sacred site was identified near Blairmore. Benga noted that the Piikani had identified culturally important and sacred sites wholly or partially within the project's footprint. These were kept confidential by the Piikani and their locations were not disclosed in the EIA.

[2374] Benga characterized the magnitude of the residual effects as moderate because of a predicted change in the access to, value, and experience of physical and cultural heritage for the Piikani, including the four undisclosed cultural heritage sites. Benga characterized the geographic extent as local and the duration as long-term. The frequency was characterized as regular for physical and cultural heritage and continuous for cultural and spiritual values. Benga stated that the residual effect would be non-reversible because the loss of cultural and heritage sites and features and experience in engaging in land use could result in the loss of the knowledge of cultural heritage. The ecological and social context was characterized as sensitive because a loss of heritage sites and features or engagement with physical and cultural heritage affects cultural identity, human wellbeing and relationships, and intergenerational transfer of knowledge.

Monitoring and mitigation

[2375] The Piikani recommended that Benga assess project effects with an integrated cultural impact assessment. They also identified a need to help create cultural awareness among non-Indigenous Benga employees. Benga committed to creating a Piikani cultural program as a component of a broader effort to improve cultural awareness among its employees. Benga and the Piikani agreed that Benga would support a ceremony or ceremonies when a known site or chance find is expected to be affected by the project.

Panel analysis and findings

[2376] We recognize that existing levels of use and disturbance associated with industrial and non-Indigenous land users have affected the integrity of many cultural sites and landscapes of importance to the Piikani. The LSA and RSA feature prominently in Piikani creation stories and continue to serve as important harvesting locations. Practising traditional activities has cultural and spiritual value for the Piikani and intergenerational knowledge is shared through these practices.

[2377] We find that the project would adversely affect the ability of Piikani members to experience traditional cultural activities, and reduce their engagement in such activities. In turn, they would have less opportunity to share their knowledge with younger generations. The mine footprint would disturb documented and undocumented sites of archaeological, historical, cultural, or spiritual significance. The project could also result in sensory effects on cultural and spiritual activities in the LSA and RSA.

Benga's cultural site contingency plan would address archaeological and heritage finds, but we are uncertain if the plan would fully mitigate the effects. We understand that Benga and the Piikani have entered into an agreement; this cooperative relationship may provide a mechanism to address issues of importance to Piikani Nation.

[2378] Even with the implementation of Benga's proposed mitigation, we find the project would have an adverse residual effect on the Piikani Nation's physical and cultural heritage, including direct effects on potential archaeological or cultural sites linked to ceremonies, and indirect effects related to the use of and cultural connection to their traditional territory.

[2379] The residual effects can be characterized as follows:

- **Magnitude:** moderate to high. The project would result in considerable effects in areas of cultural importance. The disturbance would be both physical and sensory in nature and could affect spiritual and cultural practices. Multiple effects would occur within and adjacent to an area of high importance for harvesting and cultural activities.
- **Geographic extent:** local. Most project effects on physical heritage would be limited to the LSA. However, some sensory effects (e.g., noise, dust, and visual quality) that can affect cultural activities and experience would likely extend beyond the LSA to the RSA.
- **Duration:** persistent. The effects on the cultural and spiritual connection to the land and intergenerational would persist well after operations cease.
- **Frequency:** continuous. The effects would occur throughout the mine life.
- **Reversibility:** irreversible. The loss of a cultural connection cannot be repaired once the mine is closed.
- **Ecological or social context:** negative. Historical pressures have contributed to a declining ability of the Piikani to access their traditional territory for cultural purposes.

[2380] We find that the project would result in residual adverse effects on the Piikani Nation's physical and cultural heritage in the LSA and RSA. The effects would be significant and are likely to occur. We find that even with implementation of Benga's proposed mitigation, the project would have a residual effect on structures and sites, such as physical remains, navigational tools, and ceremonial sites, that are of historical, archaeological, paleontological, or architectural significance to the Piikani.

[2381] The residual effects can be characterized as follows:

- **Magnitude:** moderate. Specific sites of importance to the the Piikani would be lost, but none of these sites have been identified as being of specific concern to the Piikani.
- **Geographic extent:** local. Only resources within the LSA would be affected.
- **Duration:** medium for the sites that would not be destroyed. Access to those sites would be restricted during construction and operations, but available post-closure. For sites that are destroyed, the duration is persistent.

- **Frequency:** periodic. Removal of known historical sites would occur throughout construction and operation of the project. Previously unknown sites could be found intermittently over the assessment period.
- **Reversibility:** reversible upon cessation of activities for sites that are not destroyed, but irreversible for sites that are removed as they cannot be replaced.
- **Ecological or social context:** negative. Historical pressures have contributed to a declining ability of the Piikani to access their traditional territory for cultural purposes.

[2382] We find that the project would result in a residual adverse effect on sites that are of historical, archaeological, palaeontological, or archeological significance to the Piikani in the LSA. The effect would be not significant.

Health

[2383] The Piikani Nation noted that for Indigenous groups, health and well-being is a holistic concept that can be affected by a number of interacting determinants, including social support networks within families and communities, mental health, level of education, economy, diet, the physical environment, and excessive exposure to industrial chemicals. The Piikani noted that modern technology, drugs, and alcohol also contribute to the degradation of traditional culture, and that industrial development could influence all of these determinants; however, Benga addressed only the physical environment in its human health risk assessment. The Piikani said their perception of risk may be to a higher standard than the western–science based human health risk assessments, and are unconvinced by assertions that industrial emissions do not harm human health.

[2384] The Piikani were concerned that the project would adversely affect wildlife by diminishing their access to clean water. The Piikani Nation stated that surface water quality is extremely important to the Piikani’s traditional livelihood as it plays a role in overall ecosystem health, supporting traditional plant and animal communities and the Piikani culture.

[2385] The Piikani noted that the prevailing winds are from the west through Crowsnest Pass (blowing toward Brocket) and that members, particularly elders, are already experiencing health issues from wildfires and other projects such as Turner Valley and gas wells. They said that as the project is located in an area with little industrial activity, they do not expect air quality to deteriorate to a level where risks to human health are present. They do not want the project to affect their members’ quality of life. They said that issues such as dust and odours, while they might not pose immediate threats to one’s health, are considered nuisances that could have an adverse impact on their members’ enjoyment of traditional land and the exercise of traditional land use rights.

[2386] The Piikani Nation has a health services centre on their reserve, but noted that the services were in high demand. The Piikani also noted that, in the view of their health service providers, the project could positively influence members’ health. They described employment and stable incomes as key health determinants, and identified the employment of Piikani members as a positive effect on community health. The Piikani stated that, in general, sensory effects such as noise, smell, dust, and visibility—alone and cumulatively—have the most impact on the use and enjoyment of traditional lands in the vicinity of a

project. The effects of perceived pollution, odours, and noise can combine to erode traditional culture, social support systems, and traditional land use.

[2387] A summary of Benga's evidence on health for Indigenous groups appears earlier in this chapter in the section on Benga's approach and assessment.

Panel analysis and findings

[2388] The Piikani provided clear evidence of their use of the LSA and RSA for harvesting, including hunting and plant gathering. They said that surface water quality is extremely important to their traditional livelihood as it plays a role in overall ecosystem health, supporting traditional plant and animal communities and Piikani traditional use and culture. We understand that the Piikani fish primarily for sport, and not for subsistence purposes, in streams and lakes near the reserve, and that they have concerns about water quality near the Oldman Dam. As such, our findings regarding health as discussed in the section on Benga's approach and assessment apply to the Piikani.

[2389] We find that the project is not expected to result in residual adverse effects on Piikani health. However, even with implementation of Benga's proposed mitigation, the perception of an increased health risk resulting from potential contamination, including selenium contamination in the downstream watershed, could cause avoidance of harvesting areas. We address these effects in our assessment of current use of lands and resources.

Socioeconomic conditions

[2390] The Piikani Nation expressed concerns about negative socioeconomic effects caused by potential community changes, including increased spending among community members, increased income disparity, and associated impacts on social cohesion in community. The Piikani identified the occupational risk of mining as an issue, and noted that they expected it would involve a range of occupations at the project. As a result, their occupational exposures might be higher than those of the general public, and they expected that Benga would implement effective occupation health and safety programs.

[2391] The Piikani noted that their community was interested in employment opportunities and income associated with the project. They noted that it was extremely important that they share in the economic benefits of the project. They were particularly interested in construction, environmental services, and provision of equipment on site. They also would like to see their members move into jobs beyond manual labour, but noted there were challenges that made it difficult for members to take advantage of employment opportunities. They identified childcare as a barrier for employment for some members.

[2392] The Piikani said that the project could result in an increase in the population on reserve. Their study found the project has the potential to create jobs for Piikani members living on reserve and some of the 200 to 250 Piikani members living off reserve could move back. This population influx could have consequences for services and infrastructure on reserve, which are already strained. In addition, they noted an existing housing shortage on reserve, which would be exacerbated if more people moved back.

[2393] The Piikani recommended that Benga implement a socioeconomic monitoring program. The Piikani also made a number of recommendations and indicated they were working with Benga on employment and contracting targets, recruitment and training opportunities, and workplace support. A summary of Benga's evidence on socioeconomics for Indigenous groups appears earlier in this chapter in the section on Benga's approach and assessment and was applied to our assessment for the Piikani.

[2394] Benga noted that the project would likely have an important positive effect on Indigenous groups who are closer to the project, such as the Piikani, who do not currently have many other economic opportunities.

Panel analysis and findings

[2395] Our findings and discussion in the socioeconomic conditions portion of the section on Benga’s approach and assessment in this chapter apply to the Piikani.

[2396] We acknowledge Benga’s commitment to provide Indigenous employment and procurement opportunities. We agree with Benga that the socioeconomic effects of the project would differ among Indigenous groups as different factors determine how each community would be affected by the project. The effects would also vary by group and individual within a community. We acknowledge that the Piikani anticipated positive implications from the project, including employment for members and other economic benefits. They also foresaw negative implications, such as further strains on reserve housing, increased demand for services, traffic, and employment barriers.

[2397] The Piikani submitted letters of non-objection to the project, stating that their project-specific concerns have been addressed. We understand that Benga has entered into an agreement with the Piikani and recognize that this cooperative relationship may provide a mechanism to address issues of importance to the Piikani. We believe the Piikani’s involvement in proposed monitoring and in the implementation of their agreement would at least partially mitigate potential adverse socioeconomic impacts.

[2398] In consideration of the arrangements Benga has in place with Indigenous groups, as well as Benga’s stated objective of achieving a net positive effect for Indigenous communities, we expect the overall positive economic impact of the project would extend to the Piikani. However, Benga provided limited group-specific socioeconomic information and the Piikani provided limited information about the potential socioeconomic effects of the project on their community. As we do not have enough specific evidence from either Benga or the Piikani, we are unable to complete an assessment of the effects of the project on the socioeconomic conditions for the Piikani Nation.

[2399] Table 22-4 provides a summary of our assessment of the residual effects of the project on the Piikani Nation.

Table 22-4. Summary of panel analysis of residual effects on the Piikani Nation

CEAA 2012 section 5 effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Ecological or social context
Current use of lands and resources for traditional purposes	Moderate	Local, regional for sensory effects	Long	Periodic, continuous for access restrictions	Reversible in the long term, however effects to trails and travelways are irreversible	Negative
Physical and cultural heritage	Moderate to high	Local, regional for sensory effects	Persistent	Continuous	Irreversible	Negative
Structure, site or thing	Moderate	Local	Medium/ Persistent	Periodic	Irreversible for sites that are destroyed, reversible for those that are not	Negative
Health conditions	Residual effects are not expected					
Socioeconomic conditions	Unable to complete assessment					

Cumulative effects

[2400] The Piikani Nation noted that they were already facing pressures from cumulative effects, stating that much of their traditional territory had been taken up, making the remaining areas more important. The Piikani stated that existing levels of use and sensory disturbance associated with industrial and non-Indigenous land users (noise and visual impacts) have already affected the integrity of many Blackfoot cultural sites and landscapes. They said that they frequently cannot access areas in their traditional territories and must exercise their traditional practices elsewhere. They noted that historical mining within their territory had disturbed the “few remnants of Piikani presence” on the land. In their view, even the loss of small areas could negatively affect their ability to undertake traditional activities, affecting cultural values.

[2401] The Piikani raised concerns about the previous loss of access to and use of lands and resources as a result of the construction of the Oldman Dam near the Piikani reserve. They have already experienced major impacts on their culture from the change in the Oldman River created by the dam, and any new changes, no matter how small, could affect their culture. They raised concerns about the potential for the project to interact with other projects within the Crownsnest River watershed, which is used for traditional purposes by their members, including fishing and navigation. The Piikani requested that Benga assess potential impacts of changes in hydrology on their use of surface water resources, including the health of tributaries to the Oldman River and the integrity of the watershed, boat access and navigation, sources of potable water, and cultural sites and resources for recreational use. The Piikani reported concerns about how cumulative effects on aquatic ecology were assessed given the uncertainties in Benga’s impact analysis.

[2402] The Piikani raised concerns about an increase in disturbed areas due to historical mining activities. In response, Benga stated that the project would disturb some previously undisturbed Crown lands, and access to Crown lands during construction and operations would be restricted for safety reasons. Benga also said that, to the extent possible, areas that were already disturbed on Crown land would be incorporated into the construction and operational plans of the project to minimize new disturbance. The Piikani also raised concerns about the potential for cumulative effects related to human presence on wildlife migration routes.

Panel analysis and findings

[2403] We accept the Piikani’s position that a cumulative effect is already taking place and the project would add to that effect. We find the existing effect is significant. There are cumulative effects on current use of lands and resources and physical and cultural heritage for the Piikani Nation. These effects occur primarily as a result of past projects and activities within Piikani traditional territories.

[2404] The cumulative effects can be characterized as follows:

- **Magnitude:** moderate to high, when taking into consideration the historical context. The project would further exacerbate the considerable effects to date on the Piikani’s ability to use their traditional territory.
- **Geographic extent:** regional. There has been widespread privatization and development of lands within Piikani’s traditional territory.

- **Duration:** persistent. The effects could last indefinitely, continuing to affect the Piikani’s relationship with their traditional territory and their ability to pass on cultural traditions.
- **Frequency:** continuous, when considering the effects of the project in combination with all activities, past and present.
- **Reversibility:** irreversible. The cumulative effects would contribute to existing effects and not diminish over time.
- **Ecological or social context:** negative. Historical pressures have already contributed to the deterioration of the Piikani’s traditional territory.

[2405] We find that the project, in combination with other projects and activities that have been or would be carried out, is likely to contribute to existing significant adverse cumulative effects on the Piikani Nation’s current use of lands and resources for traditional purposes and physical and cultural heritage. These cumulative effects occur primarily as a result of other past projects and activities that have occurred within Piikani traditional territories.

Rights

The Piikani Nation noted in their letters of non-objection that “any decision including our non-objection should not be construed or interpreted as abandoning, waiving or extinguishing our Aboriginal or treaty Rights or claims of inherent rights of the Piikani people and heritage to the project area that rest completely in Piikani Traditional Territory” (CIAR 200, PDF p. 1). They said that pursuant to Treaty 7, they have the following rights to the use and enjoyment of their traditional lands and reserve lands, which could be adversely affected by the project:

- The right to hunt, trap, and harvest natural resources within their traditional territory, to their way of life, to the use, enjoyment and control of lands reserved for them and the right to a livelihood and cultural and spiritual practices from their traditional lands
- Alberta’s right to “take up” lands for mining and other purposes pursuant to Treaty 7 is limited by Piikani Nation’s right to sufficient lands, and access to them, of a quality and nature sufficient to support the meaningful exercise of their treaty rights
- The right to hunt for food in all seasons pursuant to the Natural Resources Transfer Agreement (being schedule 2 of the *Constitution Act*, 1930)
- The right to be consulted and accommodated about potential adverse effects on their rights and the interests secured by these rights
- The right to use and enjoyment of our reserve lands pursuant to section 18(1) of the *Indian Act* (R.S. 1985, C. I-5)
- The statutory right to hunt, fish, and trap on Crown lands pursuant to the *Hunting, Fishing and Trapping Heritage Act* (S.A. c. H-15.5)

[2406] The Piikani stated they have never given up the right to these lands and, although faced with many challenges as a people, have continually strived to maintain their distinct language, spirituality and culture, including their family and social relationships, and traditional governmental systems, while promoting political interests, economic interests, and education programs that would enhance the lives of the Piikani people. The Piikani were concerned that the project represents an infringement of their hunting rights. They were also concerned that the project would infringe on their water rights and that they have already experienced a major impact on their culture from the change in the Oldman River created by the Oldman Dam. Any new changes, no matter how small, could affect Piikani culture.

[2407] Benga presented a summary of information provided by the Piikani about their asserted or established rights in the project area, which noted the importance of the Crowsnest Pass as a place to exercise their rights. Benga noted that the Piikani had identified the current loss of hunting, access, and culture, and that experience by future generations, as a potential adverse impact of the project on their ability to practise their rights. Benga described its agreement with the Piikani as a mitigation measure to address potential impacts on those rights.

[2408] The Treaty 7 section provides information on the Agency's preliminary assessment of the project's potential impacts rights, including those of the Piikani Nation. A separate section is devoted to the ACO's conclusions on the adequacy of consultation.

Panel analysis and findings

[2409] Our assessment includes the effects of the project on *CEAA 2012* section 5 factors for the Piikani, in combination with historic and contemporary cumulative effects, to determine the extent to which the Piikani's exercise of rights has already been impacted, and the further potential impact on rights from the project. We considered the Agency's preliminary assessment of potential impacts on asserted or established Aboriginal or treaty Rights and the ACO reports dated October 23, 2020, and December 3, 2020.

[2410] We accept that the Piikani assert Aboriginal rights in the project area, and that they have treaty rights under Treaty 7. The Piikani said that the project would be located on land they currently use for traditional purposes, including the practice of rights. We accept their concern that, as much of their traditional territory has already been developed for other purposes, the remaining areas are that much more important.

[2411] We acknowledge that the Piikani have signed an agreement with Benga, and submitted letters of non-objection to the project, stating that their project-specific concerns have been addressed. We respect the Piikani's ability to determine for themselves the degree to which the project would impact their ability to practise their rights.

[2412] The potential impacts on Aboriginal and treaty rights of the Piikani can be characterized as follows:

- **Cultural well-being:** moderate. An impact on areas for the practising of cultural important activities is likely. Access to areas required to practise cultural activities would be disrupted or limited. The disturbance may be physical or sensory (e.g., noise, dust, and visual quality) or may affect customs

and/or spiritual and cultural practices. These impacts would be in addition to those already present on the landscape.

- **Geographic extent:** moderate. The impact could occur within the LSA and RSA for the exercise of rights. Impacts might occur within some areas of preferred use.
- **Duration, frequency, reversibility:** high. The Piikani have demonstrated moderate use of the project area for harvesting and cultural activities. The impact would occur constantly during and potentially beyond the life of the project. Cumulative impacts are likely to persist over multiple generations. Any loss in Piikani's ability to transfer knowledge cannot be reversed.
- **Health:** moderate. There could be an impact on physical, mental, emotional and/or spiritual aspects of health because of the Piikani's use of project lands and waters, as well as the downstream watershed. The environmental effects from the project would be tied to food that is culturally important. The exercise of rights would be altered due to quantifiable and/or perceived effects from the project.
- **Cumulative impact:** moderate. The project could interact with one of only a few preferred areas where rights can still be practised. The project might cause environmental effects on culturally important species or sites. Other land uses, including proposed or existing projects, in the community's territory already impact the ability to practise Piikani rights. The project could have environmental effects on culturally important species.
- **Impact to governance:** low. The agreement between Benga and the Piikani indicates a high level of cooperation between the two parties. We did not find evidence to suggest that the project would have an impact on areas that support the governance of the land.
- **Impact inequity:** uncertain. Insufficient information is available to determine whether subgroups of the Piikani members would be disproportionately affected by the project.

[2413] Taking into consideration the evidence presented above, we find that if the project were to proceed, it would have a moderate impact on Piikani Nation's Aboriginal and/or treaty rights that would have a high likelihood of occurring.

Siksika Nation

[2414] The Siksika Nation is part of the Blackfoot Confederacy, and a signatory to Treaty 7. The Siksika have a reserve approximately 95 km east of Calgary. There are currently 7130 registered Siksika members, including 3925 who live on reserve and 3004 who live off-reserve. Their traditional territory is located in southern Alberta and includes the Crowsnest Pass and the surrounding areas.

[2415] The Siksika provided a letter of no concern to us on March 23, 2020. They stated that they did not object to the project on the basis that Benga had adequately addressed the Siksika's project-specific concerns. After that letter, the Siksika did not provide any further information to us and did not participate in the public hearing. The information used in our analysis was submitted prior to the Siksika signing an agreement with Benga and submitting a letter of no concern.

Current use of lands and resources for traditional purposes

[2416] The Siksika stated that the project is in the heart of an area used intensively for millennia by Siksika members for hunting, fishing, gathering, and traditional purposes. They said that there is a sacred agreement between humans and animals and that the Blackfoot peoples are stewards of the animals within their traditional territory.

Hunting and trapping

[2417] The Siksika Nation stated that their members do not hunt in the LSA and RSA as extensively as they did in the past. But the area continues to be a source of wildlife hunted for use in ceremonies, sacred bundles, and for subsistence purposes. The Siksika provided affidavits in their 2016 statement of concern attesting that some members have hunted within and to the east and west of the LSA for sustenance, as well as to teach their hunting traditions. The Siksika were concerned that the project would affect their culture and way of life by altering hunting and other traditional activities in the area for more than 30 years.

[2418] The Siksika expressed concerns about the potential impacts of the project on wildlife habitat, migratory patterns, and reproduction rates, including those of bears. This would affect Siksika culture, which is intertwined with the land and animals. The Siksika identified the following wildlife species of importance in the project area: moose, elk, deer, cougars, wolves, rabbits, squirrels, woodpeckers, wild turkeys, crows, and golden eagles. Other animals commonly hunted by Siksika members include black-tailed deer, mule deer, white-tailed deer, big horn sheep, beavers, and muskrats.

[2419] Historically, bison, antelopes, and mountain sheep have been important as well. Hunting is important, as it enables Siksika to provide healthy, sustainable, and cost-efficient sustenance to their families and community members. Hunting is a traditional activity that continues to be taught and passed down from generation to generation. Hunting connects the Siksika to the land. The Siksika are also concerned that project-related noise may affect the success of their harvesting.

[2420] The Siksika recommended that wildlife in the project area be given time to relocate to new habitat by developing the project in appropriate timeframes. The Siksika proposed that any waterbodies holding runoff from the mountain and effluent from the mine be fenced so that animals did not drink from them and that alternative clean-water drinking spots for those animals be created nearby. The Siksika also proposed establishing alternative nesting locations for eagles for the duration of the project.

[2421] Benga stated that the Siksika did not identify any specific hunting sites in the LSA. However, it noted that project activities would intersect, or be in proximity to, habitat and species that were identified for hunting by the Siksika. Benga acknowledged Siksika concerns that the project would continue to reduce access to hunting locations. Benga stated that the Siksika did not provide any information or identify an interest in trapping within the LSA, but noted that it was historically a traditional activity.

[2422] Benga predicted that there would be residual adverse effects on the Siksika's hunting and trapping activity after the implementation of mitigation measures. Benga characterized the residual adverse effects as moderate in magnitude for hunting because any change in the Siksika's ability to hunt would be limited to the project area. The effect on trapping was characterized as low in magnitude because the Siksika did not identify any active trapping in the project area. Benga characterized the

ecological and social context for both hunting and trapping as sensitive. Benga explained that this was because the Siksika reported a decline in the number of species and raised concerns about limited accessibility and avoidance due to private land ownership, non-traditional land use activities, contamination, safety, and overall negative experiences on the land. Benga noted that species that occur in the project area remain important sources of food for Siksika members. Benga further explained that, from an ecological and social context, these issues placed hunting and trapping at moderate to high risk.

Fishing

[2423] The Siksika stated that the potential for downstream water pollution was high, given the location of the project in the headwaters of the Oldman. They did not understand “how the project would not inevitably pollute the waters in the Project Area and the waters downstream” (CIAR 68, Package 1, PDF p. 380). They also raised concerns about potential contamination of the Gold and Blairmore Creeks ecosystems and microclimates as it would affect fish and their traditional use of creek bottoms. The Siksika identified rainbow trout, whitefish, pike, and bull trout as species of interest for fishing, and said they had been fishing in the Grassy Mountain area. The Siksika provided affidavits in their 2016 statement of concern stating that their members had fished for, and caught, rainbow trout, pike, and whitefish in Gold Creek and the waterways within and to the east (downstream) of the project. Their members said they fished regularly in the summertime and ice fished in the winter. As one Siksika member stated, “I intend to fish in the future. It has been part of my diet all my life” (CIAR 68, Package 1, PDF p. 388).

[2424] Benga stated that the Siksika have a fishing interest in the project area but added that they did not provide any additional information about their current fishing practices. Benga predicted that there would be residual adverse effects on the Siksika’s fishing activity after implementation of mitigation measures. Benga characterized the residual adverse effects as moderate in magnitude because any change in the Siksika’s ability to fish would be limited to the project area. Benga characterized the ecological and social context as sensitive because the Siksika noted that past and present activities had substantially reduced fishing opportunities in the area.

Plant gathering

[2425] The Siksika stated that plants have always been highly important and are gathered during all seasons for subsistence as well as ceremonial and medicinal purposes. Siksika members still gather material from the project area for ceremonies. Sweet pine, which is located in the project area around Gold Creek, was described as a culturally important species. The Siksika mentioned that they need to harvest some of these species from the project area because they do not grow on their reserve lands. They said that a number of sacred, medicinal, and ceremonial plants growing in the microclimate of Gold Creek and elsewhere at Grassy Mountain need to be protected from the project.

[2426] The Siksika said they would want to revisit the project site during growing seasons to obtain a full list of medicinal and ceremonial plants that would require protection. They recommended harvesting important species prior to construction, and then undertaking near-term greenhousing and eventually replanting them during reclamation.

[2427] Benga stated that the Siksika identified habitat and species for plant gathering in the LSA, including areas specific for harvesting culturally important plant species. Benga predicted residual adverse effects on the Siksika's plant-gathering activity after the implementation of mitigation measures. Benga characterized these effects as moderate in magnitude because the project was predicted to change the ability of Siksika members to gather plants in the project area, including areas used to harvest culturally important plants. Benga characterized the ecological and social context as sensitive because plant gathering is sensitive to disruption, and past and present activities have put traditional land uses at high risk.

Trail and travelways

[2428] The Siksika Nation did not provide any information specific to trails or travelways.

[2429] Benga stated that the Siksika did not identify any specific trails, travelways, or features associated with navigation within the LSA. Sites of importance associated with trails and travelways were identified. Benga predicted that there would be residual adverse effects on the Siksika's use of trails and travelways after implementation of mitigation measures. Benga characterized these effects as moderate in magnitude because the project is predicted to change the Siksika's ability to use or access trails and travelways within the mine permit boundary. However, their ability to use trails and travelways in the RSA would not be affected. Benga characterized the ecological and social context as resilient because, in Benga's view, the Siksika can use alternative routes to travel between cultural and spiritual sites and resources within their traditional territory.

Monitoring and mitigation

[2430] The Siksika proposed the development of a mitigation and remediation strategy with meaningful participation of their members. The strategy would ensure that the animals, waters, and plants at the project site and nearby are protected during project construction and operation, and that all are fully restored by the end of project remediation. They also proposed that Benga include an effective water protection plan in the mitigation and remediation strategy and develop it in consultation with the Siksika.

Panel analysis and findings

[2431] We recognize that the project is in the heart of an area that has been used by Siksika members for hunting and other traditional activities for millennia. We understand the Siksika were concerned that the project would continue to reduce their access to hunting locations and have negative effects on their culture and way of life. We accept that some Siksika members have hunted in the project area in the recent past and that the area is a source of wildlife used in ceremonies and sacred bundles and for subsistence purposes. We expect that the project footprint would reduce wildlife habitat for species hunted by the Siksika; however, we do not expect any significant effects on hunted species. The Siksika did not identify any trapping in the project area, although some of the wildlife they identified as important may be trapped and/or hunted.

[2432] The affidavits provided by Siksika members described fishing in the general area of the project during their lifetimes. They also said that they fish in the waters downstream of the project area. We agree with the Government of Canada that the presence of contaminants may decrease Indigenous peoples' confidence in their ability to use and rely on water in the project area and downstream watershed. This may affect fishing, other traditional use activities, and the intergenerational transfer of knowledge.

[2433] We accept that the Siksika continue to gather plants in the project area for ceremonial use and that the LSA contains a number of sacred, medicinal, and ceremonial plants important to the Siksika. We also note that the Siksika were concerned about the potential effects on vegetation in the project area and that project-related noise may affect the success of their members' harvesting activity.

[2434] The Siksika provided no information on trails and travelways. However, given the number of important sites in the project area (see the discussion and physical and cultural heritage), it is reasonable to assume that there are trails and travelways of importance to the Siksika in the project area. As well, the project would also lead to visual and auditory disturbances during hunting and gathering in the LSA and RSA. The project would interrupt the ability of the Siksika to harvest for both subsistence and ceremonial purposes in the LSA, and could affect traditional knowledge transfer.

[2435] The Siksika submitted a letter of no concern, indicating that their project-specific concerns have been addressed. There is also a confidential agreement between Benga and the Siksika. We respect the Siksika's ability to work directly with Benga to address potential effects of the project on their traditional activities. We find that, even with implementation of Benga's proposed mitigation and the existence of an agreement between Benga and the Siksika, the project would have a residual effect on the Siksika's current use of lands and resources for traditional purposes. This is consistent with Benga's conclusions.

[2436] The residual effects can be characterized as follows:

- **Magnitude:** moderate. The project would disrupt access to important areas for plant harvesting by the Siksika, as well as disrupt an important source of wildlife harvested by the Siksika. The disturbance could also affect their connection to the land and cultural practices.
- **Geographic extent:** local. Most project effects would be limited to the LSA. However, some sensory effects (e.g., noise, dust, and visual quality) would likely extend beyond the LSA to the RSA.
- **Duration:** long. The direct effects would last for the life of the project, but are not expected to persist beyond operations.
- **Frequency:** periodic. During the project life, the frequency of effects would be periodic, affecting the Siksika when members are near the project footprint. Access restrictions would be continuous during the project life.
- **Reversibility:** reversible. The effects would diminish after a number of decades. The biophysical effects on species related to hunting and gathering are reversible. The species harvested by the Siksika are expected to return to the project site following operations, and the Siksika would still be able to access and harvest in the areas they use following cessation of project activities. We also expect that traditional plant species would be available post-closure, but acknowledge that full reclamation could take a few generations, and that reclamation is uncertain. It is unclear whether trails and travelways would be affected by the project, but if they are, the effect would be irreversible.
- **Ecological and social setting:** negative. The Siksika demonstrated that existing and historical pressures have contributed to a declining ability to use their traditional territory.

[2437] We find that the project would result in residual adverse effects on the Siksika Nation's current use of lands and resources for traditional purposes in the LSA and RSA. The effects would not be significant.

Physical and cultural heritage

[2438] The project area is of high religious significance to the Siksika, who have songs for the Crowsnest Pass area which, translated from the Blackfoot language, is called "Raven's Nest." The Siksika Nation noted that their sites in the Crowsnest Pass region are close to Crowsnest Mountain, and the ceremonial, medicinal, spiritual, hunting, and burial sites at Grassy Mountain have been in continuous, intensive use for millennia. In the Siksika's view, the project would continue to diminish their traditional culture by irreversibly destroying their use of spiritual and ceremonial sites of worship in the Crowsnest Mountain area.

[2439] Siksika elders described a ceremonial and spiritual complex comprising multiple sites in the Gold Creek and Blairmore Creek valleys and benches, and the saddle of land connecting Grassy Mountain and Grassy Mountain South (Bluff Mountain), as well as Crowsnest Mountain. The spiritual complex is believed to be the oldest Blackfoot spiritual site in Alberta. Siksika members stated that the complex is older by many millennia than the Siksika medicine wheels found at Majorville and Sundial Butte, whose origins date to about 5200 years ago. According to the Siksika, the complex has profound spiritual importance. Siksika members stated: "those sites are alive for us still and are connected to each other and to us. They cannot be steered around or between like pylons without substantive impacts to our use" (CIAR 185, PDF p. 497).

[2440] The Siksika described Crowsnest Mountain as one of their most sacred sites, as it is at Crowsnest Mountain that the Siksika received the Thunder Pipe from Thunder before he was forced by Crow to live at Chief Mountain. The Siksika view the Thunder Pipe as perhaps the greatest of all Blackfoot pipes. For millennia, the Thunder Pipe ceremony was held at Grassy Mountain when the first thunder was heard each year. The Siksika have used the area for more than 9000 years. The Siksika continue to worship at Crowsnest Mountain. Siksika youth engage in vision quests at Crowsnest Mountain and there are burial sites found in the area.

[2441] During a site visit, Siksika members identified a stone cairn (DkPo-07) in the proposed south dump area, and stated that they have buried their dead on high ground for millennia, some interred and some laid on the ground. Siksika members stated that their protocol for these sites was to leave them alone and keep their distance, as spirits must not be disturbed. Siksika members also described two pre-contact campsites (DjPo-98 and DjPo-130) as important and requested that they be protected (Table 22-2). The Siksika also identified yellow ochre at sites near the golf course and stated that no further impacts on the sacred and ceremonial paint source should be permitted. The Siksika noted that "an abundance of eagles" live and nest seasonally in the project area since the site is on a major eagle migratory route. The eagle is sacred to the Siksika, who were concerned about the destruction of nesting grounds as well as the effects of noise pollution and air pollution from the project on eagle health.

[2442] The Siksika explained that members remain connected to the land and feel a responsibility to preserve their traditional lands and ensure that traditional activities on these lands continue for generations to come. They said that wildlife and vegetation continue to form the basis of their way of life

and any disturbance or disruption would necessarily interfere with their traditional activities, including the ability to transmit traditional knowledge about the area to younger generations. The project would have lasting adverse impacts on Siksika culture. They requested that a ceremony be conducted if any area is expected to be affected by the project, and encouraged Benga to provide support for Siksika ceremonies and community events. The Siksika stated that the ceremonial and spiritual complex needed to be protected and that the means to protect it should follow a process of meaningful consultation between Benga and the Siksika. They also urged Benga to collaborate with them to develop and implement a cultural training program.

[2443] Benga noted that the Siksika expressed concerns about the possible loss of sacred sites and experiences within the range of the project owing to visual and sensory effects such as noise. Benga also noted that the Siksika identified three sacred sites within the LSA and that direct effects on physical and cultural heritage sites were anticipated within the project footprint. Benga committed to avoiding two pre-contact campsites (DjPo-98 and DjPo-130) identified by the Siksika and other Treaty 7 groups as important, and agreed to continue discussions with the Siksika about mitigation measures for a stone cairn (DkPo-07), which would be buried under the south rock dump. At the hearing, Benga stated that the project site would be visible from certain areas on Crowsnest Mountain and could potentially affect the viewscape. Benga stated that there would be no effects due to scent from that distance, but that faint noise would be generated from blasting.

[2444] Benga predicted that there would be residual adverse effects on the Siksika's physical and cultural heritage and spiritual and cultural values after implementation of mitigation measures. Benga characterized the residual adverse effects as moderate in magnitude because the project was predicted to change the values and experience associated with physical heritage. Siksika cultural and spiritual sites would also experience direct disturbance and changes in noise and air quality in the project area. Benga characterized the ecological and social context as sensitive because the loss of engagement with sites and land use would affect cultural identity, human wellbeing and relationships, and intergenerational transfer of knowledge. Benga concluded that the project would not result in any significant adverse environmental effects on the Siksika physical and cultural heritage, including spiritual and cultural values and historical resources.

Panel analysis and findings

[2445] The Siksika Nation has demonstrated a spiritual and religious connection to the project area and Crowsnest Mountain. We acknowledge the spiritual importance of Grassy Mountain and its association for Siksika with the Thunder Pipe ceremony. We recognize the project may be visible at certain elevations and audible at certain times from as far away as Crowsnest Mountain. We find that this could affect the Siksika's cultural connection with the landscape.

[2446] As explained further in the wildlife chapter, we recognize that, while Grassy Mountain is located in an important eagle flyway, the project site has not been identified as an important stopover site. We are also satisfied with Benga's proposal to conduct pre-disturbance nest searches prior to any tree clearing. As such, we do not anticipate that the project would have any effects on eagles, which are culturally important to the Siksika.

[2447] We find that the project would result in the loss of, or loss of access to, culturally and spiritually important sites. This loss would adversely affect the experience, and reduce the ability, of Siksika members to engage in traditional activities and to carry out cultural activities, reducing their ability to share knowledge with younger generations. The project may also result in sensory effects on cultural and spiritual activities in the LSA and RSA.

[2448] The mine footprint would disturb documented and undocumented sites of archaeological, historical, cultural, or spiritual significance. Benga's cultural site contingency plan would manage archaeological and heritage finds, but we are uncertain if the plan would fully mitigate the effects.

[2449] We understand that Benga and the Siksika have entered into an agreement; this cooperative relationship may provide a mechanism to address issues of importance to Siksika. We find that, even with implementation of Benga's proposed mitigation, the project would have adverse residual effects on Siksika physical and cultural heritage, including direct effects on potential archaeological or cultural sites, and indirect effects on the use of and cultural connection to their traditional territory.

[2450] The residual effects can be characterized as follows:

- **Magnitude:** high. The project would result in considerable effects on areas and practices of cultural importance, and the disturbance would be of both a physical and sensory nature. Some culturally important sites would likely be lost, access to sites required to practise cultural activities would likely be disrupted or limited, and the disturbance would be of a physical or sensory nature and may affect law, knowledge, customs and/or spiritual and cultural practices.
- **Geographic extent:** local. Most project effects would be limited to the LSA, although some sensory effects (e.g., noise, dust, and visual quality) that can affect cultural activities and experience would likely extend beyond the LSA to the RSA.
- **Duration:** persistent. The effects on the cultural and spiritual connections to the land and intergenerational transfer of knowledge would persist well after operations cease.
- **Frequency:** continuous. The effects would occur throughout the mine life.
- **Reversibility:** irreversible. The loss of a cultural connection cannot be repaired once the mine is closed.
- **Ecological or social context:** negative. Historical pressures have contributed to a declining ability of the Siksika to access their traditional territory for cultural purposes.

[2451] We find that the project would result in residual adverse effects on Siksika Nation's physical and cultural heritage. The effects would be significant and are likely to occur.

[2452] The Siksika identified a number of important historical resource sites in the project area. Benga committed to protecting two of the important sites (DjPo-98 and DjPo-130) originally located in the project footprint, and to continuing discussions with the Siksika about a third site within the footprint that will be fully buried if not excavated (DkPo-07). Benga also committed to a chance-find protocol. Benga's commitment to protect sites DjPo-98 and DjPo-130 would not prevent the effects of reduced access to the sites, or sensory effects associated with proximity to the project footprint.

[2453] We find that, even with implementation of Benga’s proposed mitigation, the project would have a residual effect on structures and sites, such as cairns, ceremonial sites, and campsites that are of historical, archaeological, paleontological, or architectural significance for the Siksika.

[2454] The residual effects can be characterized as follows:

- **Magnitude:** high. Siksika members view Grassy Mountain as an important ceremonial and spiritual complex which includes important historical resource sites. The Siksika view the project area as one of high religious and cultural significance.
- **Geographic extent:** local. Only resources within the LSA defined by Benga would be affected.
- **Duration:** medium for the sites that would not be destroyed because access to those sites would be restricted during construction and operations, but available post-closure; persistent for sites that are destroyed.
- **Frequency:** periodic. Removal of known historic sites would occur throughout construction and operation of the project. A number of potential unknown sites may be found intermittently over the assessment period.
- **Reversibility:** irreversible. Once removed, historical resources cannot be replaced.
- **Ecological or social context:** negative. Historical pressures have contributed to a declining ability for the Siksika to access their traditional lands for cultural purposes.

[2455] We find that the project would result in a residual adverse effect on sites that are of historical, archaeological, palaeontological, or archeological significance to the Siksika in the LSA. The effects would be significant and are likely to occur.

Health

[2456] The Siksika Nation said its members practised subsistence harvesting, including fishing and plant gathering, in the LSA and RSA. They said they fished in the Grassy Mountain area, including in Gold Creek and the waterways within and to the east (downstream) of the project. They were concerned that the effects would not be limited to the project area, noting that the potential for downstream water pollution is high given the project’s location at the headwaters of the Crowsnest River. They also raised concerns about potential contamination of the Gold and Blairmore Creeks as it would affect their traditional use.

[2457] A summary of Benga’s evidence on health conditions for Indigenous groups appears earlier in this chapter in the section on Benga’s approach and assessment. Benga noted that the project is located within the Siksika’s traditional territory, near areas currently used by Siksika members to harvest plants and wildlife for subsistence, medicinal, and ceremonial purposes.

Panel analysis and findings

[2458] The Siksika Nation provided clear evidence of their use of the LSA and RSA for plant gathering, and their use of the Crowsnest River watershed downstream of the project area for fishing. Our findings regarding health that are discussed earlier in this chapter in the section on Benga’s approach and assessment apply to the Siksika.

[2459] We find that the project is not expected to result in residual adverse health effects to the Siksika. However, even with implementation of Benga's proposed mitigation, the perception of an increased health risk resulting from potential contamination, including selenium contamination in the downstream watershed, could cause the Siksika to avoid harvesting areas. We address these effects in our assessment of current use of lands and resources.

Socioeconomic conditions

[2460] A summary of Benga's evidence on socioeconomics for Indigenous groups appears earlier in this chapter in the section on Benga's approach and assessment and was applied to our assessment for the Siksika. Benga noted that the Siksika demonstrated a strong interest in being involved in economic opportunities throughout the life of the project. Benga reported that, in 2011, the unemployment rate for Siksika members was 17.9 per cent, while the employment rate was 39.1 per cent. Benga also identified several Siksika-owned businesses, including building and construction, recreation, and hospitality services, all located outside the LSA. Benga concluded that the project and associated project activities were not expected to have an adverse effect on the Siksika's socioeconomic conditions, commercial activity, forestry and logging operations, and recreational use.

Panel analysis and findings

[2461] Our findings and discussion in the socioeconomic conditions portion of the section on Benga's approach and assessment in this chapter apply to the Siksika.

[2462] We acknowledge Benga's commitment to provide Indigenous employment and procurement opportunities. We agree with Benga that the socioeconomic effects of the project would differ among Indigenous groups, as different factors determine how each community would be affected by the project. The effects would also vary for different groups and individuals within a community.

[2463] Siksika submitted a letter of no concern, saying their project-specific concerns had been addressed. We understand that Benga entered into an agreement with the Siksika and recognize that this cooperative relationship may provide a mechanism to address issues of importance to the Siksika. We expect the Siksika's involvement in proposed monitoring and in the implementation of their agreement would, at least partially, mitigate potential adverse socioeconomic impacts.

[2464] In consideration of the arrangements Benga has in place with Indigenous groups, as well as Benga's stated objective to achieve a net positive effect for Indigenous communities, we expect the overall positive economic impact of the project would extend to the Siksika. However, Benga provided limited group-specific socioeconomic information, and the Siksika provided limited information about the potential socioeconomic effects of the project, either positive or negative, on their community. As we do not have enough specific evidence from either Benga, or the Siksika, we are unable to complete an assessment of the effects of the project on the socioeconomic conditions for the Siksika.

[2465] Table 22-5 summarizes our assessment of the residual effects on the Siksika Nation.

Table 22-5. Summary of panel analysis of residual effects on the Siksika Nation

CEAA 2012 section 5 effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Ecological or social context
Current use of lands and resources for traditional purposes	Moderate	Local, regional for sensory effects.	Long	Periodic	Reversible in the long term, however effects to trails and travelways are irreversible	Negative
Physical and cultural heritage	High	Local, regional for sensory effects	persistent	Continuous	Irreversible	Negative
Structure, site or thing	High	Local	Medium/persistent	Periodic	Irreversible	Negative
Health conditions	Residual effects are not expected					
Socioeconomic conditions	Unable to complete assessment					

Cumulative effects

[2466] The Siksika submitted a cumulative effects assessment report, presenting an initial assessment of cumulative effects of land development on ecological indicators of cultural importance to the Siksika Nation in Alberta. The study was conducted at two scales: an RSA centered near the Siksika reserve that included a broader region identified by community members as being historically important for traditional land use; and a focal study area, which involved a focused analysis of effects in an area around the project. The report noted that 18 per cent of the land cover in the focal study area already had an anthropogenic footprint, placing mule deer, elk, and fish at moderate risk. The report also noted that accessibility of the land for traditional activities was of concern, with an estimated 40 per cent inaccessible. Combined, these factors resulted in an assessment of high risk to traditional land use. Following a 50-year simulation of future landscape changes, the report projected relatively minor growth in the focal study area, with mining, primarily from development of the Grassy Mountain mine, the greatest contributor.

[2467] The report suggested that Siksika members have already experienced a substantial decline in hunting and fishing opportunities in areas close to their reserve, with these traditional land use activities displaced to more remote areas. In the Siksika's view, the project would continue to diminish their traditional culture by irreversibly destroying their spiritual and ceremonial use of sites on Grassy Mountain and their connection to regional features, including Crownsnest Mountain.

[2468] The Siksika are of the view that it is incorrect to interpret their limited use of Grassy Mountain over the last century as a lack of interest, desire, or right to continue their traditions and to access their sites located on the project lands. They stated that all sites in the spiritual complex were in continuous, regular use by Siksika members for at least 8000 to 9500 years, until about the beginning of the 20th century. At that point, they were recovering from outbreaks of disease such as smallpox introduced by non-natives. Concurrently, non-native settlers began to claim Siksika lands and restrict access to Grassy Mountain sites, practices that continue to this day.

[2469] The Siksika stated that most of the Treaty 7 area has already been taken-up. Fences surrounding oil and gas and cattle leases on Crown land have greatly restricted their members' access to traditional lands to hunt, gather, and to use for ceremonial purposes. If current trends in industrial development in

Alberta continue, at some point the Siksika would have no practical traditional use rights or sites remaining in their territory. They view this as the possible extinguishment of their Blackfoot culture.

[2470] Benga said that the Siksika were concerned about the continuing loss of cultural and spiritual values, not only as expressed through hunting, trapping, fishing, and plant gathering, but also through changes to the landscape and sacred and ceremonial sites. Benga noted the Siksika's view that the spiritual integrity of the landscape would be forever changed regardless of Benga's reclamation efforts.

Panel analysis and findings

[2471] We accept the Siksika's position that the project would continue to diminish their traditional culture through cumulative effects on traditional use, and would irreversibly destroy spiritual and ceremonial use sites. We find the existing effect is already significant. We find that there is a cumulative effect on current use of lands and resources and physical and cultural heritage for the Siksika. These cumulative effects occur primarily as a result of past projects and activities within their traditional territories.

[2472] The cumulative effects can be characterized as follows:

- **Magnitude:** moderate to high. When taking the historical context into account, there have been considerable effects on the Siksika's ability to use their traditional territory and maintain their cultural heritage, an ability that requires a close connection with regional landscape features, including Crowsnest Mountain. The project would further exacerbate those effects.
- **Geographic extent:** regional. There has been widespread privatization and development of lands within Siksika's traditional territory.
- **Duration:** persistent. The effects could last indefinitely, continuing to affect the Siksika's relationship with their traditional territory and their ability to pass on cultural traditions could be affected.
- **Frequency:** continuous, when considering the effects of the project in combination with all activities, past and present.
- **Reversibility:** irreversible. The effects would contribute to existing pressures and not diminish over time.
- **Ecological or social context:** negative. Historical pressures have already contributed to the deterioration of the Siksika's traditional territory.

[2473] We find that the project, in combination with other projects and activities that have been or would be carried out, is likely to contribute to existing significant adverse cumulative effects to Siksika's current use of lands and resources for traditional purposes and physical and cultural heritage. These cumulative effects occur primarily as a result of past projects and activities within the Siksika's traditional territories.

Rights

[2474] The Siksika explained that, prior to signing Treaty 7 and before the creation of Canada and Alberta, their ancestors had Aboriginal title and rights over and throughout their traditional territory. Those Aboriginal rights remain unextinguished and persist to the present day. In 1877, the Siksika entered into Treaty 7, which confirmed their right to hunt, fish, and gather on their traditional territory. The Siksika

described this territory as extending north of the North Saskatchewan River, east of the Rocky Mountains, west of the Cypress Hills, and south to the Yellowstone River in the northern United States.

[2475] The Siksika stated that, according to the Supreme Court of Canada, if taking up of land for development leaves the Siksika with no meaningful right to hunt and fish in their traditional territory, a potential action for treaty infringement would arise. The Siksika stated that industrial development must be compatible with, and accommodate, traditional-use rights and ceremonial, spiritual, hunting, and burial sites. The Siksika noted that wildlife, fish, and vegetation are parts of the ecosystem that forms the basis of the Siksika's way of life, which was guaranteed by Treaty 7 and protected by section 35 of the *Constitution Act*. The Siksika said that adverse impacts on ecosystems that support this way of life amount to a prima facie infringement of their constitutionally protected treaty rights.

[2476] The Siksika said that their members are not limited to practising their Aboriginal and Treaty 7 rights on their reserve, and that the *Constitution Act, 1930* expanded the hunting rights of Aboriginal peoples subject to Treaty 7, including the Siksika, beyond the geographical limits of Treaty 7. They may, and do, hunt, trap, fish, and gather over any unoccupied Crown lands in the province. Accordingly, the location of the Siksika's reserve lands does not diminish the negative impacts of the project on the Siksika's Aboriginal and treaty rights.

[2477] In January 2016, the Siksika stated that the project represented an unreasonable infringement on the ability of their members to enjoy and exercise their Aboriginal and Treaty 7 rights. The Siksika stated that they enjoy constitutionally protected Aboriginal and Treaty 7 rights within, and directly adjacent to, the project area. This includes the right to hunt, fish, gather, and trap, and the right to transmit traditional knowledge to subsequent generations. The rights of Siksika members over their traditional territory constitutes a *sui generis* interest in the lands which can only be infringed upon in accordance with the principles established by the courts. The Siksika noted that their traditional land use reports and member affidavits clearly demonstrate a degree of location or connection between the project's activities and Siksika Aboriginal rights and treaty rights. The Siksika noted that the project would occupy 1582 hectares of land, much of which is currently, and would otherwise be, used by Siksika members to exercise Aboriginal and treaty rights.

[2478] However, Benga and the Siksika have since negotiated and signed an agreement. The Siksika notified the ACO and us on March 23, 2020, that Benga has adequately addressed their project-related concerns. Benga provided a summary of information from the Siksika about their asserted or established rights in the project and regional area. Benga stated that they did not receive any information from the Siksika about their views on the effectiveness of Benga's mitigation or accommodation measures.

[2479] The Treaty 7 section provides information on the Agency's preliminary assessment of the project's potential impacts on rights, including those of the Siksika Nation. A separate section is devoted to the ACO's conclusions on the adequacy of consultation.

Panel analysis and findings

[2480] We used our assessment on the effects of the project on *CEAA 2012* section 5 factors for the Siksika, in combination with historical and contemporary cumulative effects, to determine the extent to which the Siksika's exercise of rights have been impacted, and any further potential impacts on rights

due to the project. We considered the Agency's preliminary assessment of potential impacts on asserted or established Aboriginal or treaty rights and the ACO reports dated October 23, 2020, and December 3, 2020.

[2481] We accept that the Siksika assert Aboriginal rights in the project area, and that they have treaty rights under Treaty 7. We also accept that the project is in the heart of an area used intensively by Siksika members for hunting, fishing, gathering, and other traditional purposes, and the project is in an area of high cultural significance to the Siksika. We accept their concern that much of the land in the Treaty 7 area has already been developed, restricting their members' access to hunt, gather, and use the lands for ceremonial purposes.

[2482] The Siksika have signed an agreement with Benga, and have submitted a letter of no concern, indicating that their project-specific concerns have been addressed. We respect the Siksika's ability to determine for themselves the degree to which the project would impact their ability to practise their rights.

[2483] The potential impacts on Aboriginal and treaty rights of the Siksika Nation can be characterized as follows:

- **Cultural well-being:** moderate to high. An impact on areas and practices of considerable cultural importance is likely. Access to areas required to practise cultural activities would likely be disrupted or limited. The disturbance may be of a physical or sensory nature (e.g., noise, dust, and visual quality) or may affect customs and/or spiritual and cultural practices that require an interconnected landscape. These impacts would be in addition to those existing on the landscape.
- **Geographic extent:** moderate. The impacts could occur over a moderate spatial extent relating to the exercise of rights. Impacts may occur within some areas of preferred use.
- **Duration, frequency, reversibility:** high. The impacts are likely to persist over multiple generations. The impacts would occur constantly during and beyond the life of the project and may not be reversible. The intergenerational transfer of knowledge would be interrupted for an extended time period and may not be reversed either in whole or part.
- **Health:** moderate. Physical, mental, emotional, and/or spiritual aspects of health may be affected because of the Siksika's use of project lands and waters, as well as the downstream watershed. The environmental effects from the project are tied to food that is culturally important. The exercise of rights may be altered due to quantifiable and/or perceived effects from the project.
- **Cumulative impact:** moderate. The project may interact with one of only a few preferred areas where rights can still be practised. The project may cause environmental effects on culturally important species or sites. There are other land uses, including proposed or existing projects, in the community's territory that impact the practice of rights. The project may cause environmental effects on culturally important species.
- **Impact on governance:** low. The agreement between Benga and the Siksika indicates a high level of cooperation between the two parties. We find no evidence to suggest that the project would have an impact on areas that support the governance of the land.

- **Impact inequity:** unknown. Insufficient information is available to determine whether subgroups of Siksika members would be disproportionately affected by the project.

[2484] Taking into consideration the evidence presented above, we find that if the project were to proceed, it would have a moderate impact to Siksika Nation’s Aboriginal and/or treaty rights that would have a high likelihood of occurring.

Stoney Nakoda Nations

[2485] The Stoney Nakoda Nations described their members as the original “people of the mountains” or *Iyarhe Nakoda*. The project is located within the traditional territories asserted by the Stoney Nakoda. They included a map of their traditional territory, which covers land as far north as Jasper, Alberta, and south into the state of Montana, and includes the project area. Historically, the Stoney Nakoda inhabited regions across Alberta, British Columbia, Saskatchewan, and Montana. They maintained a semi-nomadic lifestyle, travelling throughout their traditional territory to harvest various resources, until the arrival of European settlers shifted their traditional use and customs. The increasing settler presence and resulting loss of bison on the plains led their members to rely increasingly on resources in the eastern Rocky Mountains, and forced a shift in harvesting to other large game, such as deer and elk.

[2486] The Stoney Nakoda are part of the Great Sioux Nation. Their members are descendants of Sioux who speak the Dakota Siouan language. The Stoney Nakoda comprise the Bearspaw First Nation, Chiniki First Nation, and Wesley First Nation, with their population located largely in three communities: Eden Valley Indian Reserve, Bighorn Indian Reserve, and Morley Indian Reserve, with a total registered population of approximately 5440. The Stoney Nakoda stated that the residents of Eden Valley Indian Reserve 216 would be the most adversely affected of their members due to their proximity to the project.

[2487] The Stoney Nakoda advised us on March 11, 2019, that they had entered into an agreement with Benga, and provided a letter stating that they did not object to the project as Benga had adequately addressed their project-specific concerns. At the public hearing, Mr. B. Snow, on behalf of the Stoney Nakoda, reiterated this conditional support of the project and outlined the conditions. Mr. Snow said that the Stoney Nakoda were of the view that Benga’s consultation with the nation should be deemed adequate. Following their presentation at the public hearing, the Stoney Nakoda submitted a letter to us advising that they did not object to the project and were not asking us to implement the conditions described. The information used in our analysis below was submitted prior to the Stoney Nakoda signing an agreement with Benga and submitting their letter of no concern.

Current use of lands and resources for traditional purposes

[2488] Benga acknowledged that the project site was within the Stoney Nakoda traditional territory, but stated that the project footprint would cover less than 0.01 per cent of traditional Stoney Nakoda territory. Benga noted that the project would intersect or be in proximity to habitat and species identified for hunting and plant gathering by the Stoney Nakoda, but also noted that specific harvesting sites within the LSA had not been identified. Benga committed to continue to work with the Stoney Nakoda on any additional mitigation measures.

Hunting and trapping

[2489] The Stoney Nakoda Nations said their members hunt deer, elk, and other animals but did not identify any specific hunting sites in the LSA. They identified the potential loss of important deer, elk and moose habitat in the eastern foothills as a concern. They also raised a concern that the project could interrupt and alter migratory and travel routes for various species of the area. Their members continue to trap within their registered fur-management areas but none of the trapping areas registered to the Stoney Nakoda are within the LSA. Benga stated that the Stoney Nakoda consultation team did not identify an interest in trapping in the project area.

[2490] Benga acknowledged that the Stoney Nakoda continue to hunt throughout their traditional territory for species found in the project area, but noted that no specific hunting sites were identified. Benga stated that project activities would intersect or be in proximity to habitat for species of interest to the Stoney Nakoda. Species identified for hunting by the Stoney Nakoda include deer, elk, black bear, coyote, lynx, squirrel, beaver, mink, marten, and moose. However, Benga did not expect the project to have a measurable effect on these species. Benga noted that, with the implementation of their access management plan, the project was not expected to alter access.

[2491] Benga acknowledged that effects on wildlife could affect the cultural and spiritual relationship between the Stoney Nakoda and wildlife. It characterized the project's potential to affect the ability of the Stoney Nakoda to hunt as moderate in magnitude. Benga characterized the ecological and social context as sensitive because hunting is sensitive to disruption and important to the cultural and spiritual relationship between the Stoney Nakoda and wildlife. Benga stated that, as the Stoney Nakoda had not identified an interest in trapping in the project area, it did not anticipate that the project would have adverse effects on trapping activities for the Stoney Nakoda. Benga noted that should the Stoney Nakoda trap in the area, the proposed mitigation measures would be applicable.

Fishing

[2492] Benga described the Stoney Nakoda Nations as being unique in valuing fish for subsistence. Fishing was described as linked to other intangible values, and involves the intergenerational sharing of knowledge about ceremonies, legends, and the use of fish and medicine and food. Benga noted that the Stoney Nakoda had a fishing interest in the project area.

[2493] The Stoney Nakoda raised a concern about the potential loss of important whitefish and trout habitat in a number of rivers and tributaries, including the Livingstone River and its tributaries and the Oldman River. Benga clarified that the Livingstone watershed was north (upstream) of the project and would not be affected by the project. Benga stated the project would have no effect on fish populations downstream in the Oldman River. Benga supported a cultural assessment overview in Blairmore and Gold Creeks and indicated there were no whitefish identified during population inventories.

[2494] Benga stated that, although there would be no direct effects on Blairmore and Gold Creeks, access to them could be affected because current access to some portions of watercourses was through Benga's private lands. Once the project was underway, members would have to use other trails to access the creeks.

[2495] Benga stated that the project could result in changes in fish habitat, use of access to fishing locations, and preferred fishing methods. Benga acknowledged Stoney Nakoda members might want to avoid fishing in locations within sight and sound of the project. Benga predicted a residual effect on fishing of moderate magnitude because of changes in the ability to fish in the project area. Benga characterized the ecological and social context as resilient because the Stoney Nakoda engage in fishing primarily outside of the project LSA in the Crowsnest River and Oldman River watersheds.

Plant gathering

[2496] The Stoney Nakoda said that the mountains have always had important plants and plants of interest. They emphasized the importance of many of the alpine plants on Grassy Mountain to ceremonial and healing practices and their spirituality. Although they provided details on plant and wildlife species of interest, they did not reference any specific harvesting activities practised in the project area. They did not provide details of how the project area was used, but did provide information on the possibility of trails according to geomorphology, elevation, and landscape features.

[2497] The Stoney Nakoda were concerned that the project could adversely affect their harvesting of herbs, plants, and berries for nutritional and medicinal purposes, and use of rocks and lumber for tools, campfire rings, and sweat lodges. They also identified lodgepole pine and spruce as species used for poles, and balsamroot, sweet pine, grasses, and ferns as important plants or plants of interest to them.

[2498] Benga stated that the project would intersect or be in proximity to habitat and species identified for plant gathering by the Stoney Nakoda. The project would remove traditional use plants within the LSA, but beyond that the plant habitats would remain intact. According to information Benga received, the Stoney Nakoda do not currently harvest plants from the LSA, despite the presence of identified species of interest.

[2499] Benga predicted the residual effect on plant gathering would be moderate in magnitude because there would be a change in the ability of Stoney Nakoda members to gather plants in the project area. The ecological and social context was characterized as sensitive because engagement in plant gathering is sensitive to disruption.

Trails and travelways

[2500] Benga noted that it was possible that the project could intersect or be in proximity to an area identified for trails and travelways by the Stoney Nakoda. However, none were identified. Benga predicted the residual effect on trails and travelways would be moderate in magnitude because of changes in the ability of the Stoney Nakoda to access trails and travelways. The Stoney Nakoda did not disclose to Benga in detail how the project area was used, but acknowledged that the project could intersect or be in proximity to areas that might be identified as trails and travelways. The ecological and social context was characterized as resilient because the Stoney Nakoda did not identify trails and travelways in the project area, and there could be alternative routes to travel between cultural and spiritual sites and resources within their traditional territory.

Monitoring and mitigation

[2501] At the public hearing, the Stoney Nakoda outlined a number of measures they wanted to see implemented if the project proceeded, although they later stated that they were not asking us to implement the conditions. The Stoney Nakoda requested an Indigenous environmental monitoring program be required as part of the project, and said they would work collaboratively with Benga and other Indigenous groups to develop the program. They said the monitoring program should be developed and implemented for the construction, operation, and reclamation phases of the project, and the program should show how Indigenous traditional knowledge was taken into consideration. They said that an Indigenous monitor from each of their three communities (Bears paw, Chiniki, and Wesley First Nations) should be included in the monitoring program. They acknowledged Benga's willingness to include their community in Indigenous monitoring.

[2502] The Stoney Nakoda also requested that we consider a condition that required the development and incorporation of comprehensive wildlife and fishery protection plans. While the Stoney Nakoda did not provide any specific evidence that they hunt or trap in the LSA, they did raise general concerns about the project effects on wildlife in the region. They did not provide specific harvest locations, but said that they harvest in their traditional territory, which includes the project area.

[2503] Benga recognized the Stoney Nakoda's interest in fishing in Gold and Blairmore Creeks, but said there is no evidence to suggest Stoney Nakoda fish in the project area at present. The Stoney Nakoda specifically raised a concern about potential effects on the Livingstone and Oldman watersheds, and fishing in the Crowsnest River. We agree with Benga's characterization that no pathway of effects exist between the project and the Livingstone watershed.

Panel analysis and findings

[2504] We agree with the Government of Canada that the presence of contaminants may decrease the Indigenous peoples' confidence in the quality of water in the project area, and the downstream watershed. This may affect fishing, other traditional use activities, and the intergenerational transfer of knowledge.

[2505] The Stoney Nakoda identified a number of vegetation species of importance, including lodgepole pine. They have not specifically said they harvest on Grassy Mountain at this time. While the project would result in the loss of plant species important to Indigenous peoples within the project footprint, we find that Benga's proposed measures to restore the traditional plant potential of the project area are reasonable. We agree that most traditional plant species would remain available in the LSA.

[2506] No evidence was provided to suggest a history of use within the local study area, so we do not anticipate that the physical footprint of the project would directly affect the Stoney Nakoda through direct biophysical effects on species or access restrictions. The project would potentially result in sensory disturbances for the Stoney Nakoda while hunting and gathering from locations in the RSA. Benga acknowledged that the project would be visible from various elevations and that sound from the project could travel long distances, affecting the experience of current use for Stoney Nakoda members in proximity to sensory effects.

[2507] The Stoney Nakoda submitted a letter of no concern, indicating that their project-specific concerns have been addressed. They also reached a confidential agreement with Benga. We respect

Stoney Nakoda's ability to work directly with Benga on how they would address potential effects of the project on their traditional activities. We find that, even with implementation of Benga's proposed mitigation and the existence of an agreement between Benga and the Stoney Nakoda, the project would have a residual effect on the Stoney Nakoda's current use of lands and resources for traditional purposes. This is consistent with Benga's conclusions.

[2508] The residual effects can be characterized as follows:

- **Magnitude:** low. The evidence suggests few effects on harvesting areas, or areas of cultural importance to Stoney Nakoda.
- **Geographic extent:** local. Most project effects would be limited to the LSA. However, some sensory effects (e.g., noise, dust, and visual quality) would likely extend beyond the LSA to the RSA.
- **Duration:** medium. The sensory effects would last for the life of the project, but end with the operational phase.
- **Frequency:** occasional. When the Stoney Nakoda are practising activities either close enough or at a high enough elevation to see or hear the project.
- **Reversibility:** reversible. The sensory effects would diminish upon cessation of activities.
- **Ecological and social setting:** neutral to negative. The Stoney Nakoda are likely subject to historical pressures but have not provided sufficient evidence to demonstrate a declining ability to use their traditional territory.

[2509] We find that the project would result in residual adverse effects on the Stoney Nakoda's current use of lands and resources for traditional purposes in the LSA and RSA. The effects would not be significant.

Physical and cultural heritage

[2510] The Stoney Nakoda Nations identified the importance of spirituality to their way of life. For the Stoney Nakoda, honouring, respecting, and understanding their spirituality lies at the core of their appreciation of traditional knowledge and land uses. The Stoney Nakoda hunt, fish, and gather plants for food and sustenance, and important cultural and spiritual considerations are associated with those activities. They said those practices are typically linked to other intangible values with spiritual, artistic, and aesthetic elements. Intergenerational knowledge about ceremonies, traditions, and customs are shared while conducting those activities. In addition, hunting, fishing, and gathering plants teaches members about the value of harvested species as medicine, food, tools, clothing, and shelter.

[2511] The Stoney Nakoda provided a map of their traditional territory, including cultural resource areas. None of these cultural resource areas were close to the project. The Stoney Nakoda noted that their people recognize certain areas on Grassy Mountain as meditation sites. They said many of the plants in the alpine at Grassy Mountain are central to Stoney Nakoda ceremonies, healing practices, sweat lodges, preparation for vision quests, and spirituality. They did not say that they currently harvest in the project area.

[2512] The Stoney Nakoda said that their traditional environmental knowledge was culturally sensitive and should not be made public, and their traditional use sites should remain undisturbed. They requested Benga prove that it had obtained all required archaeological and heritage resource permits, and demonstrate how it would meet any conditions.

[2513] The Stoney Nakoda asked that Benga be required to give them a plan to undertake ongoing traditional land-use investigations. They said they had not completed a traditional land use study for the project, but that Benga was supporting the development of a study. The Stoney Nakoda noted the need for a cultural assessment overview of the project area and undertook field work for a study. No report was submitted to us, but the ACO's report noted that the concern had been addressed.

[2514] Benga stated that the project could intersect or be close to areas of cultural and spiritual importance to the Stoney Nakoda, and that the spiritual integrity of the landscape would be forever changed despite reclamation efforts. The visual and sensory experience of visiting those locations could change as a result of the project.

[2515] Benga predicted that residual effects on physical and cultural heritage and cultural and spiritual values would be moderate in magnitude. There would be a change in access to, and the value of, physical and cultural heritage, and a change in the experience associated with cultural or spiritual sites for the Stoney Nakoda. Benga characterized the geographic extent as local, the duration as long-term, and the frequency as regular and continuous. The effect would be irreversible as the loss of heritage sites and features and experience in engaging in land use could result in loss of the knowledge of cultural heritage. The ecological and social context was characterized as sensitive, as the loss of engagement with physical and cultural heritage affects cultural identity, human wellbeing and relationships, and the intergenerational transfer of knowledge. Benga concluded that the residual effect on physical and cultural heritage and cultural and spiritual values for Stoney Nakoda was not significant.

Panel analysis and findings

[2516] We accept that there are important cultural and spiritual aspects of the Stoney Nakoda's way of life and use of their traditional territory. The Stoney Nakoda stated that there were areas on Grassy Mountain that are recognized meditation sites. They identified plants on the mountain that are central to Stoney Nakoda's spirituality, but did not provide evidence to suggest those alpine plants were harvested in the project area. No historical resources or cultural resource areas were identified in the LSA specifically by the Stoney Nakoda. We recognize that Benga and Stoney Nakoda have entered into an agreement and this cooperative relationship may provide a mechanism to address issues of importance to Stoney Nakoda.

[2517] We find that even with implementation of Benga's proposed mitigation measures, the project would have an adverse residual effect on Stoney Nakoda's physical and cultural heritage, including direct effects on potential archaeological or cultural sites, and indirect effects related to the use of and cultural connection to their traditional territory.

[2518] The residual effects can be characterized as follows:

- **Magnitude:** low. Minimal effects are expected to areas of cultural importance to Stoney Nakoda.
- **Geographic extent:** local. Most project effects would be limited to the LSA. However, some sensory effects (e.g., noise, dust, and visual quality) would likely extend beyond the LSA into the RSA.
- **Duration:** medium. The sensory effects would last the life of the project, but end with the operational phase.
- **Frequency:** occasional. When the Stoney Nakoda are practising cultural activities that are close enough or at a high enough elevation to see or hear the project.
- **Reversibility:** reversible. The sensory effects would diminish upon cessation of activities.
- **Ecological and social setting:** neutral to negative. The Stoney Nakoda are likely subject to historical pressures but have not provided sufficient evidence to demonstrate a declining ability to access their traditional territory for cultural purposes.

[2519] We find that the project would result in a residual adverse effects on the Stoney Nakoda Nations' physical and cultural heritage in the LSA and RSA. The effects would not be significant.

[2520] None of the cultural resource areas identified were close to the project, and Stoney Nakoda provided limited information on the areas on Grassy Mountain that were recognized by their members as meditation sites. Given this limited information, we cannot determine the significance on the effects of the project on any structure, site or thing that is of historical, archaeological, paleontological, or architectural significance to the Stoney Nakoda.

Health

[2521] The Stoney Nakoda Nations have been sustained by the waters flowing through their traditional lands since time immemorial. They are concerned about poor water quality resulting from accidental spills. Stoney Nakoda said that they fished downstream in the Oldman River, but no evidence was given to suggest use within the LSA.

[2522] A summary of Benga's evidence on health conditions for Indigenous groups is provided in the Health conditions section of Benga's approach and assessment in this chapter. Benga noted that the project is within the Stoney Nakoda's traditional territory and in proximity to areas currently used by their members to harvest plants and wildlife for subsistence, medicinal, and ceremonial purposes.

Panel analysis and findings

[2523] The Stoney Nakoda Nations did not provide evidence of their use of the LSA for harvesting. While they said they fished for subsistence downstream of the project in the Oldman River, it was not clear whether this included fishing in the Oldman Reservoir or only at the outlet of the reservoir to the Oldman River, farther downstream. As such, we are uncertain whether our findings related to selenium as discussed in the Health portion of the section of this chapter on Benga's approach and assessment apply to the Stoney Nakoda. Other findings in the Health portion of that section apply generally to the Stoney Nakoda as a community characterized in the health risk assessment.

[2524] We find that the project is not expected to result in residual adverse health effects on the Stoney Nakoda. However, even with implementation of Benga's proposed mitigation, the perception of an increased health risk resulting from potential contamination, including selenium contamination in the downstream watershed, could cause the Stoney Nakoda to avoid harvesting areas. We address these effects in our assessment of current use of lands and resources.

Socioeconomic conditions

[2525] The Stoney Nakoda Nations raised unemployment in Eden Valley as a major concern, and noted that it would be valuable if Benga offered advanced or on-the-job training for their members in Eden Valley. The Stoney Nakoda asked Benga to implement a long-term Indigenous training and education plan, to be developed in cooperation with the Stoney Nakoda and other affected Indigenous groups.

[2526] The Stoney Nakoda emphasized that they wanted the project to protect the environment while providing maximum economic and social benefits to them. They asked that Indigenous monitors be employed to observe both socioeconomic and environmental indicators, and that the system for evaluating monitors be developed collaboratively with the Stoney Nakoda and other affected Indigenous groups.

[2527] The Stoney Nakoda requested that Benga develop an Indigenous business capacity inventory to analyze the ability and capacity of Indigenous businesses to work on project construction and operations. They requested a minimum of 15 per cent of all contracting work be awarded directly to Indigenous businesses. They identified the 15 per cent Indigenous employment figure as adequate to ensure affected First Nations can reasonably contribute and participate in natural resource projects.

[2528] A summary of Benga's evidence on socioeconomic conditions for Indigenous groups is in the Socioeconomic conditions portion of the section on Benga's approach and assessment in this chapter and has been applied to our assessment for the Stoney Nakoda.

[2529] Benga identified tourism, hospitality, and commercial and industrial development as economic development opportunities for the Stoney Nakoda. Benga also stated that natural resource exploration was a key source of revenue and a main employer for Stoney Nakoda members. Benga reported the unemployment rate for Stoney Reserves 142, 143, and 144 as 37.9 percent, and the unemployment rate for Eden Valley as 37.5 percent at the time of its assessment.

[2530] Benga stated that it did not expect the project to have any direct or adverse effects on the Stoney Nakoda's socioeconomic conditions, but did predict a low-magnitude residual effect on traditional land use and culture from a socioeconomic perspective. Benga would not commit to a specific Indigenous employment target, but stated that it would continue conversations on employment opportunities through channels established in its agreement with the Stoney Nakoda.

Panel analysis and findings

[2531] Our findings and discussion in the Socioeconomic conditions portion of the section on Benga's approach and assessment in this chapter apply to the Stoney Nakoda.

[2532] We acknowledge Benga’s commitment to provide Indigenous employment and procurement opportunities. We agree with Benga that the socioeconomic effects of the project would differ among Indigenous groups as different factors that would affect how each community would be impacted by the project. The effects would also vary for different groups and individuals within a community.

[2533] Stoney Nakoda submitted a letter of no concern, stating that their project-specific concerns have been addressed. We also understand that Benga has entered into an agreement with the Stoney Nakoda and recognize that this cooperative relationship could provide a mechanism to address issues of importance to the Stoney Nakoda, who stated that they were in favour of the potential socioeconomic benefits the project could provide. We expect the Stoney Nakoda’s involvement in proposed monitoring and in the implementation of their agreement would, at least partially, mitigate potential adverse socioeconomic impacts.

[2534] In consideration of the arrangements Benga has in place with Indigenous groups, as well as Benga’s stated objective to achieve a net positive effect for Indigenous communities, we expect the overall positive economic impact of the project would extend to the Stoney Nakoda. However, both Benga and the Stoney Nakoda provided limited group-specific information about the potential socioeconomic effects of the project on the Stoney Nakoda. Therefore, we are unable to complete an assessment of the effects of the project on the socioeconomic conditions for Stoney Nakoda.

[2535] Table 22-6 provides a summary of our assessment of the residual effects of the project on the Stoney Nakoda Nations.

Table 22-6. Summary of panel analysis of residual effects on the Stoney Nakoda Nations

CEAA 2012 section 5 effects	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Ecological or social context
Current use of lands and resources for traditional purposes	Low	Local, regional for sensory effects	Medium	Occasional	Reversible and diminish upon cessation of activities	Neutral to negative
Physical and cultural heritage	Low	Local, regional for sensory effects	Medium	Occasional	Reversible and diminish upon cessation of activities	Neutral to negative
Structure, site, or thing	None identified					
Health conditions	Residual effects are not expected					
Socioeconomic conditions	Unable to complete assessment					

Cumulative effects

[2536] The Stoney Nakoda Nations did not describe how the project would contribute to cumulative effects within their traditional territory. They provided information to emphasize their connection to their traditional territory, but the project footprint is a small portion of that territory.

Panel analysis and findings

We accept that historical pressures have affected the Stoney Nakoda’s relationship with their traditional territory. We expect that these effects would be exacerbated by the project, but we cannot characterize them or determine their significance based on the evidence.

Rights

[2537] The Stoney Nakoda Nations stated that they have Aboriginal and Treaty 7 rights that are protected under section 35 of the *Constitution Act, 1982*. The Stoney Nakoda stated that they exercise their rights throughout their traditional lands. The Stoney Nakoda said that when they signed Treaty 7, they did not surrender their Aboriginal title to the water in their traditional territory, nor any other interests associated with Aboriginal rights, which they continue to hold. In signing Treaty 7, they understood that they would be free to continue to make use of as much of the waters as they had in the past and that those waters would be left to their use. As such, they continue to pursue their water rights in court. They stated that the governments of Canada and Alberta had duties to consult and accommodate them on the project.

[2538] The Stoney Nakoda said they expect the Alberta and Canadian governments to “replace lands that are taken up for this particular project with new lands that are suitable to the Stoney Nakoda to practice our Aboriginal and treaty rights or, failing that, otherwise compensate Stoney — Stoney Nakoda” (CIAR 740, PDF p. 60). The Stoney Nakoda are claiming Aboriginal title in the Court of Queen’s Bench of Alberta, Action No. 0301-19586, on the grounds that the project would be located in part of their traditional territory identified in the title claim. They argue they have not received full compensation for the use of coal within their reserve lands or traditional lands, and compensation for the use of such minerals is the subject of that title claim.

[2539] The Stoney Nakoda stated that their support of development of the project should not be interpreted “in a manner that extinguishes, abrogates, or diminishes the Stoney Nakoda Nations’ Aboriginal or Treaty rights” (CIAR 207, PDF p. 2). Prior to submission of their letter of no concern, the Stoney Nakoda stated that they believed the project would have impacts on their traditional rights because the project is located in their traditional territory, specifically the territory identified in their title claim.

[2540] Benga acknowledged that the Stoney Nakoda consider the mountains a place of importance where they could practise their Aboriginal rights. Benga presented a summary of information provided by the Stoney Nakoda about their asserted or established rights in the project and regional area. Benga said that it did not receive any information from the Stoney Nakoda on the potential adverse impacts of the project on the Stoney Nakoda’s ability to practise their rights. Benga considered its agreement with the Stoney Nakoda a mitigation measure for addressing potential impacts to rights.

[2541] In its preliminary assessment on impacts to rights, the Agency determined that the Treaty 7 communities, including the Stoney Nakoda Nations, were expected to experience the most potential adverse impacts of all Indigenous groups. The Agency noted that the project and adjacent areas represented a “deeply important” cultural landscape for the Stoney Nakoda. The Agency reiterated that the submissions from the Stoney Nakoda noted how they continue to hunt and gather within their traditional territory for subsistence and for ceremonial, spiritual, medicinal, and cloth-making purposes. The Agency also identified that plants were of importance in the project area, and that spirituality was central to the Stoney Nakoda way of life.

[2542] The Treaty 7 section provides information on the Agency’s preliminary assessment of the project’s potential impacts on rights, including those of the Stoney Nakoda Nations. A separate section is devoted to the ACO’s conclusions on the adequacy of consultation.

Panel analysis and findings

[2543] Our assessment includes the effects of the project on *CEAA 2012* section 5 factors for the Stoney Nakoda, in combination with historical and contemporary cumulative effects, to understand the extent to which Stoney Nakoda's exercise of rights has already been impacted, and the further potential impact on rights from the project. We considered the Agency's preliminary assessment of potential impacts on asserted or established Aboriginal or treaty rights. We find we do not have the evidence to support the Agency's statement that "the project and adjacent areas represented a deeply important cultural landscape" as it applies to the Stoney Nakoda. We also considered the ACO reports dated October 23, 2020, and December 3, 2020.

[2544] We acknowledge that the Stoney Nakoda assert Aboriginal rights in the project area, and that they have treaty rights under Treaty 7. We accept that the project is within Stoney Nakoda traditional territory. We recognize the Stoney Nakoda's agreement with Benga, and their letter of no concern, stating that their project-specific concerns have been addressed. We respect the Stoney Nakoda's ability to determine for themselves the degree to which the project would impact their ability to practise their rights.

[2545] The potential impacts on Aboriginal and treaty rights of the Stoney Nakoda Nations can be characterized as follows:

- **Cultural well-being:** low to moderate. Little evidence was presented that there would be an impact on areas of cultural importance and the project is not likely to impede access to practise cultural activities. The Stoney Nakoda have concerns about impacts from the project on the downstream watershed used to practise rights.
- **Geographic extent:** low. No impact is expected within an area of preferred or exclusive use.
- **Duration, frequency, and reversibility:** moderate. The impact is likely to last up to one generation. The impact would occur at sporadic, intermittent intervals throughout the operation of the project. Transfer of knowledge between generations may be interrupted for a moderate period of time by the project, although practices may be resumed broadly within one generation.
- **Health:** low to moderate. An impact on physical, mental, emotional, or spiritual aspects of health is possible because of the Stoney Nakoda's use of the downstream watershed. The environmental effects from the project are tied to food that is culturally important. The exercise of rights will be altered by quantifiable or perceived effects from the project.
- **Cumulative impact:** moderate. Other land uses, including proposed or existing projects, in the community's territory may impact the practice of rights.
- **Impact on governance:** low. The agreement between Benga and the Stoney Nakoda indicates a high level of cooperation between the two parties. We find no evidence to suggest that the project would affect areas that support the governance of the land.
- **Impact inequity:** uncertain. Insufficient information is available to determine whether subgroups of Stoney Nakoda members would be disproportionately affected by the project.

[2546] Taking into consideration the evidence presented above, we find that if the project were to proceed, it would have a low to moderate impact on the Stoney Nakoda Nations' Aboriginal and/or treaty rights that have a moderate likelihood of occurring.

Tsuut'ina Nation

[2547] Members of Tsuut'ina Nation were previously known as Sarcee, a name derived from the Blackfoot word "Sussewa," which means "Bold People." Tsuut'ina stated that they are traditional allies of the Blackfoot Confederacy. Tsuut'ina traditional territory in Alberta runs from northern Alberta to the US border in the south, and from west of the Rocky Mountains east to the Cypress Hills. (CIAR 67, PDF p. 1)

[2548] Tsuut'ina stated that they base their governance and legislation on the teachings of "Wusa," which means "the future," and that anything done today must benefit the future of those born and those yet to be born. This generational responsibility is a guiding principle applied to every aspect of Tsuut'ina's governance.

[2549] On December 4, 2019, Tsuut'ina provided a letter of no concern. They said they did not object to the project on the basis that Benga had adequately addressed their project-specific concerns. Following that letter, Tsuut'ina did not provide any further information to us and did not participate in the public hearing. The information used in our analysis was submitted prior to Tsuut'ina signing an agreement with Benga and submitting their letter of no concern.

Current use of lands and resources for traditional purposes

[2550] Tsuut'ina stated that their connection to their homeland through stories, myths, and the continued use of, and reverence for, sacred elements in the landscape such as Crowsnest Mountain, is paramount to their cultural identity and survival. They stated they were doing their best to retain and pass on their knowledge of their homeland and to protect those areas that contain the resources that are important to them.

[2551] Tsuut'ina said that when development of Grassy Mountain began over a century ago, they sought out other areas for hunting and harvesting that were less disturbed. During their visit to the project site, the main focus of discussions was on the importance and uses of alpine plants, wildlife, and birds on Grassy Mountain. They covered a range of plants, including berries, sweet pine, lodgepole pine, juniper, bear root, muskeg tea, lichen, fungus, tree moss, willow, and poplar. Several types of wildlife and birds are culturally, spiritually, and nutritionally important to them, including moose, elk, deer, buffalo, grizzly bears, sheep, wolves, cougar, lynx, rabbit, squirrels, and other small rodents. Each of these species has a story and deep connections to other species. Water quality and overall fish health were also identified as important. Tsuut'ina identified eagles as particularly sacred.

Hunting and trapping

[2552] Tsuut'ina stated that the Crowsnest Pass provided them with a range of important resources. Their members both visited and lived in the Crowsnest Pass and exploited the resources it offered. In addition, there were well-established trading routes that Tsuut'ina used throughout the Crowsnest Pass, such as those used to trade with the Shuswap Indian Band. They said that, traditionally, large game animals and widely used plant resources were exploited in the area in all seasons. They acknowledged

that traditional hunting practices have changed, but stated that modern hunting of game animals is still important and the harvesting of plants for medicinal and ceremonial uses remains a priority.

[2553] Benga predicted a moderate residual effect on hunting for Tsuut'ina because of a reduction in hunting opportunities, engagement in hunting, and hunting success during construction and operation due to loss of access to hunting locations, sensory disturbance, and change in wildlife use within the mine permit area. Benga noted that Tsuut'ina do not hunt as extensively as they once did, but they still hunt in the Crowsnest Pass area. Benga characterized the ecological and social context as resilient because Tsuut'ina hunt in the Crowsnest Pass area, which is outside the LSA, and Tsuut'ina did not identify any hunting areas in the project area.

[2554] Benga predicted no residual effect on trapping for Tsuut'ina as they have no traplines in the LSA, and they did not provide information on current trapping practices.

Fishing

[2555] Tsuut'ina raised technical concerns about potential effects on fish and fish habitat, including effects on groundwater and surface water quality that would affect fish, and effects on fish from blasting. Tsuut'ina observed three different kinds of trout in Blairmore Creek during ground-truthing, but Benga reported that there was little fish-related discussion. Tsuut'ina said that this is not an indication that water and fish are not of concern; they identified fishing outside the project area at Bow River, Bragg Creek, and Fish Creek during the summer, but did not express an interest in fishing in the Crowsnest Pass or project area.

[2556] Benga predicted residual effects on fishing for Tsuut'ina because of a reduction in fishing opportunities, engagement in fishing, and fishing success during construction and operation due to a loss of access to fishing locations and sensory disturbance within the mine permit area. Benga characterized the magnitude as low because Tsuut'ina had not identified an interest in fishing in the project area. Benga characterized the ecological and social context as resilient because Tsuut'ina identified fishing outside the project area but did not express an interest in fishing in the Crowsnest Pass or project area.

Plant gathering

[2557] Tsuut'ina stated that multiple alpine plants found at Grassy Mountain crucial to their ceremony, healing practices, cultural identity, and spirituality are not found at lower elevations near their communities. They noted that the medicinal power of a plant can be derived from the root, flowers, leaves, and bark; roots can be eaten raw or pounded into a poultice; and leaves can be boiled and eaten or dried and made into tea. Although Tsuut'ina provided details about alpine plant species, they did not reference any specific harvesting activities practised in the project area for these species. Tsuut'ina had technical concerns about the potential effects from closure and reclamation, including the viability of vegetation, wildlife habitat, and wildlife success.

[2558] Benga predicted a residual effect moderate in magnitude on plant gathering for Tsuut'ina because of a reduction in harvesting opportunities, plant gathering, and harvesting success during construction and operations. This is due to loss of access to plant-gathering locations and sensory disturbance within the mine permit area. The ecological and social context was characterized as sensitive because Indigenous engagement in plant gathering is sensitive to disruption. As well, the loss of the use of plant gathering

locations or access to these locations—or a change in gathering methods—could affect the cultural and spiritual relationship between Tsuut’ina and their territory.

Trails and travelways

[2559] Tsuut’ina described how hunting trails tied strongly to wildlife trails and other key habitat types continue to exist today and are used throughout the Grassy Mountain area. Tsuut’ina oral history describes where they travelled, including in vicinity of the project. Travel and access to the Crowsnest Pass by Tsuut’ina members has diminished since contact with Euro-Canadian settlers. No site-specific details were provided.

[2560] Benga predicted a moderate magnitude residual effect on trails and travelways for Tsuut’ina due to restricted use or access, and engagement with features associated with trails and travelways during construction and operation. This is due to loss of access to trails and travelways locations, sensory disturbance, and change in use within the mine permit area. The ecological and social context was characterized as resilient because Tsuut’ina identified trails and travelways outside of the LSA. Benga noted that Tsuut’ina could use alternative routes between cultural and spiritual sites and resources within their traditional territory.

[2561] Tsuut’ina did not provide specific evidence that they hunt, trap, fish, gather plants, or use trails in the LSA. They did not provide evidence to show they fish in the project area, or the Crowsnest Pass upstream or downstream of the project. Their members do fish at Bow River, Bragg Creek, and Fish Creek, while areas east of the project are not connected to the Oldman watershed. Tsuut’ina raised a general concern about project effects on wildlife, plants, and waterways in the region.

Panel analysis and findings

[2562] We agree with the Government of Canada that the presence of contaminants may decrease Indigenous peoples’ confidence in their ability to use and rely on water in the project area and downstream watershed. This may affect fishing, other traditional use activities, and the intergenerational transfer of knowledge. We acknowledge Tsuut’ina stated that the Crowsnest Pass provided a range of important resources and that their members visited and lived in the Crowsnest Pass and exploited the resources it offered. We recognize that Tsuut’ina said that, when development of Grassy Mountain began over a century ago, they sought out other areas for hunting and harvesting that were less disturbed.

[2563] The project would potentially result in sensory disturbances for the Tsuut’ina while hunting and gathering in the RSA. Benga acknowledged that the project would be visible from various elevations and that sound from the project could travel long distances and affect the experience of current use.

[2564] Tsuut’ina submitted a letter of no concern, indicating that their project-specific concerns have been addressed. There is also a confidential agreement between Benga and the Tsuut’ina. We respect Tsuut’ina’s ability to work directly with Benga to address potential effects of the project on traditional activities. We find that, even with implementation of Benga’s proposed mitigation and the existence of an agreement between Benga and Tsuut’ina, the project would have a residual effect on Tsuut’ina’s current use of lands and resources for traditional purposes. This is consistent with Benga’s conclusions.

[2565] The residual effects can be characterized as follows:

- **Magnitude:** low. The evidence suggests few effects on harvesting areas or areas of cultural importance to Tsuut'ina.
- **Geographic extent:** local. Most project effects would be limited to the LSA. However, some sensory effects (e.g., noise, dust, and visual quality) would likely extend beyond the LSA into the RSA.
- **Duration:** medium. The sensory effects would last the life of the project, but end with the operation phase.
- **Frequency:** occasional. When the Tsuut'ina are practising activities either close enough to the project, or at a high enough elevation to see or hear the project.
- **Reversibility:** reversible. The sensory effects would diminish upon cessation of activities.
- **Ecological and social setting:** neutral to negative. Tsuut'ina are likely subject to historical pressures but have not provided sufficient evidence to demonstrate a declining ability to use their traditional territory.

[2566] We find that the project would result in residual adverse effects on Tsuut'ina's current use of lands and resources for traditional purposes in the LSA and RSA. The effects would not be significant.

Physical and cultural heritage

[2567] Tsuut'ina have stated that the Crowsnest Pass and surrounding area are important to their religion and spirituality. During the Tsuut'ina ground-truthing trip in July 2015, they stated that “[i]t appears that there are few remnants of Tsuut'ina presence in the area previously disturbed by historic mining, and significant impacts to the environment, water quality, landscape, and spirit” (CIAR 42, Appendix 7, PDF p. 289). In a later submission, in May 2019, Tsuut'ina stated that there are sacred sites in the area, ceremonial sites, rock paintings, burial sites, and natural materials to make ceremonial paint and items. The specific locations of these sites were not disclosed, and no further information was provided by Tsuut'ina, Benga, or the ACO.

[2568] Tsuut'ina stated that Benga had taken a “bones and stones” approach to assessing the impact on culture (CIAR 220, PDF p. 20). They were concerned that Benga had not considered the impact on intangible culture, such as the inability to transmit knowledge and stories on the land. Tsuut'ina have many oral stories that depict their history and where they travelled, and they said their ability to pass on these stories by taking the next generation out on the land would be affected by the project.

[2569] Tsuut'ina emphasized the intangible aspects of culture, including the experience related to physical and cultural heritage, and the importance of an interconnected landscape. They said that physical and cultural heritage is not only associated with an individual physical site, but also with the experience lived by Indigenous groups, and the importance of the landscape as a whole. The geophysical and landscape elements of the Crowsnest Pass and surrounding area also play important parts in their religion and spirituality. Tsuut'ina stated it is not sufficient to mention how many sacred sites would be disturbed by the project. Instead, a description and analysis of the importance of the connections to the landscape

and the experience embodied in physical and cultural heritage are necessary. Tsuut'ina described their spiritual footprint as “absolute” and always there.

[2570] Tsuut'ina stated that they view water as a source that sustains life and they consider it medicine. There is concern that water used for the project would become contaminated, which would affect the environment and Tsuut'ina cultural, spiritual, and harvesting activities. They said that Benga did not recognize the importance of the waterbodies in the LSA and RSA, nor that damage to water quality represented an impact on cultural heritage.

[2571] Benga stated that Tsuut'ina have a strong spiritual and cultural connection with the land in and around the project area. Benga noted that the Tsuut'ina consider many traditional practices conducted in and around the project site as holding cultural and spiritual value. Benga stated that Tsuut'ina said that the project area has been one of the most preferred sites for Tsuut'ina elders to conduct spiritual ceremonies. Hunting has important cultural and spiritual values, and intergenerational knowledge is shared while hunting. Plant-gathering activities are likewise linked to intangible spiritual, artistic, and aesthetic elements. In addition to a direct change to cultural and spiritual values and associated features, Benga expected that the visual and sensory experience of visiting these locations would change.

[2572] Benga predicted residual effects of moderate magnitude on physical and cultural heritage and cultural and spiritual values for Tsuut'ina. Benga characterized the geographic extent as local, the duration as long-term, and the frequency as continuous for cultural and spiritual values and regular for physical and cultural heritage. Benga stated that the effect would be non-reversible because the loss of heritage, cultural, and spiritual sites and experience in engaging in land-use could affect knowledge. The ecological and social context was sensitive because loss of heritage-site engagement in land use affects cultural identity, human well-being and relationships, and intergenerational knowledge transfer.

Panel analysis and findings

[2573] We accept that Tsuut'ina physical and cultural heritage is not only associated with individual physical sites, but also with their life experiences. We understand that, for Tsuut'ina, the landscape as a whole has great importance. Tsuut'ina's evidence about whether cultural sites are present on Grassy Mountain is unclear. No historical or cultural resource areas were identified in the LSA by Tsuut'ina.

[2574] We understand that Benga and Tsuut'ina have entered into an agreement; this cooperative relationship may provide a mechanism for addressing issues of importance to Tsuut'ina. We find that, even with implementation of Benga's proposed mitigation, the project would have an adverse residual effect on Tsuut'ina physical and cultural heritage, including direct effects on potential archaeological or cultural sites, and indirect effects related to the use of and cultural connection to their traditional territory.

[2575] The residual effects can be characterized as follows:

- **Magnitude:** low. Minimal effects are expected to areas of cultural importance to Tsuut'ina.
- **Geographic extent:** local. Most project effects would be limited to the LSA. However, some sensory effects (e.g., noise, dust, and visual quality) would likely extend beyond the LSA into the RSA.
- **Duration:** medium. The sensory effects would last the life of the project, but end with the operation phase.

- **Frequency:** occasional. When the Tsuut'ina are practising activities either close enough to the project or at a high enough elevation to see or hear the project.
- **Reversibility:** reversible. The sensory effects would diminish upon cessation of activities.
- **Ecological and social setting:** neutral to negative. Tsuut'ina are likely subject to historical pressures but have not provided sufficient evidence to demonstrate a declining ability to access their traditional territory for cultural purposes.

[2576] We find that the project would result in residual adverse effects on Tsuut'ina Nation's physical and cultural heritage in the LSA and RSA. The effects would not be significant.

[2577] The Tsuut'ina and Benga provided limited information on the areas or sites on Grassy Mountain that were of cultural importance. As such, we cannot determine the significance on the effects of the project on any structure, site or thing that is of historical, archaeological, paleontological, or architectural significance to Tsuut'ina.

Health

[2578] Tsuut'ina raised concerns about potential project effects on human health and subsequent effects on their traditional land use, relating to coal dust and noise, and water pollution and contamination. Tsuut'ina said the impacts on health prevented them from exercising Aboriginal and treaty rights such as hunting and gathering.

[2579] Tsuut'ina said that an assessment should consider the health impacts, including psychological impacts, of not being able to exercise their treaty rights and accessing harvesting areas throughout their territory or being disturbed in the exercise of those rights from the sights, sounds, and air quality impacts of the mine. They said that there were health benefits from being outside, exercising, harvesting medicinal plants, and eating resources from the land.

[2580] Tsuut'ina recommended that Benga continue traditional knowledge work as part of healthy business relations and continue to respect their input. Tsuut'ina asked that Benga provide adequate funding for ongoing project involvement costs associated with Indigenous traditional environmental monitoring, harvesting vegetation through the project, and annual project review.

[2581] A summary of Benga's evidence on health for Indigenous groups appears in the Health portion of the section on Benga's approach and assessment in this chapter and applies to Tsuut'ina.

Panel analysis and findings

[2582] Tsuut'ina were concerned about the potential health effects of the project and how health should be considered in the assessment. We recognize that Tsuut'ina said that an assessment should consider the health impacts, including psychological impacts, of not being able to exercise Tsuut'ina treaty rights, including hunting, fishing, gathering, and accessing harvesting areas throughout their territory or being disturbed in the exercise of those rights from the sights, sounds, and air quality impacts of the mine.

[2583] Tsuut'ina did not provide any specific evidence that they hunt, trap, fish, gather plants, or use trails in the LSA or in the Crowsnest River downstream of the project. The areas where their members do fish at Bow River, Bragg Creek, and Fish Creek, while east of the project, are not connected to the

Oldman watershed. Our findings as discussed in the Health section of Benga's approach and assessment apply generally to Tsuut'ina as a community characterized in the health risk assessment.

[2584] We find that the project is not expected to result in residual adverse health effects on Tsuut'ina. However, even with implementation of Benga's proposed mitigation, the perception of an increased health risk resulting from potential contamination, including selenium contamination in the downstream watershed, could cause Tsuut'ina to avoid harvesting areas. We have addressed these effects in our assessment of current use of lands and resources.

Socioeconomic conditions

[2585] No specific information was provided by Tsuut'ina about socioeconomic conditions.

[2586] Benga reported that the 2011 unemployment rate for Tsuut'ina members was 8.8 per cent. Benga identified several Tsuut'ina businesses, including small businesses and recreational services. Benga noted that Tsuut'ina were interested in employment opportunities related to the project and Benga committed to provide employment opportunities for members. Benga stated that the project is not expected to have an adverse effect on Tsuut'ina commercial activity, forestry and logging operations, or recreational use.

[2587] Benga noted that Tsuut'ina Nation was farther away from the project and had other commercial projects underway closer to their community and therefore would be less likely to benefit from the project directly.

Panel analysis and findings

[2588] Our findings and discussion on socioeconomic conditions portion of the section on Benga's approach and assessment in this chapter apply to Tsuut'ina.

[2589] We acknowledge Benga's commitment to provide Indigenous employment and procurement opportunities. We agree with Benga that the socioeconomic effects of the project would differ among Indigenous groups as different factors determine how each community would be affected by the project. The effects would also vary for different groups and individuals within a community. As Tsuut'ina Nation is farther from the project, they are possibly less likely to benefit directly.

[2590] Tsuut'ina submitted a letter of no concern, stating that their project-specific concerns have been addressed. We understand that Benga entered into an agreement with Tsuut'ina and recognize that this cooperative relationship may provide a mechanism to address issues of importance to Tsuut'ina, who said they were in favour of the socioeconomic benefits the project could provide. We expect Tsuut'ina involvement in proposed monitoring and in the implementation of their agreement would, at least partially, mitigate potential adverse socioeconomic impacts.

[2591] In consideration of the arrangements Benga has in place with Indigenous groups, as well as Benga's stated objective to achieve a net positive effect for Indigenous communities, we expect the overall positive economic impact of the project would extend to Tsuut'ina. However, consistent with Benga's observation, we acknowledge that, because Tsuut'ina are farther away from the project, they are possibly less likely to benefit from the project directly. For similar reasons, they may also be less likely to experience negative socioeconomic effects.

[2592] However, Benga provided limited group-specific socioeconomic information, and Tsuut’ina provided limited information about the potential socioeconomic effects of the project, either positive or negative, on their community. As we do not have enough specific evidence from either Benga or Tsuut’ina, we are unable to complete an assessment of the effects of the project on the socioeconomic conditions for Tsuut’ina.

[2593] Table 22-7 provides a summary of our assessment of the residual effects of the project on the Tsuut’ina.

Table 22-7. Summary of panel analysis of residual effects on Tsuut’ina Nation

CEAA 2012 section 5 effects	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Ecological or social context
Current use of lands and resources for traditional purposes	Low	Local, regional for sensory effects	Medium	Occasional	Reversible and diminish upon cessation of activities	Neutral to negative
Physical and cultural heritage	Low	Local, regional for sensory effects	Medium	Occasional	Reversible and diminish upon cessation of activities	Neutral to negative
Structure, site or thing	None identified					
Health conditions	Residual effects are not expected					
Socioeconomic conditions	Unable to complete assessment					

Cumulative effects

[2594] Tsuut’ina did not provide specific information to describe how the project would contribute to cumulative effects within their traditional territory. They expressed concern that Benga’s cumulative effects assessment did not consider the impacts of the project on intangible culture, such as the ability to transmit knowledge to future generations. Tsuut’ina stated that these impacts should be considered significant because they are high in magnitude, long-term, continuous, irreversible, and sensitive. Once knowledge of a place is lost by one generation, it is difficult if not impossible to regain this knowledge in the future. Tsuut’ina provided information stating that landscape elements of the Crowsnest Pass and surrounding area play important parts in their religion and spirituality, and that they were concerned about the cumulative effects to their intergenerational transfer of knowledge.

Panel analysis and findings

[2595] We accept that additional historical pressures have affected Tsuut’ina relationships with their traditional territory over time. We expect that these effects would be exacerbated by the project, but we cannot characterize these effects or determine their significance based on the evidence.

Rights

[2596] Tsuut’ina said they have prima facie inherent Aboriginal rights and hold established Treaty 7 rights and interests, including governance and stewardship rights. Tsuut’ina stated that they have treaty and “Inherent” rights to hunt, fish, harvest, travel, and practise cultural and ceremonial activities throughout their Treaty 7 Territory.

[2597] Tsuut'ina viewed Benga's framing of ecological and social context as "resilience" of an Indigenous group as being synonymous with "asking the question whether an Aboriginal group can go elsewhere to exercise rights in other areas and/or to undertake specific harvesting activities there" (CIAR 192, PDF p. 41). They said that Benga had not carried out an assessment of the rest of Tsuut'ina's territory to determine whether Tsuut'ina would be able to exercise their rights in other areas or undertake specific harvesting activities they could undertake in the project area, such as the gathering of unique and localized plant species only found in specific locations.

[2598] Tsuut'ina stated that Benga approached the assessment as a function of the proportion of the project footprint to the entirety of Tsuut'ina territory. In their view, this wrongly assumed that the rest of the territory was available for harvesting specific species available in the project area, and failed to consider project effects outside the project footprint. Tsuut'ina stated that impacts to their rights could not be determined by using a formula of project footprint to size of their territory. In addition, Tsuut'ina noted that even if a group is resilient, that does not mean that the impact is not significant.

[2599] Although Tsuut'ina signed a letter of no concern, the letter also noted that support for the project in no way "extinguishes, abrogates, or diminishes [their] Aboriginal or Treaty rights, including Aboriginal title, which are protected under section 35 of the *Constitution Act*" (CIAR 299, PDF p. 1). Benga presented a summary of information provided by Tsuut'ina that showed the importance of the Crowsnest Pass as a place to exercise their rights. Benga noted that Tsuut'ina had raised multiple concerns about the potential adverse impacts of the project on their ability to practise their rights. Benga also stated that it did not receive any information with respect to determining thresholds for the severity of impacts on Tsuut'ina Aboriginal and treaty rights.

[2600] The Treaty 7 section provides information on the Agency's preliminary assessment of the project's potential impacts on rights, including those of Tsuut'ina Nation. A separate section is devoted to the ACO's conclusions on the adequacy of consultation.

Panel analysis and findings

[2601] Our assessment includes the effects of the project on *CEAA 2012* section 5 factors for Tsuut'ina Nation, in combination with historical and contemporary cumulative effects, to understand the extent to which Tsuut'ina's exercise of rights has already been impacted, and the further potential impact on rights from the project. We considered the Agency's preliminary assessment of potential impacts on asserted or established Aboriginal or treaty Rights and the ACO reports dated October 23, 2020, and December 3, 2020.

[2602] We accept that Tsuut'ina assert Aboriginal rights in the project area, and that they have treaty rights under Treaty 7. We accept that the project is within Tsuut'ina traditional territory. We acknowledge that the Tsuut'ina have signed an agreement with Benga, and submitted a letter of no concern, stating their project-specific concerns have been addressed. We respect Tsuut'ina's ability to determine for themselves the degree to which the project would impact their ability to practise their rights.

[2603] The potential impacts on Aboriginal and treaty rights of Tsuut'ina Nation can be characterized as follows:

- **Cultural well-being:** low to moderate. Some sensory effects on areas of cultural importance can be expected, but the project is not likely to impede access to practising cultural activities.
- **Geographic extent:** low. No impact is expected within the area of preferred or exclusive use.
- **Duration, frequency, and reversibility:** moderate. The impact is likely to last up to one generation. The impact would occur at sporadic, intermittent intervals throughout the operation of the project. Transfer of knowledge between generations may be interrupted for a moderate period of time but practices may be resumed broadly within one generation.
- **Health:** low. There may be an impact on physical, mental, emotional, and/or spiritual aspects of health. The exercise of rights may be altered due to perceived effects from the project.
- **Cumulative impact:** moderate. Other land uses, including proposed or existing projects, in the community's territory may impact the practising of rights.
- **Impact to governance:** low. The agreement between Benga and Tsuut'ina indicates a high level of cooperation between the two parties. We find no evidence to suggest that the project would have an impact on areas that support the governance of the land.
- **Impact inequity:** uncertain. Insufficient information is available to determine whether subgroups of Tsuut'ina members would be disproportionately affected by the project.

[2604] Taking into consideration the evidence presented above, we find that if the project were to proceed, it would have a low to moderate impact on Tsuut'ina Nation's Aboriginal and/or treaty rights that would have a moderate likelihood of occurring.

Métis Nation of Alberta – Region 3

[2605] The Métis community in Crowsnest Pass consists of members of the Métis Nation of Alberta – Region 3, as well as Pincher Creek Métis Local 1880. Métis peoples have worked and lived in the area since the late 1800s. The Métis Region 3 provided a statement of concern and comments on the EIA and associated addenda. On June 9, 2020, they sent a letter to us saying they had no outstanding concerns about the project. At the public hearing they were in full support of the project, stating that they would like to see it move forward. The information used in our analysis below was submitted prior to the Métis Region 3 saying they had no outstanding concerns about the project.

Current use of lands and resources for traditional purposes

[2606] The Métis Region 3 stated that the Aboriginal rights of the Métis community are linked directly to the health of the environment, as their members hunt wild game and fish and gather plants and berries for food and medicinal purposes. They said most of the areas of direct concern to them, such as Daisy Creek and Gold Creek, are to the north of and outside the project footprint. They identified access to Crown lands north of the project area as a major concern.

Hunting and trapping

[2607] Métis Region 3 members hunt in Daisy Creek, Gold Creek, and Blairmore Creek as well as an area north of the project footprint. They have hunted in the project area but did not identify specific hunting sites. Their members noted that the RSA provides habitat for deer, elk, bear, wild turkey, and

grouse, all species of cultural significance that are harvested for sustenance, pelts, and other uses. Their members identified elk calving grounds between Grassy Mountain and the Livingstone Range. Métis Region 3 members were concerned about impacts on wildlife and their hunting activities. Métis Region 3 did not identify trapping activities within the project study area, but it was described as habitat for fur-bearing species.

[2608] Benga noted that the Métis Region 3 raised concerns about restricted access to the project site, which would limit their ability to practise traditional land use. Benga also noted that the Métis Region 3 were of the view that this effect could be alleviated if they entered into an access agreement. Benga acknowledged that the project would be visible from various elevations and that sound from the project could travel long distances, affecting the experience of current use by Métis Region 3 members in proximity to sensory effects.

[2609] Benga predicted that there would be residual adverse effects on Métis Region 3 hunting and trapping activity, after the implementation of mitigation measures. Benga characterized the residual adverse effects as low because the project's effects on the habitat of hunted species, such as elk, could be mitigated through the project wildlife mitigation and monitoring plan. Benga also stated that any change in Métis Region 3's ability to trap would be limited to the project area and the Métis Region 3 did not identify any active trapping in the LSA. Benga characterized the ecological and social context as resilient because the Métis Region 3 did not identify hunting or trapping in the project area.

Fishing

[2610] Métis Region 3 members said they fished in Daisy, Gold, and Blairmore Creeks, as well as an area north of the project footprint. They provided a map showing that fishing occurs upstream of the project area. They were concerned about westslope cutthroat trout populations and the protection of their habitat, specifically in Blairmore and Gold Creeks, noting that Gold and Blairmore Creeks are both tributaries of the Crowsnest River and ultimately the Oldman River. Métis Region 3 members sought assurances that westslope cutthroat trout and its critical habitat would be protected, and that their members would be included in any protection measures and activities.

[2611] Benga noted that the Métis Region 3 have an interest in fishing in the project area and were concerned that restricted access around the project site would limit their ability to practice traditional land uses, including fishing. Benga also noted that the Métis Region 3 were of the view that this effect may be alleviated by an access agreement.

[2612] Benga predicted there would be residual adverse effects on the Métis Region 3's fishing activity, after the implementation of mitigation measures. Benga characterized the residual adverse effects as low in magnitude because any change in the Métis Region 3's ability to fish would be limited to the project area. Benga stated that the effects would be reversible because planned reclamation and offsetting would maintain the fish population and the access management plan would restore access to the area. Benga characterized the ecological and social context as resilient. Benga said the Métis Region 3 did not identify fishing sites in the project area for which access would be affected by the project. As a result, the Métis Region 3's engagement in fishing was considered not sensitive to disruption from the project.

Plant gathering

[2613] Métis Region 3 members gather medicinal and culturally significant plants throughout their traditional territory and travel long distances to harvest plants. Plants are gathered in a variety of environmental locations including old-growth forests, along watercourses and wetlands, and in clearings and meadows. Information about medicinal plants is passed down through families and generations and is considered proprietary by the community. They were concerned about impacts on medicinal and traditional use plants within the RSA.

[2614] Métis Region 3 members said they gathered plants in the project area but did not identify specific gathering sites within the project area. Their members said plant harvesting was carried out in Daisy Creek, as well as an area north of the project footprint. The Métis Region 3 made recommendations to Benga to protect plant species, and to this end indicated that Benga should undertake continued engagement with them. The recommendations include reduction of stripping when possible, the retention of plant roots for reclamation, limiting the use of chemical applications, allowing for the harvest of medicinal and culturally significant plants prior to construction, retaining riparian plant species when possible, and reclaiming the area utilizing native plants.

[2615] Benga noted that the Métis Region 3 identified an interest in gathering plants and berries for medicinal and consumption purposes in the project area, as there are ecosystems that support medicinal plants. But they did not identify active plant-gathering locations. Benga noted that the Métis Region 3 provided recommendations that would protect plant populations; these measures could minimize effects on plant gathering.

[2616] Benga predicted residual adverse effects on the Métis Region 3's plant-gathering activity, after the implementation of mitigation measures. Benga characterized the residual adverse effects as low in magnitude because the project was predicted to change the Métis Region 3's ability to gather plants in the project area, but it would not affect the gathering of plants in the RSA. Benga stated that the effects would be reversible because its planned reclamation activities would re-establish natural processes and ecosystems that support traditional use plants and access to plant-gathering locations would be re-established after mine closure. Benga characterized the ecological and social context as resilient because the Métis Region 3 did not identify sites used for plant gathering in the project area.

Trails and travelways

[2617] A map prepared with the help of Métis Region 3 elders showed that Métis Region 3 members travelled through the project area to access areas north of the project for traditional land uses. Métis Local 1880 members were historically permitted to use the trails and undeveloped roadways to access areas north of the project. However, Benga restricted access to the roads leading to areas such as Daisy Creek, resulting in a greatly extended travel time to reach areas for traditional use as members would be required to go around the project area.

[2618] Benga said it was aware of the areas accessed "through" the project footprint by Métis Region 3 members, including Daisy Creek, Gold Creek, Blairmore Creek and an area north of the project. Benga noted that the Métis Region 3 were of the view that this effect may be alleviated by an access agreement.

[2619] Benga predicted there would be residual adverse effects to the Métis Region 3's use of trails and travelways, after the implementation of mitigation measures. Benga characterized the residual adverse effects as low in magnitude because, although changes to trails and travelways in the project area were predicted, the Métis Region 3 had not identified any trails or travelways or features associated with navigation within the LSA. Benga characterized the ecological and social context as resilient because the Métis Region 3 had not identified any trails or travelways, features associated with navigation, or important cultural areas within the LSA, and their use of trails and travelways was considered not sensitive to disruption from the project.

Monitoring and mitigation

[2620] The Métis Region 3 made recommendations to Benga about the protection of wildlife, including implementing all its mitigation measures, adhering to species-specific time constraints, noise reduction, limited use of chemicals, complying with the regulatory requirements outlined by *SARA*, being aware of elk calving grounds between Grassy Mountain and the Livingstone range, ensuring elk have clear passage, and continued engagement with and use of traditional knowledge from the Métis Region 3.

[2621] The Métis Region 3 made recommendations to Benga about their spiritual and cultural values, adopting best practices in blasting operations and strategically planning blasting to minimize dust and odour effects on surrounding land, mitigating noise and dust created by the project, creating a community noise complaint process with a mandate to explore potential mitigation, and continued engagement with the Métis Region 3. The Métis Region 3 recommended establishing a joint noise advisory committee to develop appropriate mitigation and monitoring measures to verify and manage observed effects of project-related noise emissions on wildlife health and abundance.

Panel analysis and findings

[2622] While the Métis Region 3 did not identify hunting, trapping, plant gathering, or fishing sites in the project area, they did provide evidence showing that they use the RSA—primarily north and upstream of the project—for hunting and plant gathering. They also provided evidence they fish in Gold Creek and Blairmore Creek, upstream and outside of the project area. The Métis Region 3 did not identify the cultural importance of these areas.

[2623] We find that Métis Region 3 access to lands north of the project for harvesting would be affected. The trails used by members of the Métis Region 3 to travel through the project area to access areas north of the project for traditional land uses would no longer be accessible. This effect may be at least partially mitigated by Benga's commitment to work with Indigenous groups to improve the access management plan and grant access to non-operational areas of Benga land and crown land being used for the project.

[2624] We do not expect any effects on plants or animals harvested by Métis Region 3. However, based on our conclusions in the chapter on fish and fish habitat, we find that the populations of fish in Blairmore and Gold Creek upstream of the project may be affected. Our assessment of the effects on fish and aquatic habitat in Blairmore Creek can be found in the chapter on fish and aquatic habitat. We agree with the Government of Canada that the presence of contaminants may decrease Indigenous peoples' confidence in their ability to use and rely on waters in the project area and downstream watershed. This may affect fishing, other traditional use activities, and the intergenerational transfer of knowledge. This decreased confidence may also apply to interconnected fish populations in the upstream reaches of Blairmore and

Gold creeks. The project could result in sensory disturbances for the Métis Region 3 while hunting, fishing, and gathering in the RSA.

[2625] We note that Métis Region 3 said they were in full support of the project and had no outstanding concerns. The Métis Region 3 submitted a letter of support for the project, and have signed a confidential agreement with Benga. We respect Métis Region 3's ability to work directly with Benga to address potential effects of the project on their traditional activities. We find that even with implementation of Benga's proposed mitigation, the project would have a residual effect on the Métis Region 3's current use of lands and resources for traditional purposes. This is consistent with Benga's conclusions.

[2626] The residual effect can be characterized as follows:

- **Magnitude:** low to moderate. There is evidence to suggest the project would affect access to harvesting and cultural areas north of the project. Although the project would cause a change in access for harvesting, other access routes are available. Populations of fish upstream of the project in Blairmore and Gold Creeks may be affected.
- **Geographic extent:** local. Most project effects would be limited to the LSA. However, some sensory effects (e.g., noise, dust, and visual quality) would likely extend beyond the LSA into the RSA.
- **Duration:** long. The direct effects would last the life of the project.
- **Frequency:** occasional. When the Métis Region 3 members are practising activities either close enough to the project, or at a high enough elevation to see or hear the project. Access restrictions would be continuous during the project life.
- **Reversibility:** reversible. The sensory effects would diminish upon cessation of activities. The biophysical effects on species related to hunting and gathering are reversible and would diminish after a number of decades. Wildlife are expected to return to the project site following operations. We also expect that traditional plant species would be available post-closure, but we acknowledge that it could take a few generations for full reclamation and that reclamation is uncertain.
- **Ecological and social setting:** neutral to negative. The Métis Region 3 are likely subject to historical pressures but have not provided sufficient evidence to demonstrate a declining ability to use their traditional territory.

[2627] We find that the project would result in residual adverse effects on the Métis Region 3's current use of lands and resources for traditional purposes in the LSA and RSA. The effects would not be significant.

Physical and cultural heritage

[2628] The Métis Region 3 stated the project would affect their ability to access Crown lands on which their members currently practise cultural activities. Specific areas north of and surrounding the project, including Daisy, Gold, and Blairmore Creeks, hold cultural value to their members. Benga said that the Métis Region 3 were concerned that noise and visual disturbances would affect their cultural experience. Benga said the project would not overlap any sacred, gathering, habitation, or heritage sites identified by

the Métis Region 3. Benga was of the view that the project would not affect the physical or cultural heritage of the Métis Region 3.

[2629] Benga predicted that there would be low-magnitude residual adverse effects on Métis Region 3's spiritual and cultural values, after the implementation of mitigation measures. Benga stated that while the use of, access to, and experiences associated with sites of cultural and spiritual values in the project area may change, this will not affect the use and experience in the RSA. Benga characterized the ecological and social context as resilient because the Métis Region 3 did not identify cultural and spiritual values in the project area and their cultural and spiritual values were not considered sensitive to disruption from the project.

Panel analysis and findings

[2630] We accept that the Métis Region 3 have a cultural connection to the RSA, but we received limited information about how the project may affect the Métis Region 3 cultural and spiritual use of the project area. Our assessment of project effects on Métis Region 3 physical and cultural heritage is therefore limited. If the Métis Region 3 conduct cultural and spiritual activities in the vicinity of the project, we anticipate that their cultural connection to their traditional territory would be limited to those of a sensory nature. The effects would not be significant. Métis Region 3 provided no evidence to suggest there is any structure, site or thing that is of historical, archaeological, paleontological, or architectural significance to them that would be affected by the project.

Health

[2631] The Métis Region 3 raised concerns about air quality and noise, but no specific concerns related to human health. A summary of Benga's evidence on health for Indigenous groups is in the Health portion of the section on Benga's approach and assessment earlier in this chapter. Métis Region 3 said they harvested to the north of the project, but did not provide evidence to show they fished downstream of the project.

Panel analysis and findings

[2632] Our findings as discussed in the Health portion of the section on Benga's approach and assessment in this chapter apply generally to the Métis Region 3 as a community characterized in the health risk assessment.

[2633] We find that the project is not expected to result in residual adverse health effects on the Métis Region 3. However, even with implementation of Benga's proposed mitigation, the perception of an increased health risk resulting from potential contamination, including selenium contamination in the downstream watershed, could cause avoidance of harvesting areas. This avoidance may also extend to upstream reaches of Blairmore and Gold creek. We address these effects in our assessment of current use of lands and resources.

Socioeconomic conditions

[2634] The Métis Region 3 explained that their commercial and subsistence economies are based on the ability to hunt and trap. They expressed an interest in training, employment, and contracting opportunities to offset loss of use in the Crowsnest Pass area and said they would like to leverage tourism

opportunities with Benga and the Government of Alberta in the historic townsite of Lille, which is just east of the project.

[2635] Benga said there were no known businesses owned by Métis Region 3 members within the project area. Although the Métis Region 3 noted many Métis-owned businesses operate throughout the region. The Métis Region 3 provided a letter of support for the project as their hearing submission. They made a presentation at the public hearing stating that they were in full support of the project and were in negotiations with Benga to work through items of concern. Our findings and discussion on socioeconomics in the section on Benga’s approach and assessment earlier in this chapter apply to the Métis Region 3.

Panel analysis and findings

[2636] We acknowledge Benga’s commitment to provide Indigenous employment and procurement opportunities. We agree with Benga that the socioeconomic effects of the project would differ among Indigenous groups as different factors determine how each community would be affected by the project. The effects would also vary among different groups and individuals within a community. We understand the Métis Region 3 is in full support of the project and are engaged directly with Benga. We recognize that this cooperative relationship may provide a mechanism to address issues of importance to the Métis Region 3.

[2637] In consideration of the arrangements Benga has in place with Indigenous groups, as well as Benga’s stated objective to achieve a net positive effect for Indigenous communities, we expect the overall positive economic impact of the project would extend to the Métis Region 3. However, Benga provided little group-specific socioeconomic information, and the Métis Region 3 provided limited information about the potential socioeconomic effects of the project, either positive or negative, on their community. As we do not have enough specific evidence from either Benga or Métis Region 3, we are unable to complete an assessment of the effects of the project on the socioeconomic conditions for the Métis Region 3.

[2638] Table 22-8 provides a summary of our assessment of the residual effects of the project on the Métis Region 3.

Table 22-8. Summary of panel analysis of residual effects on the Métis Nation of Alberta – Region 3

CEAA 2012 section 5 effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Ecological or social context
Current use of lands and resources for traditional purposes	Low to moderate	Local, regional for sensory effects	Long, continuous for access restrictions	Occasional	Reversible and diminish upon cessation of activities	Neutral to negative
Physical and cultural heritage	Unable to complete assessment					
Structure, site or thing	None identified					
Health conditions	Residual effects are not expected					
Socioeconomic conditions	Unable to complete assessment					

Cumulative effects

[2639] The Métis Region 3 did not provide specific information to describe how the project would contribute to cumulative effects within their traditional territory.

Panel analysis and findings

[2640] We accept that additional historical pressures have affected the Métis Region 3's relationship with their traditional territory over time. We expect that these effects would be exacerbated by the project, but we cannot characterize these effects, or determine their significance based on the evidence.

Rights

[2641] Métis have worked and lived in the Crowsnest Pass area since at least the late 1800s. The membership of Pincher Creek Métis Local 1880 considers this area their traditional lands, as they have hunted, fished, and gathered in it for 150 years. The Métis Region 3 believe that the project has the potential to directly and adversely impact the rights of the Métis community living in and around the communities of Pincher Creek, Blairmore, and Coleman and who are members of the Métis Region 3, specifically Pincher Creek Métis Local 1880. The Métis Region 3 noted that the Aboriginal rights of the Métis are directly linked to the health of the environment, as they hunt wild game and fish, and gather plants and berries for food and medicinal purposes. As Aboriginal rights are directly connected to the natural environment, these issues have the potential to impact the rights of the Métis community, rights that are upheld by section 35 of the *Constitution Act, 1982*.

[2642] On June 9, 2020, the Métis Region 3 provided a letter to us stating the project “may have negative or adverse impacts on the Aboriginal rights, claims, and interests, or the historical and contemporary practices related thereto, of the Métis Nation within Alberta and its citizens” (CIAR 358, PDF p. 1). They went on to explain that, after communicating those concerns with Benga, their concerns have been mitigated or accommodated.

[2643] Benga provided a summary of information provided by Métis Region 3 about their asserted or established rights in the project area. Benga stated that they did not receive any information about the adverse impacts of the project on Métis Region 3's Aboriginal rights with respect to experience, culture, governance, or intergenerational transmission of knowledge. Benga also stated that they did not receive any information about determining thresholds for the severity of impacts on the Métis Region 3's Aboriginal or treaty rights.

Panel analysis and findings

[2644] Our assessment includes the effects of the project on *CEAA 2012* section 5 factors for Métis Region 3, in combination with historic and contemporary cumulative effects, to understand the extent to which Métis Region 3's exercise of rights has already been impacted, and the further potential impact on rights from the project. We accept that the Métis Region 3 assert Aboriginal rights in the project area.

[2645] The potential impacts on Aboriginal rights of the Métis Region 3 can be characterized as follows:

- **Cultural well-being:** low. The area to the north of the project is an area of cultural importance, and the project may limit access to their practice of cultural activities on Crown Lands. However, the Métis Region 3 are supportive of the project and have stated access issues can be alleviated through the access management plan.

- **Geographic extent:** low to moderate. No impact is expected within areas of preferred or exclusive use. However, the project is close to where Métis Region 3 members currently practice cultural activities.
- **Duration, frequency, and reversibility:** moderate. The impact is likely to last up to one generation. The impact would occur at sporadic, intermittent intervals throughout the operation of the project. Transfer of knowledge between generations may be interrupted for a moderate period by the project, although practices may resume broadly within one generation.
- **Health:** low. There may be an impact on physical, mental, emotional and/or spiritual aspects of health. The exercise of rights may be altered due to perceived effects from the project.
- **Cumulative impacts:** unknown. The Métis Region 3 provided little information to support an assessment of cumulative impacts.
- **Impact to governance:** low. The Métis Region 3 are supportive of the project and there is cooperation between Benga and the Métis Region 3.
- **Impact inequity:** uncertain. Insufficient information is available to determine whether subgroups of Métis Region 3 members would be disproportionately affected by the project.

[2646] Taking into consideration the evidence presented above, we find that if the project were to proceed, it would have a low impact on Métis Nation of Alberta – Region 3’s Aboriginal rights that would have a moderate likelihood of occurring.

Ktunaxa Nation

[2647] The Ktunaxa Nation comprises four communities: the *ʔakisq̓nuk* (Columbia Lake Band), *ʔaq̓am* (St. Mary’s Band), *yaqan nuʔkiy* (Lower Kootenay Band), and *akink’umlasnuqliʔit* (Tobacco Plains Band), as well as Ktunaxa citizens who reside outside those communities. The Ktunaxa Nation Council is the nation-level governance body of the Ktunaxa people. As of August 2015, the total registered population of the Ktunaxa was 1090, with 471 living on-reserve.

[2648] The Ktunaxa refer to their traditional territory as *ʔamakʔis Ktunaxa*. They traditionally occupied a territory extending west to the Arrow Lakes, north to Yellowhead Mountain, east to the foothills of western Alberta, and south into what are now the states of Montana, Idaho, and Washington. The project is located in a part of *ʔamakʔis Ktunaxa* known as *qukin ʔamakʔis* (Raven’s Land), which includes *Kuʔwiaʔki* (Crow’snest Lake, in the Crow’snest Pass) and other areas east of the pass. The Ktunaxa use a cultural concept of *ʔa-kxamʔis qapi q̓apsin* (all living things) to guide their assessment of activities in *ʔamakʔis Ktunaxa*.

[2649] The Ktunaxa provided comments on the EIA and addenda, as well as a study on their rights and interests in relation to the project. The Ktunaxa participated in the public hearing and provided a hearing submission and final argument.

[2650] As described in the section on Treaty 7, the Agency, on behalf of the Government of Canada, provided information on the five Treaty 7 First Nations and the Ktunaxa Nation Council. They noted a historical relationship between the Treaty 7 Nations and the Ktunaxa Nation Council. The Treaty 7

section provides information on the Agency's preliminary assessment of the project's potential impacts on rights, including those of the Ktunaxa Nation. We consider this information, as it pertains to the Ktunaxa, in our analysis below.

Current use of lands and resources for traditional purposes

[2651] Ktunaxa Nation citizens regularly used and occupied the Crowsnest Pass and surrounding areas in both pre- and post-contact times for travel to seasonal bison hunts in the eastern foothills of the Rockies, hunting (sheep, deer, elk, goat), fishing (cutthroat trout and other species), harvesting minerals (coal and stones) and plants, and to gather resources for cultural purposes. The eastern foothills of the Rocky Mountains are valued by Ktunaxa citizens for clean freshwater sources, and wildlife habitat for culturally important species that are critical to Ktunaxa harvesting and stewardship, such as bison, grizzly bears, mountain goat, sheep, elk, moose, and wolverines.

[2652] The Ktunaxa said that their citizens continue to exercise harvesting rights in the Crowsnest Pass and surrounding areas and that it was reasonable to expect that their citizens would increasingly occupy and use the area again. They believe that access to plants and fish, as well as other resources, would return and be a critical component of Ktunaxa use of lands and resources in the area into the future. The Ktunaxa noted that these activities were consistent with the definition of current use as defined by the Agency.

Hunting and trapping

[2653] The Ktunaxa Nation stated that areas west of the project contain important hunting areas for harvesting moose and white-tailed deer. They are of the view that additional studies and fieldwork would likely confirm that similar uses extend east into the project area, but they had limited capacity to carry out the studies.

[2654] The Ktunaxa said the project footprint and the surrounding area are known habitats for important traditional food plants and animals. The project area and Crowsnest Pass contain a multitude of ecological values tied to cultural use and stewardship of the landscape by Ktunaxa, including rutting areas for bighorn sheep and areas for hunting moose and elk. Other values are related to other plant and animal species of critical importance, including grizzly bears, mountain goats, and bison. The Ktunaxa were concerned the project's footprint and associated disturbance corridors would damage habitat for species they rely on for the exercise of spiritual, cultural, and harvesting practices, and reduce their access to the area for harvesting. The Ktunaxa's relationship with grizzly bears in mountains is particularly fundamental to Ktunaxa stewardship.

[2655] The Ktunaxa were concerned that the project would further reduce the habitat available to support the potential future reintroduction of bison, a species the Ktunaxa are working to restore to its historical range in *qukin ʔamakʔis*. Ktunaxa citizens consider the project area as a place where their ancestors once harvested abundant bison as a staple food until its extirpation in the late 19th century. The Ktunaxa consider plains bison critically important, both culturally and ecologically, to the past and future practice of Ktunaxa rights in the project area and the eastern slopes of the Rockies. The Ktunaxa believe that it is reasonably foreseeable that Ktunaxa harvesting of bison, and related cultural practices (e.g., transmission of knowledge, use of hunting camps) in the project area would resume once conditions change as planned under the Buffalo Treaty.

[2656] Benga noted that the Ktunaxa continue to hunt throughout their traditional territory, although no specific hunting sites in the LSA were identified. Benga noted that the Ktunaxa were concerned about grizzly bear and bison, and the project's impact on the success of bison restoration in particular. Benga predicted that there would be residual adverse effects on the Ktunaxa's hunting activity, after the implementation of mitigation measures. Benga characterized the residual adverse effects as moderate in magnitude because any changes would be limited to the project area.

[2657] Benga noted that, although the Ktunaxa had not identified site-specific hunting areas within the project area, hunting remained important to the Ktunaxa for subsistence, as well as guide-outfitting activities. The geographic extent was rated as local, the duration as long-term, and the frequency as continuous. Benga stated that the effects would be reversible because reclamation would re-establish natural processes and ecosystems that support hunted species and the access management plan would restore access to the area. Benga characterized the ecological and social context as sensitive because the project was in an area that Ktunaxa citizens valued as habitat for culturally important species that were critical to their harvesting practices and stewardship.

[2658] The Ktunaxa noted that their current use of the project area for trapping had been impeded since coal mining began in the 1900s. Benga stated that the Ktunaxa did not identify any traplines or specific trapping sites in the LSA. Benga predicted that there would be a low-magnitude residual adverse effect on the Ktunaxa's trapping activity, because any change in the Ktunaxa's ability to trap would be limited to the project area and the Ktunaxa did not identify any active trapping in the area. Benga characterized the ecological and social context as sensitive because the Ktunaxa noted that the project area and Crowsnest Pass contain ecological values tied to their harvesting practices, including trapping, and that their use of the area has been impeded.

Fishing

[2659] The Ktunaxa Nation stated that areas west (upstream) of the project contain important fishing areas for cutthroat and rainbow trout. The Ktunaxa are of the view that additional studies would likely confirm that similar uses extend east into the project area, but they had limited capacity to carry out the studies. The Ktunaxa were concerned about effects of the project on healthy waterways and fish, fish health, and fish habitat. The Ktunaxa also were concerned about the potential effects of blasting on fish and other wildlife. The Ktunaxa recommended that employees and contractors be prohibited from angling in Gold and Blairmore Creeks.

[2660] Benga stated that the Ktunaxa did not identify fishing as a site-specific current use in the project area, but stated that the project was located within an area valued by the Ktunaxa for clean freshwater sources and key fishing sites. Fishing areas for cutthroat and Rainbow trout are used by the Ktunaxa to the west of the project area. Benga predicted that there would be residual adverse effects on the Ktunaxa's fishing activity, after the implementation of mitigation measures. Benga characterized the residual adverse effects as low in magnitude and the ecological and social context as resilient because the Ktunaxa do not currently fish in the project area. Benga was of the view that the Ktunaxa's ability to fish was not sensitive to disruption from the project.

Plant gathering

[2661] The Ktunaxa Nation noted that the project footprint and the surrounding area provide habitat for important traditional food plants and animals, and contain a multitude of ecological values and ties to cultural use and stewardship of the landscape. The whitebark pine, for example, is a species of critical importance. Benga said no site-specific plant-gathering areas overlapping the LSA were identified by the Ktunaxa Nation. However, Benga recognized that such areas may exist under the broader definition of current use. Benga also noted that the project would intersect, or be in proximity to, habitat and species identified by the Ktunaxa for plant gathering.

[2662] Benga predicted that there would be residual adverse effects on Ktunaxa plant-gathering activity. Benga characterized the effect as low in magnitude as the Ktunaxa did not identify any current site-specific plant-gathering activities within the project area.

Trails and travelways

[2663] The Ktunaxa Nation stated that archival and ethnohistorical documents indicate that several trails associated with their movement through the Rocky Mountains directly intersect the project area, as well as areas to the north and south of the project. They continue to travel to, and through, the project area to maintain their connection to their territory and exercise their rights. These trails continue to be important values for the transmission of knowledge and connection to Ktunaxa ancestors and oral history in the Crowsnest Pass.

[2664] The Ktunaxa described a major ancestral travel route that roughly follows the Crowsnest Pass along the current route of the Crowsnest highway. They also provided a map of site-specific values that demonstrated cultural, habitation, and environmental values clustered along the highway corridor. The route is still in active use by Ktunaxa citizens as a modern travelway. The Ktunaxa stated that the creation of modern routes and roadways has a serious impact on the overall ability of Ktunaxa citizens to use ancestral trails and travel routes.

[2665] Based on known patterns of use elsewhere in *Ɂamakʔis Ktunaxa*, Ktunaxa camps are particularly reliant on access provided by trail networks and water resources. The Ktunaxa presented oral history related to camping at the lakes in Crowsnest Pass, as well as archaeological evidence of camps in the pass area. The Ktunaxa anticipated that the project would interrupt road and trail access through the project area.

[2666] Benga predicted that there would be a low-magnitude residual and adverse effect on the Ktunaxa's use of trails and travelways after implementation of mitigation measures. Benga predicted a change in the ability of the Ktunaxa to access routes in the project area, and several trails and travelways used by the Ktunaxa to move through the Rocky Mountains directly intersect the project area. However, Benga was of the view that the Ktunaxa do not actively use them. In addition, the project would not change the Ktunaxa's ability to access trails and travelways in the RSA.

Monitoring and mitigation

[2667] The Ktunaxa Nation provided the following recommendations:

- Benga should be required to include full Indigenous participation in the development of all project management and mitigation plans.

- Benga should be required to fill the gaps in baseline data for aquatic effects, rare plants, wildlife diversity and regional habitats, aerial raptors, nocturnal owls, and climate change before the project begins construction, with the updated data incorporated into finalized management plans.
- Benga should be required to set clear and measurable thresholds for responsive adaptive management. For example, the aquatics monitoring plan should include clear and measurable exceedance thresholds that would trigger defined management responses. Similarly, the reclamation plan must identify clear timelines, restoration targets, and thresholds that would trigger further measures if the ambitious reclamation objectives are not being achieved.
- Benga should be required to provide adaptive management responses tied to clear management actions. Effective management plans need to be able to respond and adapt to new information as it develops. Of equal importance, and to avoid undue delays in developing responses to new information, management plans should include specific mitigation and management measures that would be implemented if triggering events occur.
- Alberta and Canada should establish an Indigenous-led cumulative effects management and offsetting program. Given the existing and proposed development pressures in the project area, it would be important that an Indigenous-led cumulative effects process at least proceed in tandem with the development of the project.

[2668] The Ktunaxa proposed that project-specific mitigation plans include the acquisition or protection of lands to offset the mine footprint. These lands would serve both environmental and cultural functions by ensuring the ongoing protection of, and access to, intact lands that can at least partly mitigate the long-term losses due to development of the mine site. Benga noted that they had not proposed any terrestrial offsets, but that they continue to work with the Ktunaxa to help them understand where Benga had already incorporated some of their recommendations into the reclamation plan.

Panel analysis and findings

[2669] The Ktunaxa Nation have used and occupied the Crowsnest Pass and the surrounding areas for travel to hunt, fish, and harvest. We acknowledge that the Ktunaxa's existing use and occupancy show they continue to exercise harvesting rights in the Crowsnest Pass and surrounding areas.

[2670] The Ktunaxa said that the project footprint and surrounding area is known as habitat for traditional food, plants, and animals. We recognize that they are concerned that the project's footprint and associated disturbance corridors would impair habitat for species the Ktunaxa rely on for the exercise of spiritual, cultural, and harvesting practices, and reduce their ability to access the area for harvesting.

[2671] We also acknowledge the Ktunaxa's relationship with grizzly bears in mountain areas is particularly fundamental to Ktunaxa stewardship, and that animals in the project area are important resources for spiritual and cultural practices. As we discuss in the chapter on wildlife, we find that the project would have a residual adverse effect on grizzly bears that is not significant.

[2672] In addition, we acknowledge the Ktunaxa's concerns about plains bison, with respect to both the bison's cultural importance and potential future hunting practices. We recognize the importance of the Buffalo Treaty to the Ktunaxa. While we understand the Ktunaxa's concerns are related to the potential

for the project to further reduce the habitat available to support future reintroduction of bison, we find that the project area is unlikely to be able to support the reintroduction of bison, as discussed in the wildlife chapter.

[2673] We accept that the Ktunaxa consider the project area to be important to their past and future traditional use practices, and that they continue to travel through the Crowsnest Pass area to maintain their connection to their territory. The Ktunaxa did not identify hunting, trapping, plant gathering, or fishing sites in the project area to which access would be affected by the project, nor did they identify specific trails of importance within the project area.

[2674] We find that the project could result in sensory disturbances for the Ktunaxa while hunting, fishing, and gathering in the RSA. Benga acknowledged that the project would be visible from various elevations and that sound from the project could travel long distances, affecting the experience of current use for Ktunaxa members in proximity to sensory effects.

[2675] We find that, even with implementation of Benga's proposed mitigation measures, the project would have a residual effect on the Ktunaxa's current use of lands and resources for traditional purposes.

[2676] The residual effect can be characterized as follows:

- **Magnitude:** low. There is little evidence to suggest the project will affect the Ktunaxa's harvesting practices and cultural areas.
- **Geographic extent:** local. Most project effects would be limited to the LSA. However, some sensory effects (e.g., noise, dust, and visual quality) would likely extend beyond the LSA to the RSA.
- **Duration:** medium. The sensory effects would last for the life of the project, but end with the operational phase.
- **Frequency:** occasional. When Ktunaxa citizens are practising activities either close enough to the project or at a high enough elevation to see or hear the project.
- **Reversibility:** reversible. The sensory disturbances would diminish upon cessation of activities. It is unclear whether trails and travelways used by Ktunaxa would be affected by the project, but if they were, the effect would be irreversible.
- **Ecological and social setting:** negative. The Ktunaxa demonstrated that the existing historical pressures have contributed to a declining ability to use their traditional territory.

[2677] We find that the project would result in residual adverse effects on the Ktunaxa's current use of lands and resources for traditional purposes in the LSA and RSA. The effects would not be significant.

Physical and cultural heritage

[2678] The Ktunaxa Nation stated that the project and adjacent areas, including Crowsnest Mountain, Crowsnest Pass, Crowsnest Lake, and the area near Frank, are profoundly important to their cultural landscape. The landscape is associated with oral histories of bison hunting, relationships with the Piikani and other groups, and ancestral Ktunaxa villages east of the Rockies. Ktunaxa creation stories describe

particular landforms such as the Frank slide, and areas connected to specific ceremonial practices, including an important Ktunaxa ceremonial location just east of Crowsnest Mountain.

[2679] The Ktunaxa noted that documented values of importance are reflected in Ktunaxa place names and tied to key stories and landscape features and to teaching areas that are used to pass on Ktunaxa knowledge and history within the LSA and in the area of Blairmore and Frank. The Ktunaxa consider the fact that they have names for geographically and culturally significant locations in the project area, including *qukin ʔakitʔaʔis* (Raven’s House or Crowsnest Mountain) and *Kuʔwiaʔki* (Crowsnest Lake) as an indication as to the time and depth of Ktunaxa use and occupation of the area. In their rights and interests study, the Ktunaxa identified a particular area—about 10 to 15 km west of the project—with a significant density of habitation, subsistence harvesting, cultural, and travel sites.

[2680] The Ktunaxa explained that they consider *qukin ʔakitʔaʔis* (Raven’s House or Crowsnest Mountain) and the headwaters of Crowsnest River especially sensitive, sacred, and tied to Ktunaxa oral history and specific ceremonial practices. Crowsnest Mountain is also a lookout for watching the movements of Blackfoot groups and bison in the Crowsnest Pass and the surrounding valleys. *Kuʔwiaʔki* (Crowsnest Lake) is an important, at-risk, sacred, and ceremonial place to the Ktunaxa.

[2681] The Ktunaxa believe that a major open-pit coal mine in the sacred landscape of *qukin ʔamakʔis* (Raven’s Land) would impair their ongoing cultural and spiritual relationship to the area. They said that project activities are a primary concern for their current and future use and stewardship of the values associated with *qukin ʔakitʔaʔis* (Crowsnest Mountain), *Kuʔwiaʔki* (Crowsnest Lake), and nearby areas associated with place-based cultural-spiritual practices. The Ktunaxa expressed concern about the potential for negative changes on the viewscape and sensory environment (e.g., noise, smell, and air quality) due to mine construction and operations. Their place-specific knowledge relies on the integrity of the viewscape and sensory environment. Ktunaxa stated that the project is likely to contribute to further adverse residual impacts on Ktunaxa cultural and spiritual values, including their sense of place and ability to pass on place-specific knowledge related to sacred landforms and Ktunaxa oral history of the Crowsnest Pass.

[2682] Benga predicted that there would be residual adverse effects on the Ktunaxa’s physical and cultural heritage and spiritual and cultural values after implementation of mitigation measures. Benga characterized the residual adverse effects as moderate in magnitude because the project was predicted to change access to and engagement with physical and cultural sites and values for the Ktunaxa in the project area. The geographic extent was rated as local and the duration long-term. Benga stated that the effects would be non-reversible because the loss of cultural and heritage sites and features could result in the loss of knowledge. Benga characterized the ecological and social context as sensitive because the cultural identity, human wellbeing, relationships, and the intergenerational transfer of knowledge of the Ktunaxa would be affected as a result of the loss of sites, and connection to land. Benga concluded that the project would not result in any significant adverse environmental effects on the Ktunaxa’s physical and cultural heritage, including spiritual and cultural values and historic resources.

Panel analysis and findings

[2683] The Ktunaxa Nation consider Crowsnest Mountain, Crowsnest Pass, Crowsnest Lake, Crowsnest River, and the area of Blairmore and Frank, including Turtle Mountain, parts of an important sacred and cultural landscape tied to their key creation stories. The Ktunaxa believe the project would intrude on this sacred landscape and damage their ongoing cultural and spiritual relationship with it. The project may be visible at certain elevations as well as audible at certain times, as far away as Crowsnest Mountain and Turtle Mountain. We find that this could affect the Ktunaxa's cultural and spiritual connection to the landscape.

[2684] The Ktunaxa raised concerns that Blairmore and Gold Creeks, which flow into the Crowsnest River, may be affected by the project. They pointed out that the Crowsnest River is sensitive and sacred to the Ktunaxa, as it is considered the home of the creation-being Raven and is used for camping and other traditional uses. We do not expect the project to have any effect on Crowsnest Lake, as it lies upstream of the confluence of Blairmore creek and the Crowsnest River. It was unclear to what extent Ktunaxa citizens harvest downstream of the project area.

[2685] We find that even with the implementation of Benga's proposed mitigation measures, the project would have an adverse residual effect on the Ktunaxa's physical and cultural heritage due to indirect effects on the use of their traditional territory and their cultural connection to it.

[2686] The residual effect can be characterized as follows:

- **Magnitude:** moderate to high. The project would have sensory effects on a broad area of considerable cultural importance, including Crowsnest Mountain to the west and Turtle Mountain to the east. The disturbance could affect cultural and spiritual practices.
- **Geographic extent:** local. Most project effects would be limited to the LSA. However, some sensory effects (e.g., noise, dust, and visual quality) that can affect cultural activities and experience would likely extend beyond the LSA into the RSA. The Ktunaxa's cultural connection to the landscape could be affected at a regional level.
- **Duration:** medium. The sensory effects would last for the life of the project, but end with the operational phase.
- **Frequency:** occasional. When the Ktunaxa practise activities either close enough to the project, or at a high enough elevation to see or hear the project.
- **Reversibility:** reversible. The sensory effects would diminish upon cessation of activities.
- **Ecological and social setting:** negative. The Ktunaxa demonstrated that the historical pressures have contributed to a declining ability to access their traditional territory for cultural purposes.

[2687] We find that the project would result in a residual adverse effect on Ktunaxa's physical and cultural heritage in the RSA. The effect would not be significant. Ktunaxa did not provide evidence to suggest any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance to them would be affected by the project.

Health

[2688] The Ktunaxa Nation raised concerns that Blairmore and Gold Creeks could be affected by the project, and noted that both waterways flow into Crowsnest River. They were concerned that increased impacts on water would likely alter their ability to use camps and habitation areas adjacent to the Crowsnest River and its tributaries.

[2689] The Ktunaxa were also concerned about the project's effects on water and aquatic habitat. They identified the mobilization of contaminants, in particular selenium and sulphate, into local waterways as a primary impact on water. The Ktunaxa said the contamination of water reduced their confidence in the safety of harvesting fish, resulting in further displacement of their rights and cultural practices. The Ktunaxa noted that their experiences in the Elk Valley demonstrated that the contamination of water and health concerns associated with upstream mining often resulted in a direct impact on Ktunaxa members' confidence in the safety of wild food, and on their ability to rely on their preferred places and species for harvesting. A summary of Benga's evidence on health conditions for Indigenous groups is in the section on Benga's approach and assessment earlier in this chapter.

Panel analysis and findings

[2690] The Ktunaxa Nation said their citizens continue to exercise harvesting rights in the Crowsnest Pass and surrounding areas. They expressed concerns about contamination of water from the project, as well as reduced confidence in the safety of harvesting fish. They identified fishing areas for cutthroat and rainbow trout to the west and upstream of the project area. While we understand that Ktunaxa harvest primarily upstream, it was unclear whether they also harvest downstream of the project area. As such, our findings as discussed in the Health section of Benga's approach and assessment apply generally to the Ktunaxa as a community characterized in the health risk assessment.

[2691] We find that the project would not be expected to result in residual adverse health effects on the Ktunaxa. If their members conduct traditional land use or cultural activities in the vicinity of the project, we anticipate the effects would be limited to those of a sensory nature and of Ktunaxa members avoiding downstream harvesting.

Socioeconomic conditions

[2692] The Ktunaxa Nation described their experience with past mining projects in the Crowsnest Pass as one in which most or all socioeconomic benefits were received by non-Indigenous communities and workers, and a disproportionate share of negative impacts were received by Indigenous communities. The Ktunaxa explained that this resulted in a net adverse impact for Ktunaxa citizens and the continued erosion of Ktunaxa use, rights, and interests. The Ktunaxa noted that they were engaging in ongoing, confidential, good-faith negotiations with Benga about the project, with the goal of concluding a project agreement.

[2693] When it conducted its assessment in 2011, Benga reported an unemployment rate of 28.6 per cent for the Tobacco Plains Indian Band, 13.3 per cent for the Columbia Lake Band, 30.8 per cent for the St. Mary's Indian Band, and 25 per cent for the Lower Kootenay Indian Band. Benga did not identify any Ktunaxa-owned businesses or any specific areas of use by the Ktunaxa that would interact with or be in proximity to project activities. Our findings and discussion on socioeconomics in the section on Benga's approach and assessment in this chapter apply to the Ktunaxa.

Panel analysis and findings

[2694] We acknowledge Benga’s commitment to provide Indigenous employment and procurement opportunities. We agree with Benga that the socioeconomic effects of the project would differ among Indigenous groups as each community had different factors influencing how they would be affected by the project. The effects would also vary for different groups and individuals within a community. We understand the Ktunaxa are currently engaging in ongoing good-faith negotiations with Benga. We recognize that this cooperative relationship could provide a mechanism to address issues of importance to the Ktunaxa.

[2695] In consideration of the arrangements Benga has in place with Indigenous groups, as well as Benga’s stated objective to achieve a net positive effect for Indigenous communities, the overall positive economic impact of the project could extend to the Ktunaxa. However, Benga provided limited group-specific socioeconomic information, and the Ktunaxa provided limited information about the potential socioeconomic effects of the project, either positive or negative, on their community. As we do not have enough specific evidence from either Benga or the Ktunaxa, we are unable to complete an assessment of the effects of the project on socioeconomic conditions.

[2696] Table 22-9 provides a summary of our assessment of the residual effects of the project on the Ktunaxa Nation.

Table 22-9. Summary of panel analysis of residual effects on the Ktunaxa Nation

CEAA 2012 section 5 effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Ecological or social context
Current use of lands and resources for traditional purposes	Low	Local, regional for sensory effects	Medium	Occasional	Reversible and diminish upon cessation of activities	Negative
Physical and cultural heritage	Moderate to high	Local	Medium	Occasional	Reversible and diminish upon cessation of activities	Negative
Structure, site or thing	None identified					
Health conditions	Residual effects are not expected					
Socioeconomic conditions	Unable to complete assessment					

Cumulative effects

[2697] The Ktunaxa Nation stated that cumulative effects on their rights and interests stemming from impacts on lands and waters within the Elk Valley drainage have already exceeded a threshold of significance. The Ktunaxa stated that, although their assessment was preliminary, they were of the view that existing impacts on their ability to exercise their rights in the Crowsnest Pass area have been significant. The Ktunaxa said that project effects on their use, rights, and interests in the project area are adverse and likely to extend the duration, magnitude, and extent of existing significant impacts in the region. The Ktunaxa identified the extirpation of bison, historical coal mines, urban development, and other activities as contributing to ongoing cumulative impacts on Ktunaxa rights, title, and interests. In their view, without substantial mitigations and other measures, adverse impacts from other projects in the region would act cumulatively with the project to increase the magnitude and duration of those existing significant effects.

[2698] The Ktunaxa recommended the preparation of an Indigenous-led cumulative effects management strategy that could, in collaboration with governments and proponents, set the parameters for assessing and managing environmental effects on a regional level, given the proximity of the project to the already ecologically compromised landscape of the Elk Valley and the eastern foothills.

Panel analysis and findings

[2699] We acknowledge that Ktunaxa citizens have relied on and, to the extent possible, continue to rely on, the area of the Crowsnest Pass for a range of practices, including the harvesting of fish, plants, wildlife, and mineral resources, as well as the use of trails and transportation routes and associated camps and cultural areas. The Crowsnest Pass is an important cultural landscape for Ktunaxa citizens. Existing developments in this area, including historical coal mines and other infrastructure, have affected their ability to use the area.

[2700] We acknowledge that the Elk Valley portion of the Ktunaxa's traditional territory has seen extensive industrial development, affecting the Ktunaxa's ability to use that area. We accept that additional historical pressures have affected the Ktunaxa's relationship with their traditional territory over time. We expect that these effects would be exacerbated by the project, but we find we do not have enough information regarding the nature of the cumulative effects in the RSA and therefore cannot characterize these effects, or determine their significance.

Rights

[2701] The Ktunaxa explained that they maintain underlying sovereign and *sui generis* rights and title to all lands and waters within their territory. They note they have never signed a treaty with the Crown, or otherwise ceded or surrendered their title and rights to *?amak?is Ktunaxa*, including the part of the Ktunaxa territory in what is now called Alberta. The Ktunaxa maintain that Treaty 7 has no impact on their rights or interests associated with the project area, and that pre-confederation Ktunaxa rights in the area continue to be in place under Indigenous law and the *Constitution Act, 1982*. The Ktunaxa identified the Ktunaxa Nation Council as the governing body mandated with, among other things, protecting and asserting Ktunaxa title, rights, and interests.

[2702] The Ktunaxa noted that archival and oral history records indicate that the Crowsnest Pass was traditionally used by the Ktunaxa, and provides insight into the importance and continuity of their use and rights in the area. The Ktunaxa stated that practice of their rights in the project area is ongoing, despite serious impacts from past coal mining, road development, extirpation of bison, and Canadian colonial policies. The Ktunaxa stated that their citizens rely on the project area to practise a range of rights, such as subsistence harvesting, cultural spiritual practices including teaching of oral histories and transmission of knowledge, and the use of trails and roadways to access important areas and resources.

[2703] The Ktunaxa view the Grassy Mountain area as unique and of critical importance to their rights and interests, as reaffirmed by recent and ongoing work with Ktunaxa elders and communities. Ktunaxa elders and land users continue to actively use and rely on the landscape of the Crowsnest Pass and surrounding mountains as integral to their identity, and to the expression of place-specific Aboriginal rights, including teaching, cultural practices, harvesting, and transportation. The Ktunaxa consider that their rights and interests in the area are well supported by evidence. The Ktunaxa are of the view that the

project is a major coal mine in a region that is already nearing or past thresholds of significant impact on water quality, spatial disturbance, and other factors that impact their rights and interests.

[2704] The Ktunaxa raised concerns about the cumulative effects on their rights, title, and interests from impacts on lands and waters that have already exceeded thresholds of significance, as well as cumulative effects from other projects in the region. The Ktunaxa noted that they are currently engaging in good-faith negotiations with Benga about the project, and that the outcome of those negotiations, as well as those of our review, would inform their decision on the compatibility of the project with their rights and stewardship responsibilities over *ʔamakʔis Ktunaxa*.

[2705] The Ktunaxa raised a concern that the ACO had not provided an assessment for them. In their view, due to this omission, we do not have the information necessary to determine whether the consultation with Ktunaxa was adequate. The Ktunaxa requested that we ask the ACO to provide its advice on the adequacy of consultation with the Ktunaxa.

[2706] The Agency's analysis and conclusions from its preliminary assessment on impacts to rights for the Treaty 7 groups and Ktunaxa Nation can be found in the section on Treaty 7.

[2707] The Agency reported that plains bison are critically important to the Ktunaxa Nation for the past and future exercise of their rights in the project area. The Agency referenced the Ktunaxa's assertion that the return of plains bison to the area was "planned and reasonably foreseeable." In response to questions at the hearing, the Agency clarified that they could not provide any additional information on the likelihood of a return of plains bison to the project area. The Agency stated that it was not aware of any initiatives underway associated with the Buffalo Treaty.

[2708] Furthermore, the Agency could not confirm whether any Indigenous groups have a right to hunt bison in the project area, noting that the environmental assessment process was not a rights determination process. The Agency stated that once the environmental assessment process was complete, the Government of Canada would continue to engage with communities to identify potential impacts of the project on their rights, including the potential to harvest bison, should the species be reintroduced.

Panel analysis and findings

[2709] We do not have the authority to consider Ktunaxa's concerns about Alberta's decisions regarding Crown consultation and the Ktunaxa. We have no jurisdiction to assess the adequacy of the Crown's consultation with Indigenous peoples and therefore no authority to consider challenges to Alberta's decisions regarding consultation. We receive advice from Alberta, through the ACO, about Alberta's consultation with Indigenous peoples and must accept that advice. Even if we did have the necessary authority to consider the Ktunaxa's concerns, no purpose would be served in engaging in a consideration of these issues as we are denying Benga's applications.

[2710] Our assessment includes the effects of the project on *CEAA 2012* section 5 factors for the Ktunaxa Nation, in combination with historical and contemporary cumulative effects, to understand the extent to which the Ktunaxa Nation's exercise of rights has already been impacted, and the further potential impact on rights from the project.

[2711] We considered the Agency's preliminary assessment of potential impacts on asserted or established Aboriginal or treaty Rights, and find that the Agency's assessment does not reflect the information provided on the record of this review for Ktunaxa Nation. The Agency's grouping of the Treaty 7 groups and the Ktunaxa Nation in their report made it difficult to discern the context in which potential impacts on rights would occur for the Ktunaxa. This is especially so given that they were the only Indigenous group presented in the Agency's preliminary assessment of impacts on rights that has a large part of their traditional territory to the west of the project area, in British Columbia, including the Elk Valley. Given that their traditional territory is primarily upstream on the Crowsnest River and in different watersheds from the project, any potential impacts on the exercise of rights related to fish, fish habitat, and fishing and water resources do not appear to apply equally, if at all, to the Ktunaxa Nation.

[2712] The potential impacts on Aboriginal rights of the Ktunaxa can be characterized as follows:

- **Cultural well-being:** low to moderate. Some impact on areas of considerable cultural importance is likely. The disturbance would likely be of a physical or sensory nature (e.g., noise, dust, and visual quality).
- **Geographic extent:** moderate. The impacts occur over a moderate spatial extent relating to the exercise of rights.
- **Duration, frequency, and reversibility:** moderate. The impact is likely to last up to one generation at sporadic, intermittent intervals throughout the operation of the project. Transfer of knowledge between generations may be interrupted for a moderate period of time by the project, although practices may be resumed broadly within one generation.
- **Health:** low. There may be an impact on physical, mental, emotional and/or spiritual aspects of health.
- **Cumulative effects:** moderate. The Ktunaxa have noted that the impacts on their territory in the Elk Valley have already exceeded a threshold of significance, putting additional pressure on their traditional territory in the Crowsnest Pass, and there has been significant development on the Alberta side of the border within the Crowsnest Pass as well.
- **Impact to governance:** low. The Ktunaxa noted that they were engaging in ongoing, confidential, good-faith negotiations with Benga regarding the project, with the goal of concluding a project agreement. We did not find evidence to suggest that the project would have an impact on areas that support the governance of the land.
- **Impact inequity:** uncertain. Insufficient information is available to determine whether subgroups of Ktunaxa citizens would be disproportionately affected by the project.

[2713] Taking into consideration the evidence presented above, we find that, if the project were to proceed, it would have a low to moderate impact on Ktunaxa Nation Aboriginal rights that would have a moderate likelihood of occurring.

Shuswap Indian Band

[2714] The Shuswap Indian Band's community is located on and near the Shuswap Reserve east of Invermere in the Columbia Valley. Band membership is just under 300. In addition to the Invermere area, the Shuswap Band membership is spread throughout its Caretaker Area, and many members have married into neighbouring communities, including those of the Stoney Nakoda and Ktunaxa. The Shuswap Band provided a map of their Caretaker Area, which includes the eastern foothills of the Rocky Mountains and extends west into British Columbia. The Shuswap Indian Band participated in the public hearing by providing a written submission and making a presentation.

Current use of lands and resources for traditional purposes

[2715] The Shuswap Band stated that they have used, and travelled through, the project area frequently since time immemorial. They have historical and current relationships with Indigenous groups on the other side of the Rocky Mountains and they continue to trade beadwork, furs, and other items with friends and family from the Stoney Nakoda and Piikani Nations.

[2716] The Shuswap Band said that their useable land areas shrink as development reduces their ability to practise traditional activities and access culturally significant locations. Subsistence harvesting is widely practised by, and of great significance to, their members. Plant collection and fishing sites have been cut off due to development impacts or land privatization. As this trend continues, the Shuswap Band needs to rely increasingly on the lands and resources in the southeast portion of their caretaker area.

[2717] Shuswap Band members described how they camp as needed when moving through their Caretaker Area. They said the ecological health and safety of suitable camping sites was essential to their ability to access the remote areas of their caretaker area. Damage to the land and resources has the potential to affect suitability for seasonal camps. Large game, such as deer, elk, moose, and caribou, have always been a significant resource in their caretaker area. Meanwhile, impacts on habitat, migration access, food sources, and noise could disturb ungulates. They said their ancestors used to travel alongside the Ktunaxa into Crowsnest Pass to hunt buffalo in the prairies twice a year.

[2718] The Shuswap Band stated that they relied heavily on salmon historically, but have experienced 80 years of salmon loss following the damming of the Columbia River in British Columbia. These impacts have altered various ceremonies, language access, and knowledge, compounding other cumulative impacts on their wellbeing. The Shuswap Band said that recent water quality and contamination issues have led to a drastic decline in cutthroat trout, an important fish species to them, and exacerbating impacts on their community.

[2719] Shuswap Band members fish on both the west and east sides of Crowsnest Pass. They fish for bull trout within Crowsnest Pass at Bovey Lake, Crowsnest Lake, and downstream of the project at Lundbreck Falls. They fish for trout in the small lakes on the southeast side of the mountains, and for burbot and cutthroat trout in the Elk River. If impacts occur in water systems near the project area, runoff could affect surrounding fishing sites at the base of the mountains. The Shuswap Band said they would be interested in accessing lands owned by Benga for fishing. They said that subsistence harvesting is widely practised and of great importance to their members.

[2720] Members of the Shuswap Band obtain medicinal plants from mountainous areas, as their sacred properties rely on alpine and water health. The medicinal integrity of these plants is affected by the health and spiritual intentions which surround it. Species include devil's club and sage, but many medicine species and harvesting areas are confidential. The Shuswap Band recommends incorporating Indigenous knowledge into monitoring and mitigations.

[2721] Initially, Benga was of the view that the project was not in the Shuswap Band's traditional territory and there were no specific areas of use that interact with or are in proximity to project activities. Benga later stated the Shuswap Band did not provide sufficient information to determine if there were residual project effects. Prior to receiving the Shuswap Band's hearing submission, Benga stated that no information about physical and cultural heritage sites or activities in the project area was available. Benga could not determine whether project activities would interact with the Shuswap Band's physical and cultural heritage in the project area.

Panel analysis and findings

[2722] The Shuswap Band provided information in their hearing submission that was previously unavailable.

[2723] We accept that the project is located within the Shuswap Band's Caretaker Area. We acknowledge that members of the Shuswap Band have an extensive history of travelling through the region, but it is not clear that they use trails that would be affected by the project.

[2724] Historically, fish—and salmon in particular—have been important to Shuswap Band members and we accept their information about where they fish. However, as they did not provide details of the locations or names of the small lakes used for fishing, it is not clear whether these lakes are downstream of the project.

[2725] The evidence does not demonstrate that the Shuswap Band's current use of lands or resources overlap the project LSA. We accept that the Shuswap Band's ability to practise their Aboriginal rights has been affected by various developments within their traditional territory. However, we do not expect the project to have any adverse effects on the Shuswap Indian Band's current use of lands and resources for traditional purposes. Should Shuswap Band members conduct traditional land use or cultural activities in the vicinity of the project, we anticipate the effects would be limited to access and sensory disturbances. The effects would not be significant.

Physical and cultural heritage

[2726] The Shuswap Indian Band stated that spiritual practices and ceremonies rely on the quality of the water and plant resources, and that mountainous areas hold the highest quality of water and plant resources for this purpose. Their spirituality arises from a physical connection with the land and the stories tied to it. As spiritual sites are lost or become inaccessible, their members lose an integral part of their spiritual knowledge and wellbeing, while future generations lose access to this knowledge. Some sacred ceremonies, such as vision quests, occur in high alpine regions; however, the specific locations are personal and not shared.

[2727] The Shuswap Band identified two named and storied places surrounding the project area. The Rocky Mountains feature in their creation story and Turtle Mountain is referred to as Rumbling Mountain. These stories speak to their ancestral traditional knowledge and longstanding connection to the area. They said that named and storied places are tied to the physical attributes of that place, as well as the community's accessibility. Any alteration to the landscape affects its cultural significance. Furthermore, the cultural integrity of storied places depends on the community's accessibility.

Panel analysis and findings

[2728] The Shuswap Band has stories and connections to areas surrounding the project, but whether these areas would be affected by the project is not clear. We acknowledge that two named and storied places are associated with the areas surrounding Grassy Mountain, but we have no evidence that Shuswap Band members practise cultural activities in these areas or that the project would affect their activities.

[2729] The evidence does not demonstrate that the Shuswap Indian Band's physical and cultural heritage overlap the LSA. We do not dispute that their ability to practise their Aboriginal rights has been affected by various developments within their traditional territory, although we do not expect the project to have any adverse effects on Shuswap Band physical and cultural heritage, or related structures, sites, or things. Should Shuswap Band members conduct traditional land use or cultural activities in the vicinity of the project, we anticipate the effects would be limited to access and sensory disturbances. The effects would not be significant.

Health

[2730] The Shuswap Indian Band stated that any impacts on the ecosystem caused by the project have the potential to affect the air quality, health and presence of wildlife, quality of water and vegetation, and the wellbeing and health of their members. Impacts on the lands and resources in their caretaker area would affect their community's ability to pass on knowledge and skills to future generations and to access sacred or storied places, and would weaken social connections between community members and their caretaker area. A summary of Benga's evidence on health for Indigenous groups is in the section on Benga's approach and assessment in this chapter.

Panel analysis and findings

[2731] We do not expect the project to have any adverse health effects on the Shuswap Band. This is based on the limited evidence of their use of the project area, and the distance of their community,—which is east of Invermere in the Columbia Valley—from the project. Should Shuswap Band members conduct traditional land use or cultural activities in the vicinity of the project, we anticipate any effects would be limited to the avoidance of downstream harvesting and sensory disturbances.

Socioeconomic conditions

[2732] No specific information was provided by Benga or the Shuswap Indian Band about socioeconomic conditions. The Shuswap Band stated that economic benefits should be provided when development affects the lands and resources the community relies on. Based on the limited evidence demonstrating use of the project area, and the distance from the community to the project, we do not expect the project to have any adverse effects on the Shuswap Band's socioeconomic conditions.

Cumulative effects

[2733] The Shuswap Indian Band stated that, as development continues to affect its ability to practise its traditional activities and access significant cultural locations, useable land area shrinks. They stated that the cumulative effects of land use and development on their surrounding environment, particularly those areas associated with regional mining activities, were significant. Concerns around contamination and toxicity result in community members avoiding use and access in these areas.

[2734] Subsistence harvesting is widely practised by, and of high importance to, Shuswap Band members. Various plant collection and fishing sites have already been cut off due to development impacts or land privatization. The Shuswap Band experienced significant loss of traditionally important resources after construction of the Grand Coulee Dam in 1938 led to the extirpation of salmon in the Columbia Basin. They view this as a major loss, not only to available subsistence resources, but to the community's overall cultural wellbeing. Salmon fishing sites also served as teaching sites and facilitated the intergenerational transmission of traditional knowledge; these, too, were affected by the loss of salmon. To ensure a healthy diet, Shuswap members have to rely more on salmon that are restricted to lakes and rivers and do not migrate to the ocean (non-anadromous species). This puts a heavier reliance on resident species and requires that Shuswap Band members travel farther for subsistence needs. The Shuswap Band also indicated that damage to the land and resources has the potential to affect the suitability of seasonal camps.

Panel analysis and findings

[2735] The Shuswap Band provided information to show that historical pressures have affected their relationship with their traditional territory and that development continues to affect their ability to practise traditional activities and access culturally significant sites. They provided limited information to describe how the project would contribute to cumulative effects in their traditional territory. We accept that historical pressures have affected the Shuswap Band's relationship with their traditional territory. We expect that these effects would be exacerbated by the project, but we cannot characterize these effects, or determine their significance based on the evidence.

Rights

[2736] The Shuswap Indian Band assert their Aboriginal rights and title throughout their traditional territory. These include basic rights to hunt, fish, trap, and gather; to their physical and cultural heritage; and to exercise cultural practices. Benga did not contest that Shuswap Band members have a right to continue practising their Aboriginal rights.

Panel analysis and findings

[2737] We find that we do not have sufficient information to make any determination of the potential impact on rights for the Shuswap Indian Band.

Treaty 6 First Nations

[2738] Treaty 6 was signed in 1876 by the Government of Canada and First Nations in Alberta, Saskatchewan, and Manitoba. The Ermineskin Cree Nation, Louis Bull Tribe, Samson Cree Nation, and Montana First Nation are Alberta-based Indigenous signatories to Treaty 6. These groups form the Four Nations of Maskwacis.

[2739] The ACO did not require Benga to consult with the Treaty 6 First Nations.

[2740] Overall, Benga concluded there would be a not significant residual effect on current use, and predicted the effect on cultural heritage as low for the Samson Cree Nation. Benga stated that the Ermineskin Cree Nation, Louis Bull Tribe, and Montana First Nation did not provide sufficient information to determine if they would experience residual effects from the project.

Samson Cree Nation

[2741] The Samson Cree Nation is a northern member of the Nehiyawak Confederacy and a signatory of Treaty 6. The Samson Cree stated that the project was within their traditional territory, which covers the following land use regions: South Saskatchewan, Red Deer, North Saskatchewan, Upper Athabasca, Lower Athabasca, Lower Peace, and Upper Peace. Benga noted that the Samson Cree asserted that their traditional territory extends beyond the boundary of Treaty 6. The closest Samson Cree Reserve is 317 km from the RSA.

[2742] The Samson Cree Nation submitted a statement of concern and commented on the draft *Environmental Impact Statement Guidelines*. Following that, they did not provide any information to us and did not participate in the public hearing. The Samson Cree Nation said it was important that the environmental assessment consider all adverse environmental, social, cultural, and economic effects, not just from the project, but from existing, contemplated, and reasonably foreseeable developments that would result in cumulative effects. Benga predicted that the project would have a residual effect on hunting, fishing, plant gathering, and trails and travelways for the Samson Cree because it would reduce harvesting opportunities. Benga characterized the magnitude as low, as no specific sites in the project area were identified.

[2743] Benga noted that the Samson Cree's practices, traditions, and customs were integral to their culture and traditional way of life, and noted that annual ceremonies and other traditional practices take place on a seasonal basis. Benga predicted a residual effect on physical and cultural heritage and cultural and spiritual values during construction and operations due to the loss of access and sensory disturbances within the mine permit area. Benga characterized the magnitude as low because no current or historical use of sacred sites, gathering sites, or habitation sites in the project area were identified. Benga stated that it did not expect the project to have an adverse effect on Samson Cree Nation's health or socioeconomic activities.

Panel analysis and findings

[2744] The Samson Cree's participation in the review process was limited. We accept that the project is within their traditional territory and we accept that their ability to practise their asserted Aboriginal and treaty rights has been affected by various developments within their traditional territory. However, as there was minimal information received about the potential project-specific effects on their current use of lands and resources and physical and cultural heritage, our assessment of project effects to Samson Cree Nation under *CEAA 2012* section 5 is limited.

[2745] The evidence does not demonstrate that the Samson Cree's current use of lands or resources overlap with the LSA or the RSA. We do not expect the project to have any adverse effects on Samson Cree members. If any members do conduct traditional land use or cultural activities in the vicinity of the

project, we anticipate the effects to be limited to those involving access and sensory disturbances. The effects would not be significant.

[2746] The Samson Cree stated that their Aboriginal and treaty rights are inextricably connected to the land, waters, air, plant and animal life, and resources within their traditional territory. They noted that their spirituality, identity, economy, culture, heritage, language, and traditions arose from their traditional territory.

[2747] The Samson Cree stated that their rights “pre-exist Treaty No. 6 and exist in Canadian law not as a result of governmental recognition, but because they were not extinguished upon the Crown’s assertion of sovereignty” (CIAR 24, PDF p. 1). Benga stated that “in Alberta the Treaty 6 lands are located north of Treaty 7, and are not in proximity to the project area” (CIAR 42, Section H, PDF p. 218). Benga did not make any specific conclusions about impacts on rights. While we agree with Benga that the project effects would not extend as far as Treaty 6 lands, we acknowledge there is uncertainty related to the extent that Treaty 6 groups harvest resources on lands within Treaty 7, including within the Oldman River watershed. We find that we do not have sufficient information to make any determination of the impact on rights for the Samson Cree.

Louis Bull Tribe

[2748] The Louis Bull Tribe are a Cree-speaking nation located approximately 90 km south of Edmonton in Alberta. The Louis Bull Tribe has 1500 residents living on reserve and 1800 members off reserve. Louis Bull Tribe provided comments on the EIA and associated addenda, but did not participate in the hearing.

[2749] The Louis Bull Tribe explained that they have familial ties to other First Nation communities and currently practise their land uses as far as central and northeast British Columbia, western Saskatchewan, Montana, and throughout Alberta, including in the project area. They stated that they have demonstrated use of the Livingstone and Porcupine Hills, near the project area. The Louis Bull Tribe noted that the project falls within their area of traditional use, and that a variety of traditionally and culturally important plants and harvested animals can be found in the project area.

[2750] The Louis Bull Tribe noted that opportunities for the pursuit of cultural practices, including enjoyment of the land and knowledge transfers, must be viewed in the context of past cumulative effects on land access. They said the project could eliminate resources used by their members, and noted their greatest concern was cumulative effects and incremental impacts on the health and abundance of resources.

[2751] Benga relied on publicly available information for its assessment as it did not receive any information directly from the Louis Bull Tribe about the current use of land and resources for traditional purposes or Indigenous knowledge in the project area. Benga stated that large wildlife such as moose, deer, cougar, coyotes, wolves, and grizzly bears are culturally significant and are hunted by members of the Louis Bull Tribe. Their members also trap beavers and muskrats and gather medicinal and culturally significant plants throughout their traditional territory.

[2752] Benga noted that there was no information to indicate that the Louis Bull Tribe uses the project area or its resources for traditional purposes. Benga also noted that no information about physical and cultural heritage sites or activities in the project area was available or provided by the Louis Bull Tribe.

Therefore, Benga could not determine whether project activities would interact with the Louis Bull Tribe's current use of lands and resources for traditional purposes or physical and cultural heritage in the project area. Benga concluded that the Louis Bull Tribe had not provided sufficient information to determine if there were residual project effects.

[2753] No specific information was provided by Benga or the Louis Bull Tribe about health and socioeconomic conditions. Benga stated that adverse effects on health or social or economic conditions were unlikely, given the distance of the project from the Louis Bull Tribe community.

[2754] The Louis Bull Tribe provided statements that the project falls within their area of traditional use, and that a variety of traditionally and culturally important plants and harvested animals occur in the project area. Most of their concerns were related to the cumulative and incremental impacts on the health and abundance of resources.

Panel analysis and findings

[2755] We acknowledge the Louis Bull Tribe's concerns relating to past development in the regional area, and that the project area has resources that are used in their traditional practices. We recognize that cumulative impacts have exerted an incremental loss of the Louis Bull Tribe's access to lands in the area and affected their ability to practise traditional land uses. They have also been affected by the more recent settlement and development of these lands.

[2756] We have minimal information related to potential project-specific effects on the Louis Bull Tribe's current use of lands and resources and physical and cultural heritage. As a result, our assessment of project effects on the Louis Bull Tribe under *CEAA 2012* section 5 is limited. The evidence does not demonstrate that their current use of lands or resources overlap the LSA. However, we accept that the Louis Bull Tribe said that the project was within their area of traditional use. For Louis Bull Tribe members who do conduct traditional land use or cultural activities in the vicinity of the project, we anticipate the effects would be limited to those involving access and of a sensory nature. The effects would not be significant.

[2757] The Louis Bull Tribe is a signatory to Treaty 6, which they stated preserves their right to fish and hunt throughout their traditional territory. They said that they would be affected by the project because their constitutionally protected Aboriginal and treaty rights within Treaty 6 traditional territory has already been reduced by the extensive development and alteration of the landscape. They are consequently forced to travel farther to practise their rights. The Louis Bull Tribe stated that constraints on their ability to exercise their rights within their traditional territory must be acknowledged when assessing the impacts of any project. They also said that this use may not reflect past patterns of use, or the interests of a community. Benga stated that Treaty 6 lands in Alberta are located north of Treaty 7 lands, and are not close to the project area. Benga did not receive sufficient information to determine if there were any project effects on Louis Bull Tribe.

[2758] While we agree with Benga that the project effects would not extend as far as Treaty 6 lands, we acknowledge there is uncertainty related to the extent that Treaty 6 groups harvest resources on lands within Treaty 7, including within the Oldman River watershed. We find that we do not have sufficient information to make any determination of the impact on rights for the Samson Cree.

Ermineskin Cree Nation

[2759] The Ermineskin Cree Nation is a Cree-speaking nation located approximately 75 km south of Edmonton, Alberta, Canada. The Ermineskin Cree are signatories to Treaty 6 with 4856 registered members. The Ermineskin Cree did not provide any information to us during the assessment. Benga noted that it relied on publicly available information for its assessment, as it did not receive any information directly from the Ermineskin Cree about their current use of land and resources for traditional purposes or Indigenous knowledge in the project area.

[2760] Benga noted the Ermineskin Cree continue to exercise their Indigenous interests to hunt, trap, fish, and gather plants. However, Benga received no information indicating that they do so in the project area. Benga also noted that no information about Ermineskin Cree physical and cultural heritage sites or activities in the project area was available. As a result, Benga stated that it could not determine whether project activities would affect the Ermineskin Cree's current use of lands and resources for traditional purposes or physical and cultural heritage. Benga concluded that the Ermineskin Cree did not provide sufficient information to determine if there were residual project effects.

[2761] No specific information was provided by Benga or the Ermineskin Cree about health and socioeconomic conditions. Benga noted that it was unlikely the project would have adverse effects on health, social, or economic conditions, given the distance of the project from the Ermineskin Cree Nation.

Panel analysis and findings

[2762] The Ermineskin Cree did not provide any information or evidence to us. As a result, our assessment of project effects on the Ermineskin Cree under *CEAA 2012* section 5 is limited. The evidence does not demonstrate that the Ermineskin Cree's current use of lands or resources overlap the LSA or RSA. We do not expect the project to have any adverse effects on the Ermineskin Cree. If Ermineskin Cree members do conduct traditional land use or cultural activities in the vicinity of the project, we anticipate any effects to be limited to those involving access and a sensory nature.

[2763] The Ermineskin Cree did not provide any information on their asserted or established Aboriginal and treaty rights to Benga or to us. Benga stated that Treaty 6 lands in Alberta are north of Treaty 7 lands, and are not in proximity to the project area. While we agree with Benga that the project effects would not extend as far as Treaty 6 lands, we acknowledge there is uncertainty related to the extent that Treaty 6 groups harvest resources on lands within Treaty 7, including within the Oldman River watershed. We find that we do not have sufficient information to make any determination of the impact on rights for the Ermineskin Cree.

Montana First Nation

[2764] The Montana First Nation is located approximately 90 km south of Edmonton and 3 km east of Highway 2A. The registered population of the Montana First Nation is just over 1000. The Montana First Nation did not provide any information to us during the assessment. Benga provided an assessment of potential effects of the project on the Montana First Nation following a notice from the Agency in January 2019 that they should be included. Benga noted that they relied on publicly available information as they did not receive any information directly from the Montana First Nation about traditional use or knowledge in the project area.

[2765] Benga stated that the Montana First Nation continues to exercise their Indigenous interests in hunting, fishing, and plant gathering in their traditional territory. They also continue to practise traditional ways of fishing. Their members were reported to travel long distances, now and in the past, to harvest plants and share traditional knowledge. Benga identified spirituality as central to the Montana First Nation, but had limited information about their physical and cultural heritage.

[2766] Benga stated there was no information to indicate that Montana First Nation hunt, trap, or fish in the project area. Benga said it did not have any information about physical and cultural heritage, sacred sites, or cultural values in and around the project area. As a result, Benga could not determine whether project activities were expected to interact with the Montana First Nation's current use of lands and resources for traditional purposes or physical and cultural heritage.

[2767] Benga concluded that the Montana First Nation did not provide sufficient information to identify any residual effects on current use or intangible project effects. No specific information was provided by Benga or the Montana First Nation about health and socioeconomic conditions. Benga said that it was unlikely the project would have adverse effects on health or social or economic conditions, given the distance of the project from the Montana First Nation.

Panel analysis and findings

[2768] The Montana First Nation did not provide any information or evidence to us. As a result, our assessment of project effects on the Montana First Nation under *CEAA 2012* section 5 is limited. The evidence presented does not demonstrate that Montana's current use of lands or resources overlap the LSA or RSA. We do not expect the project to have any adverse effects on the Montana First Nation. If any Montana First Nation members do conduct traditional land use or cultural activities in the vicinity of the project, we anticipate the effects would be limited to those involving access and those of a sensory nature.

[2769] The Montana First Nation did not provide any information to about their Aboriginal or treaty rights to Benga or to us. Benga stated that Treaty 6 lands in Alberta are located north of Treaty 7 lands, and are not in proximity to the project area. Benga stated that they did not receive sufficient information to determine if there were any project effects on Montana First Nation.

[2770] While we agree with Benga that the project effects would not extend as far as Treaty 6 lands, we acknowledge there is uncertainty related to the extent that Treaty 6 groups harvest resources on lands within Treaty 7, including within the Oldman River watershed. We find that we do not have sufficient information to make any determination of the impact on rights for the Montana First Nation.

Métis Nation British Columbia

[2771] The Métis Nation British Columbia identified itself as the official governing organization for Métis in British Columbia. They are a self-governing, sustainable nation operating in recognition of inherent rights for Métis citizens. They comprise seven chartered communities or regions. Members live in the southeastern corner of British Columbia and include the Columbia Valley Métis Association, Métis Nation Columbia River Society, Elk Valley Métis Association, Rocky Mountain Métis Association, Nelson and Area Métis Society, and Kootenay South Métis Society.

[2772] The Métis Nation British Columbia provided written comments to the Agency early in the review of the project, and Benga included a submission from them in the EIA. They did not participate in the hearing. The Métis Nation British Columbia noted that Métis made up roughly 90 per cent of the Indigenous population in the communities that neighbour the project. They provided information on their history in the regional area around the project, describing trade by Indigenous groups on both sides of the Rockies and their link to the Métis community in the Jasper area. They said their historical boundaries were general and non-specific as the influence of the fur trade established the infrastructure that supported and encouraged mobility of the Métis.

[2773] The Métis Nation British Columbia provided a map with data from a few of their harvesters, including hunting, fishing, plant gathering, and cultural and physical heritage. They noted that the absence of use around the project area was reflective of the lack of research and not an admission of lack of use. They said further interviews were needed to determine the potential impacts of the project on Métis harvesting. The map identified harvesting sites within 75 km of the project but not in the immediate vicinity of the project. Although not noted in the map, the Métis Nation British Columbia also stated that their harvesters reported harvesting firewood, white-tailed deer, grouse, rocky mountain elk, mule deer, moose, rabbit, bear, and trout in the vicinity of the project.

[2774] Benga stated that Métis Nation British Columbia territory overlapped the project RSA, but not the LSA, and there is no indication of use in the LSA. Benga concluded there would be no residual effects on current use, physical and cultural heritage, health, or socioeconomic conditions on the Métis Nation British Columbia.

[2775] Métis Nation British Columbia did not provide any information on the potential impacts of the project on their Aboriginal rights. They said the government of British Columbia “is of the view that no Métis community is capable of successfully asserting site specific section 35 rights in BC” (CIAR 42, Appendix 7, PDF p. 297).

[2776] Benga stated that Métis Aboriginal rights have been recognized and affirmed. These include their basic rights to hunt, fish, trap, gather, to cultural and physical heritage, the right to exercise cultural practices, and self-government, and enjoy the economic benefits of the lands of their traditional territories. Benga noted that the Métis Nation British Columbia asserted Aboriginal rights throughout their territory. Neither they nor Benga identified any areas of use within the LSA. Benga stated that they did not receive any information about impacts of the project on Métis Nation British Columbia rights.

Panel analysis and findings

[2777] We received minimal information related to the potential project-specific effects on Métis Nation British Columbia use of lands and resources and physical and cultural heritage. As a result, our assessment of project effects on Métis Nation British Columbia under *CEAA 2012* section 5 is limited.

[2778] The Métis Nation British Columbia use and occupancy map suggests that members harvest and collect plants in the RSA but not that they fish within the RSA or in a watershed that would be affected by the project. It is unclear how often, or how many, members travel to areas within the RSA to participate in traditional activities. There was no evidence of use within the LSA.

[2779] The map includes sites that could be linked to cultural practices such as burial ceremonies, but Métis Nation British Columbia did not provide any information to elaborate on the physical use or spiritual connection to those sites. They did not provide detailed or specific evidence of a historical, cultural, or spiritual relationship to the Crowsnest Pass area.

[2780] The evidence does not demonstrate the Métis Nation British Columbia currently use lands or resources that overlap the LSA or RSA. We do not expect the project to have any adverse effects on the Métis Nation British Columbia. If any of their members do conduct traditional land use or cultural activities in the vicinity of the project, we anticipate the effects would be limited to those involving access and sensory in nature.

[2781] We accept that the Métis Nation British Columbia asserts Aboriginal rights in the project area. We were not provided with any information to describe the historical relationship between the Métis Nation British Columbia and the project area, or details on the conditions required by the Métis to exercise their rights or specific values of importance in assessing rights. We find that we do not have sufficient information to make any determination of impacts of the project on the rights of Métis Nation British Columbia.

Foothills Ojibway First Nation

[2782] Benga stated that it regularly provided project information to the Foothills Ojibway First Nation, but received no response and had not obtained traditional knowledge use or knowledge studies from them. Benga stated that the Foothills Ojibway are descendants of families who did not sign Treaty 6. Approximately 250 members who identify as members of the Foothills Ojibway First Nation live in Hinton, Alberta, which is the key settlement area. The Foothills Ojibway First Nation did not participate in the public hearing or provide any information or evidence to us.

[2783] Benga stated that the Foothills Ojibway First Nation is a non-treaty and non-status band. Benga stated that it was not provided with information about the location of the Foothills Ojibway traditional territory, but publicly available sources identified the Eastern Slopes of the Rocky Mountains within the Treaty 6 and 8 regions as the main portions of the Foothills Ojibway traditional territory. Benga stated that the Foothills Ojibway continue to exercise their Indigenous interests in hunting, plant gathering, and sacred gathering and habitation sites.

[2784] Benga stated that the Foothills Ojibway traditional territory does not interact with project activities and that the potential effects of the project are not anticipated to extend beyond the RSA. Benga stated that information about traditional or current use in the project area was not identified in public sources and was not provided by Foothills Ojibway First Nation. No information was provided about health and socioeconomic conditions.

[2785] Benga stated it could not determine whether project activities are expected to interact with the Foothills Ojibway's current use of lands and resources for traditional purposes. As such, no further assessment was undertaken. No information was provided by Benga or the Foothills Ojibway about their potential use of the LSA or RSA. As a result, our assessment of project effects on the Foothills Ojibway under *CEAA 2012* section 5 is limited. We find that there is insufficient information to determine whether the project would have an effect on the Foothills Ojibway's current use of lands and resources for

traditional purposes or physical and cultural heritage, or whether there are effects of the project on any structure, site, or thing of historical, archaeological, paleontological, or architectural significance to the Foothills Ojibway, or on their health or socioeconomic condition.

[2786] Benga stated that although the Foothills Ojibway First Nation has not signed a treaty and is a non-status band, they still possess Aboriginal rights. The Foothills Ojibway did not provide any information on their asserted or established Aboriginal and treaty rights to Benga or to us.

Panel analysis and findings

[2787] We find that we do not have sufficient information to make any determination about the impact of the project on the rights of the Foothills Ojibway First Nation.

23. Social and Economic Effects

[2788] Benga presented the results of its socioeconomic impact assessment in EIA Consultant Report 11. The assessment consisted of a standard economic impact analysis based on a widely used macroeconomic input-output model. Benga used this model to generate estimates for gross domestic product, taxes, labour, and employment benefits. According to Statistics Canada, input-output models are often used to simulate the economic impacts of an expenditure on the output of one or more industries. They are also used to simulate the corresponding direct, indirect, and induced impacts of an expenditure on gross domestic product, job creation, estimates of indirect taxes and subsidies generated, and other relevant metrics. Benga updated some of its assessment results shortly before the hearing and provided a new scenario for economic impacts based on updated information from the 2016 census.

The project will have positive but low to moderate economic impacts

[2789] Benga stated that the project would drive economic growth in the Crowsnest Pass, with economic benefits that would extend beyond workers employed by Benga. The project would create skilled, well-paid, full-time jobs and bring talented employees to the region. Benga stated that the project would have a substantial, long-term, and positive effect on the Crowsnest Pass economy and provide benefits to Alberta and Canada. Communities within the RSA would also benefit from the project's direct employment opportunities.

[2790] Benga also stated that Indigenous groups in the region would benefit economically from the project. Benga highlighted that it had agreements in place with all of the Treaty 7 First Nations and the Métis Nation of Alberta – Region 3. All of these Indigenous groups submitted letters of support or non-objection. We discuss social and economic impacts on Indigenous groups in the chapter on effects on Indigenous traditional use of lands and resources, culture, and rights.

[2791] In its socioeconomic impact assessment, Benga assessed income, government revenues, and employment as components that would generate positive economic impacts. It stated that project expenditures and activities would generate employment opportunities, income for workers and businesses, and revenue for government. Benga predicted that the employment benefits were likely to positively affect the RSA, nearby municipalities, and major Alberta cities such as Calgary and Lethbridge.

[2792] Benga characterized the magnitude of the effect on income and employment as low. It characterized the magnitude of the government revenues as moderate at the regional level, but low at the provincial and national levels. Benga concluded that none of the effects on income, employment, and government revenues would be significant. At the hearing, Benga clarified that it only considered a residual effect to be significant if it was adverse. Benga also clarified that its assessment identified both positive and negative project effects, although the methodology did not explicitly calculate "benefits."

[2793] We summarize the project's predicted direct, indirect, and induced impacts in Table 23-1. The factors and amounts come from Benga's applications and supplemental materials.

Table 23-1: Income and employment generated by the project

	Alberta	British Columbia
Total gross domestic product income supported by project construction expenditures	\$163 million	\$47 million
Total labour income supported by project construction expenditures	\$98 million	\$29 million
Total employment supported by project construction	1165 person-years	370 person-years
Total annual gross domestic product income supported by project operations expenditures	\$95 million annually	\$38 million annually
Total annual labour income supported by project operations expenditures	\$62 million annually	\$27 million annually
Total annual employment supported by project operations	610 person-years	250 person-years

Sources: CIAR 313, PDF p. 27; CIAR 571, PDF p. 13; CIAR 785, PDF p. 1.

[2794] Benga submitted that the project construction phase would create more than 1500 person-years of employment in Alberta and British Columbia, with approximately 190 on-site employees. It stated that the project construction phase would support gross domestic product growth of \$210 million between the two provinces. Benga estimated the project's total initial capital expenditure at \$730 million, and the construction-related impacts would last less than two years.

[2795] Benga submitted that during the operations phase, about 400 workers would be employed. This would generate \$1.7 billion (net current value) in coal royalties and income taxes for provincial and federal governments over the 23-year operational life of the project. It estimated annual municipal tax payments to the Municipal District of Ranchland No. 66 and the Municipality of Crowsnest Pass at \$990,000 and \$490,000, respectively, for the duration of the project. Benga estimated annual operating expenditures at \$225 million. It also stated that the project would attract new residents to the region and create opportunities for local business growth and residential construction.

[2796] Benga provided total employment numbers and did not break down direct, indirect, and induced employment. However, in its final argument, Benga indicated that the project would benefit regional and provincial economies through direct employment, contracting of suppliers, and goods and services purchased by workers in the project area. Benga estimated that the employment split would be 70 per cent in Alberta and 30 per cent in British Columbia.

[2797] Benga's expert, Mr. P. Shewchuk, indicated that the employment estimates were calculated using Statistics Canada's input-output model. He explained that the total direct, indirect, and induced effects were the result of a single model run that estimated the number of jobs and predicted labour income.

[2798] Benga's socioeconomic impact assessment presented three benchmark coal prices for calculating royalties: US\$100, US\$140, and US\$200 per tonne. It used the US\$140/tonne long-term average price to calculate royalty revenue estimates. Under this assumption, Benga anticipated royalty revenues, in Canadian dollars, paid to Alberta would be approximately \$30 million annually over the 23-year operational life of the project, while provincial taxes would average \$19 million annually and federal taxes would average \$28 million annually (all figures real 2019 dollars).

[2799] The Coalition submitted that Benga did not provide sufficient information about its methodology to estimate the project's economic impacts, and these estimates could not be verified. It argued that Benga used a financial feasibility model to estimate future royalties and taxes, but Benga did not enter this model into evidence. The Coalition argued that Benga's claim that the project would pay royalties averaging \$30 million per year over the life of the project was inflated. At the hearing, it asked Benga to explain how the project would pay \$30 million per year in royalties, as this amount is about five times more than the total royalties paid by all other bituminous coal mining companies in the province.

[2800] Benga replied that "it's only natural that the value generated by producing high-quality metallurgical coal as we're proposing is greater than the production of other bituminous coals that may fall into the thermal category" (CIAR 762, PDF pp. 104–105). It also stated that the financial model that generated the royalty and tax estimates contained proprietary information, and therefore it would not be appropriate to enter the model into evidence.

[2801] The Coalition's economic expert, Mr. J. Thompson, stated that the Government of Alberta's 2019 annual report on coal production showed that bituminous coal mines in Alberta produced 5.2 [million] tonnes of bituminous coal and paid only \$6.4 million in royalties in 2019. He stated that one of these mines produced thermal coal and three produced metallurgical coal. He concluded that unless Benga: "[is] able to produce that coal at a much lower cost than its competitors, their claim of \$30 million in annual royalties seem unrealistically high. A more reasonable number, based on production and amounts being paid by existing companies, would probably be in the order of 5 million [dollars] a year" (CIAR 786, PDF p. 293).

[2802] The Coalition noted in its final argument that Benga did not challenge its evidence related to the potential overestimates in royalty payments during cross-examination. Mr. Thompson also stated that because Benga's estimates of taxes came from the same financial feasibility model that produced the royalty estimates, he did not have confidence in the tax estimates either.

[2803] Benga confirmed that it would likely be five to six years into operations before it would begin paying royalties (when gross revenues exceed gross costs). Benga also confirmed that in the initial years of mine operations, it would pay lower taxes until it generated income. Benga did not confirm in what year it expected to start paying income tax, but acknowledged that income tax would likely be lower in the early years as it wrote off capital costs. Benga also stated that it was important to take note of the average taxes paid over the life of the mine as there would be years when income taxes paid would be higher than average and other years when it would be lower.

[2804] The Coal Association of Canada supported Benga's assertions that the project would provide significant socioeconomic benefits to the region. The association stated that Canada has experienced significant job losses due to the COVID-19 pandemic, and that the project would help Canada's economic recovery. They estimated that the project would result in three indirect jobs for every direct job created. In addition to direct employment, local communities would benefit from mine employees' use of local services and involvement in local programs. The association also noted that Indigenous communities expected to participate in resource production on their traditional territories and that coal mining could provide them with decades of economic opportunity.

[2805] The Town of Pincher Creek and the Municipality of Crowsnest Pass stated that they viewed the project as beneficial to their local and regional economies. Mr. McGillivray from the Town of Pincher Creek said that the regions of Pincher Creek and Crowsnest Pass were well-equipped with highly skilled workers and related service providers. Local residents could provide the expertise to support the new coal mine and look forward to an increased demand for their services.

[2806] Local residents, F. Bradley and K. Allred raised concerns about the deteriorating economic condition of the Crowsnest Pass. Mr. Bradley noted that the population of the Crowsnest Pass was both shrinking and aging, and that a large number of the town's commercial storefronts were vacant. Between both residents, they noted that the movie theatre, a grocery store, an elementary school, four automobile dealerships, and several restaurants had been forced to close for economic reasons. Mr. Allred spoke of the benefits of Benga's presence in the community, support of local charities, and development of a golf club. Both residents pointed out that the bulk of the community's tax base is residential. Mr. Allred stated that the project would add significant employment opportunities for local residents, and Mr. Bradley emphasized the economic opportunities it would bring to the region. Mr. Bradley submitted that due consideration must be given to the potential regional socioeconomic impacts in our decision-making process.

[2807] The Coalition submitted an expert report, by Mr. J. Thompson, that pointed out that Benga's economic analysis confused benefits with impacts, which was misleading in the context of understanding the project's economic effects. The report described benefits as net additions to Alberta income (taxes and royalties); it described impacts as the direct and indirect effects associated with project spending. The report also noted that Benga's socioeconomic impact assessment did not include the reliability of its project benefit estimates, and had insufficient details about the methodology used.

[2808] The Coalition argued that Benga did not clearly establish how it was using the term "significant." It noted that Benga's expert submitted that the project's socioeconomic impacts would not be significant, and that the label "significant" had been applied to an effect only if it was adverse. However, at the hearing, Benga stated that it considered the creation of 400 high-paying jobs in a community that was suffering economically to be significant.

[2809] The Livingstone Landowners Group also expressed concerns with Benga's assessment and conclusions. It raised several concerns about Benga's socioeconomic impact assessment, and submitted an expert review of the analysis by Dr. C. Joseph. The review did not support Benga's conclusion that the project would generate major economic development, employment, and community benefits. The report argued that because the socioeconomic impact assessment only assessed gross impacts, it did not offer insights into the net benefits of the project. The report suggested that a cost-benefit analysis would have offered information to provide clarity on the net project economic benefits and costs, rather than the economic impact analysis approach that Benga used.

[2810] The report stated that Benga's accounting of the economic impacts of the project did not include competition for labour, incremental financial burdens on government, and the social costs of carbon. In addition, Benga did not consider constraints on labour or other forms of capital, or the uncertainty of its economic impact predictions. The report expressed concern that Benga presented information on

labour income separately from employment, effectively double counting the same information in two different ways, and concluded that Benga's assessment was simplistic and based on weak methodology.

[2811] Benga stated that the terms of reference for the EIA required an economic impact analysis, not a cost-benefit analysis. It confirmed that economic impact analyses do not include some of the cost-benefit analysis considerations raised by the Livingstone Landowners Group. At the hearing, Benga suggested that it considered the coal royalties and the income taxes to represent project benefits. It also suggested that local employment would be a project benefit. However, Benga's economic expert, Mr. Shewchuk, confirmed that he did not conduct an analysis of project benefits.

[2812] Local residents questioned whether the project would bring the economic prosperity that Benga claimed, or even whether local residents would actually benefit from the employment opportunities. Ms. Janusz noted that the strain on the municipalities' support services and infrastructure, along with other costs, would diminish the tax benefits. Mr. B. Trafford of the Livingstone Landowners Group described the provincial tax and royalties as "paltry" at best.

[2813] The Eco-Elders for Climate Action referenced 2017 statistics that showed that the tourism sector provided considerable revenue to southern Alberta. It also stated that the tourism sector employed nine times more people than those working in mining and quarrying activities for that year. They asked, "Why would we Albertans want to destroy our landscapes, create pollution, and threaten one of our most profitable industries?" (CIAR 750, PDF p. 173). They emphasized that the project's long-term environmental impacts would significantly outweigh the short-term economic benefits.

[2814] A local resident and member of the Coalition, Ms. K. Lehr, acknowledged that the tax burden on residents was high. Yet she did not believe that the project would bring any major tax relief to the community. She noted that she paid almost \$6000 per year in property taxes for a small lot and that there are 59 lots in her area. If the same taxes are paid for each lot, it would result in approximately \$354 000 in taxes to the municipality. She noted that, because there are also larger lots that would result in more taxes, her estimate was likely low. Ms. Lehr suggested that the project's projected tax payments of \$490 000 per year to the municipality was not a substantial increase over current property taxes and not worth the environmental damage that the project would cause. Coalition member Mr. D. Rothlin added that when that \$490 000 is divided by the municipality's 5500 residents, it works out to less than \$100 per person per year. In the Coalition's view, the taxes from the project would not provide much benefit to the community.

[2815] The M.D. of Ranchland also stated that it did not believe the economic benefits of the project would offset the damage to the environment. It opposed the project despite the fact that the project would increase municipal revenues by more than 50 per cent. The M.D. of Ranchland opposed the project for numerous reasons, including concerns that a larger population would increase land demand. In addition, the proposed mine would affect the enjoyment, quality of life, land value, and aesthetics of the area. The municipality argued that the coal industry has a long history of ownership turnover and boom-and-bust cycles, and a track record of polluting watersheds.

[2816] The Crowsnest Conservation Society conducted a small survey of Crowsnest Pass residents. The dominant socioeconomic concern was that the benefits to the community would not only be modest, but obtained by negatively affecting existing lifestyle and outdoor recreation benefits. They also noted that the Crowsnest Pass community would bear the costs of the project, but not receive equal benefits in terms of the tax revenue due to the location of the project in the M.D. of Ranchland.

[2817] CPAWS concluded that the project is unlikely to have any social or economic benefits. They argued that coal is known for its high price volatility, and that the price of coal is unlikely to be stable enough to keep the project viable for the expected life of the mine. CPAWS submitted an expert report by Mr. Koljin on coal quality and markets that concluded the value of the project's product is uncertain because of the potential split between the amounts of high- and low-quality coal that the mine could produce. They also stated that Benga underestimated the environmental liabilities and overestimated the economic stability of the project. Benga's and CPAWS' evidence relating to coal quality is covered in a later section of this chapter, as well as the chapter on coal mining, handling, and processing.

[2818] We find that Benga demonstrated that the project will provide some positive economic impacts through tax revenues and well-paying jobs, and that it will have a positive effect on the regional economy. However, Benga did not submit key methodological details and models necessary to allow us to verify its estimates. Some potential downside risks to Benga's economic projections that were not adequately considered are presented later in this chapter, along with the potential negative spillover effects on other important regional economic sectors. These issues might have been captured if Benga had conducted an economic assessment to evaluate the project's net benefits. We agree that Benga's results are unclear on the project's economic benefits versus its economic impacts, and a clear understanding of net economic benefits would have been useful information to assess the project.

[2819] In particular, we do not have confidence that Benga accurately estimated its future royalty payments. We note that Benga acknowledged that in the early years of mine life it would not have to pay royalties while paying off its initial capital investment before generating positive cash flow. If royalties are to average \$30 million per year over 23 years but the first few years pay \$0 in royalties, then in the later years of the mine life the actual amount paid would be even higher than \$30 million per year. Given that all other bituminous coal mines in the province paid about \$6 million in royalties in 2019 for a similar volume of production, Benga's estimate seems to be exaggerated. Benga did not submit a detailed financial feasibility model to demonstrate how these numbers were calculated. At the hearing, we asked Benga about these estimates and their lack of clarity, but Benga did not provide a clear explanation to support its numbers. We agree with the Coalition that Benga did not adequately explain how its royalty payments would be so much higher than those of other bituminous coal mines (including metallurgical coal mines) in the province. We find that Benga's estimated royalty payments are likely overstated. By extension, we do not have confidence in the tax estimates that Benga provided as these estimates were apparently sourced from the same model.

[2820] We find that the positive economic impacts of the project will be relatively modest. We rate the magnitude of Benga's projected amount of government revenues, income, and new jobs as low at the provincial level and moderate at the local level, which aligns with the assessment Benga made in its 2016 socioeconomic impact assessment. Furthermore, the project has the potential to impose negative impacts

on other economic sectors, and Benga did not assess certain risks that could reduce the project's positive economic impacts.

The project will trigger competition for housing and need for infrastructure

[2821] In Benga's socioeconomic impact assessment, Benga split the RSA into two parts: an Alberta portion (the M.D. of Ranchland and Crowsnest Pass, including the communities of Coleman, Blairmore, Bellevue, and Frank) and a British Columbia portion, which includes Sparwood and the portion of Highway 3 that connects the project and the town. Benga stated that the permanent population of the RSA was estimated to be 9312 in 2011. Eighty (1 per cent) lived in Ranchland and 5590 (60 per cent) in Crowsnest Pass, the majority living in the communities of Coleman (1050), Blairmore (2060), Bellevue (790), and Frank (260). The balance of the population lived in Sparwood (3667).

[2822] Benga's socioeconomic impact assessment referred to an additional non-permanent population of mobile workers. The Municipality of Crowsnest Pass and the Town of Sparwood estimated that their non-permanent populations are approximately 1500 to 2000 and 400 to 1700 respectively. The non-permanent population was accommodated primarily in rental accommodations, though some also resided in hotels and motels. This population fluctuated seasonally and with the level of industrial activity.

[2823] Benga's socioeconomic impact assessment estimated that the project was expected to result in a net permanent population increase in the RSA as in-migrants relocate to the RSA to fill jobs created by the project. Benga predicted the permanent population increase associated with project activity would begin with operations, with approximately 490 in-migrants being drawn to the Alberta area of the RSA and 320 to the British Columbia area in Sparwood.

[2824] Within Alberta, Benga expected the project's population impact to affect primarily the communities of Blairmore and Coleman, as they are closest to the project. It also expected the project to result in population growth in the nearby town of Sparwood. For the construction period, Benga indicated the project may increase the average number of mobile workers in the region by approximately 120 people. During peak construction activity, the increase in the number of mobile workers could reach 195 people. Benga acknowledged that the use of mobile workers as part of the construction workforce would increase pressure on social infrastructure.

[2825] Benga said the current housing in nearby communities—and the current pace of new housing construction—are not adequate to accommodate the project's additional population needs. This would be mitigated by the construction of a temporary worker camp. Benga's socioeconomic impact assessment stated that the need for housing would be most pronounced during the construction leading up to full operations. Benga assumed that population growth would primarily affect the towns of Blairmore, Coleman, and Sparwood. However, settlement patterns of this new population are subject to uncertainty and would be influenced by a number of factors. These factors include the availability and affordability of housing, the level and quality of services, and personal preferences.

[2826] Benga described the population of the RSA as comprising long-term residents with primary homes in the area, secondary residents who visit the region sporadically, seasonal tourists, and mobile workers in the mining industry. Mobile workers were mostly housed in secondary suites, rented rooms and hotel and motel rooms. Benga stated that the mobile workers and the non-permanent population

places demands on regional infrastructure, including healthcare, social services, policing, and emergency response.

[2827] Benga confirmed that it could not dictate where new migrants to the region should live; however, its socioeconomic impact assessment assumed that new residents would be split between 60 per cent in Alberta communities and 40 per cent in British Columbia. Its assumptions on where in-migrants live were based on a study by Teck (not entered into evidence), the project's location, and the Crowsnest municipality's goal of increasing its residential population so that it can grow and flourish. Benga stated that it anticipated that the development of the project would attract new residents to the region, and this new population would create opportunity for residential construction and support local business growth. Benga assumed that most operations workers would migrate to the region and become permanent residents.

[2828] Benga acknowledged that the project would affect the RSA's social infrastructure as a result of population growth. Health, education, ambulance, fire, and policing services would be most affected, particularly in Blairmore and Sparwood. Benga said that the RSA has a well-developed social infrastructure system, with most of the infrastructure and services located in Sparwood and in communities located in Crowsnest Pass.

[2829] Benga stated that Sparwood and Crowsnest Pass municipal infrastructure was built for a population that exceeded the current population. Benga stated that about 20 ha of developable residential land are available to accommodate future growth. Benga stated in its socioeconomic impact assessment that the project would not tie into municipal water or sewer lines. Instead, it would obtain water from local runoff or wells, and wastewater would be treated on site. Later in the review process, Benga stated that it would truck wastewater off site for treatment. Benga added that the additional demand for municipal infrastructure services—driven by the population increase during the project's operating phase—would exceed the current and planned levels of municipal infrastructure in Crowsnest Pass, but not in Sparwood. It noted that the sewage treatment plant in Crowsnest Pass exceeded capacity during spring runoff and was close to capacity at other times.

[2830] Benga presented several mitigation options to address the population effects on the housing and social and municipal infrastructure of the RSA. Benga committed to creating a community committee that would provide regular project updates and performance news, notify residents of upcoming input opportunities, and serve as a general forum for community complaints and concerns such as visual impacts, traffic, noise, and socioeconomic impacts. The goal would be finding mutually beneficial solutions. Benga stated it was committed to working with local governments to facilitate the timely development of residential land and housing through ongoing discussions regarding execution strategies and project timelines. Benga would establish an on-site camp and a workforce transportation strategy to minimize the demands on local municipal infrastructure from the project's mobile construction workforce.

[2831] The M.D. of Crowsnest Pass did not identify any concerns related to municipal infrastructure. However, they recommended that Benga be required to establish an advisory committee to address socioeconomic and visual impacts as well as traffic and noise. Benga committed to establishing such a committee but did not provide details on how it would operate, except to say that a similar model

proposed for the Teck Frontier oil sands mine in the Wood Buffalo area represented a sound management approach.

[2832] The M.D. of Crowsnest Pass identified several other issues. These included visual, socioeconomic, and human-health impacts, traffic, noise, air and light pollution, watershed threats, and vegetation and weed control. Compliance with municipal bylaws and regulations were also raised as issues for discussion at the proposed socioeconomics advisory committee. The Town of Pincher Creek agreed that this project would result in an increased need for corporate housing, schooling, and health and other social services, but viewed the project as having a positive effect. They also indicated that it received no funding from the Government of Alberta to develop social housing.

[2833] Ms. B. Janusz said that the spike in population would result in increased demand for municipal support services. These services would include permitting for housing, house inspections, and municipal services such as snow removal, garbage collection, road maintenance, weed control, and other bylaw enforcement services. Ms. Janusz also said that the Benga mine would be incompatible with tourism. The Livingstone Landowners Group indicated that mine benefits need to be stable and lasting, not just part of another round of a boom-and-bust cycle. The benefits must also add to the economy of the community and not substitute or detract from what already exists. The group added that promises made must be respected and maintained in the future.

[2834] We find that Benga took a reasonable approach to assessing impacts and mitigation measures related to housing and social infrastructure. The municipalities and towns have not raised any concerns and believe they have the capacity to accommodate the project. While the project may trigger some pressure on housing and social and municipal services, the effects appear to be manageable and the proposed advisory committee could represent a reasonable mechanism to address issues that they arise.

Benga has not adequately assessed potential negative impacts on other economic sectors or amenities

[2835] Benga acknowledged the importance of recreation and tourism to the regional economy. It indicated that popular activities include hiking, birding, wildlife watching, horse riding, hunting, mountain biking, skiing, and snowboarding. In its socioeconomic impact assessment, Benga identified four fishing guides or lodges in Crowsnest Pass or Pincher Creek. Benga concluded that it did not anticipate the project would have adverse effects on fly-fishing outfitters in the region in terms of aesthetics, sensory considerations, or fish health and abundance. But it said a malfunction or unintended discharge of contaminants into one of the surrounding streams or rivers could pose temporary adverse impacts to fly fishing outfitters.

[2836] Benga stated that it considered economic development, recreation, and tourism to be compatible and mutually supportive in the community and the region. Benga stated that combining tourism and industry would create more opportunities for the service sector and support more local businesses. In turn, this would make the region a more attractive tourist destination. If the Crowsnest Pass improved its standing as a tourist destination, Benga could attract more talented employees to the region.

[2837] At the hearing, Benga's economic expert, Mr. Shewchuck, stated that the project's direct impact on tourism and recreation would not be significant. In its final argument, Benga stated that the project

would not impede recreation. Benga said that it recognized that the region's landscape and recreational opportunities contributed to the tourism economy and were part of what attracted long-term residents to the region. It noted that the generous space for recreational pursuits would continue to support Crowsnest Pass as an outdoor destination.

[2838] Benga added that negative visual impacts of the project would be temporary because of the mine's progressive reclamation plans. Benga stated that the project would address the current visual impacts associated with the historical mining disturbances on Grassy Mountain that were not properly reclaimed. Benga noted that it has taken substantive measures to address concerns related to visual impacts. This includes promoting the co-existence of the project and the developing recreation and tourism economy, establishing a socioeconomics advisory committee and adopting the International Dark-Sky Association's Dark Sky Principles.

[2839] The M.D. of Ranchland said that backcountry recreation was the region's fastest-growing recreational activity. It suggested that the area, in the heart of southwestern Alberta, was a pristine and largely untouched area, possessing some of western Canada's best ranching land. The M.D. of Ranchland raised the concern that mine lights could mean the end of the enjoyment of the night sky, particularly for southern residents of the district, neighbouring municipalities, residents of the Crowsnest Pass, travellers, and recreationalists. Mr. Davis, from the M.D. of Ranchland, said that Ranchland residents have relied on the area for water, building materials, livestock raising, and recreational activities. They did not want the project to be a legacy left behind for future generations.

[2840] Ms. Davis, a member of the Crowsnest Conservation Society, spoke in detail about the growing recreation industry, which she estimated employed 50 to 100 people in the area. As a local recreation and tourism business owner, Ms. Davis spoke of the many recreational groups that have worked to build world-recognized recreational opportunities such as a mountain bike trail that attracts people from across Canada and internationally. She said that trail running and hiking were significant economic drivers that would be most affected by the project, because two of the most popular hiking trails in the area (Turtle Mountain and Crowsnest Mountain) look down on the project area. Ms. Davis added that Benga did not consult with the tourism and outdoor recreation community when conducting its socioeconomic impact assessment.

[2841] Ms. S. Duarte-Pedrosa, also from the Crowsnest Conservation Society, expressed her passion for the recreation and outdoor lifestyle opportunities available in the community. She suggested that the proposed mine would be incompatible with these opportunities. Several participants, including the Livingstone Landowners Group and the Coalition, argued that the experience of the nearby Elk Valley in British Columbia is instructive. There, coal mine infrastructure is visible from Sparwood, but not so from Fernie, B.C. The Livingstone Landowners Group pointed out that Benga acknowledged that tourists do not usually go to Sparwood, but carry on to Fernie.

[2842] Mr. Gardner from the M.D. of Ranchland said the project would result in open cuts, pits, roads, landslides and spoil piles, and the area would be dusted black with coal dust where a mountain once stood. He added that a landscape devoid of natural species would be vulnerable to weed issues, with ramifications for the ranching industry. Individual landowners would be overwhelmed with managing

weeds, leading to potential income loss. At the hearing, Benga confirmed that its socioeconomic impact assessment did not consider cattle grazing and ranching as relevant to the assessment.

[2843] Local residents, including Mr. Des Moulin, Ms. Janusz, Mr. R. Cooke, and members of the Coalition, indicated that they live in the area for the lifestyle. Mr. Gardner from the M.D. of Ranchland confirmed that this lifestyle included ranching. Mr. Des Moulin said the project would affect the lifestyle of residents and compromise recreation, and that the community would be in a worse state. Mr. Cooke stated that the Crowsnest Pass is a residential destination and amenity lifestyle community, and it would be negatively affected by the project. A resident of the area, Mr. Redekopp, submitted that, as a licensed realtor for 30 years, he had witnessed a boom in people buying recreational properties in the area from 2007 to 2020. Benga's expert, Mr. Shewchuck, confirmed that Benga did not assess the impacts of the project on lifestyle amenities.

[2844] We find that Benga's socioeconomic impact assessment did little to assess the potential negative impacts the project might have on the region's other economic sectors. Nor did it consider the impacts the project will have on lifestyle amenities. Benga appeared to assume that these impacts did not exist or would not be important, making its projected economic impacts from the project less reliable. We address the potential visual impacts of the project, and their potential implications for tourism, in the chapter on noise, light, and visual aesthetics. While the visual impacts of the project pose a negative risk to the tourism and outdoor recreation sector, this risk is difficult to quantify.

[2845] Neither Benga nor any other participants quantified the extent to which the project might harm the region's other important economic sectors. However, we agree with some participants that a mine could disturb one's enjoyment of the area's outdoor recreational activities, and could therefore reduce the number of people taking part in these activities. This drop-off in participation would reduce expenditures in these recreational activities. While we agree that the project has the potential for negative impacts on the tourism and recreation sector, the evidence presented did not allow us to estimate the magnitude of the impact. It is less clear whether the project would affect ranching economically.

There are several sources of downside risk to Benga's projected economic impacts

Low-price scenarios

[2846] In Benga's original socioeconomic impact assessment, it based all tax and royalty revenues on a US\$140/tonne price for metallurgical coal. It later provided low- and high-price scenarios to better assess the expected government revenues from the project. Benga provided a summary of the changes in expected tax and royalty revenues (net present value in 2019 Canadian dollars) in the Eleventh Addendum, for three price scenarios. The summary is reproduced as Table 23-2.

Table 23-2: Estimates of provincial and federal income taxes and royalties for metallurgical coal

Coal price (US\$/tonne)	\$100	\$140	\$200
Provincial tax average/year (2019) (millions of Cdn\$)	\$6	\$19	\$38
Federal tax average/year (2019) (millions of Cdn\$)	\$10	\$28	\$57
Royalties tax average/year (2019) (millions of Cdn\$)	\$3	\$30	\$65

Source: Adapted from CIAR 313, Table 6.3-1, PDF, p. 24.

[2847] At the hearing, Benga confirmed that it did not incorporate a price forecast for a lower-quality coal product. It based its analysis solely on a US\$140/tonne price for premium coking coal. Benga supported its US\$140/tonne forecast by referencing a Wood Mackenzie report, *Global Metallurgical Coal Long-Term Outlook H2 2019: Future Brings Indian Order After China Chaos*, which stated: “We think long-term prices will need to sit above USD\$150/tonne in real terms in order to meet our demand forecasts. Prices are expected to trough one year earlier in our outlook, reaching USD\$133/tonne in 2024... Despite some variation in trends, average prices in the long term are very similar to our previous update, reaching USD\$154/tonne in 2040” (CIAR 313, PDF p. 23).

[2848] CPAWS asked Benga about the price it expected to receive for its product from Grassy Mountain, as US\$140/tonne was a reference price. Benga said that this was an in-house commercial number that could affect customer negotiations. Benga stated that it has an experienced marketing team looking at exports to potential customers in Japan, Korea, Taiwan, India, Southwest Asia, South America, and Europe. Benga said that this does not preclude China as a customer, even though China is decreasing its requirements for imported coking coal. Benga added that it expected the growth markets to mainly be in Southeast Asia and India.

[2849] We have already assessed the magnitude of Benga’s predicted government revenues at the benchmark coal price of US\$140/tonne to be “low to moderate.” Table 23-2 indicates that, if the benchmark price of metallurgical coal in the future is closer to Benga’s low-price scenario of US\$100/tonne, then the magnitude of government revenues from the project would be extremely low. We find that Benga adopted a relatively optimistic coal price forecast for its economic analysis. A more conservative estimate of future coal prices would have resulted in lower estimates of future government revenues from the project.

Coal quality

[2850] CPAWS produced an independent report by Mr. Koliijn, an expert in metallurgical coal markets who assessed the likely coal quality that Benga would produce based on information provided by Benga. Mr. Koliijn’s report identified significant uncertainty about the project’s value because of the coal market’s high price volatility and the split between high- and low-quality coal in the three different Grassy Mountain coal seams. We discuss the technical details of the coal quality from the project in the chapter on coal mining, handling, and processing.

[2851] Mr. Koliijn stated that coal experiences high price volatility. He described how the supply and demand balance for metallurgical coal can shift rapidly. He suggested that this volatility could make it difficult for Benga to generate adequate cash flow to cover capital and operational costs as well as ongoing environmental mitigation and reclamation efforts.

[2852] CPAWS stated that the main customer for metallurgical coal would be the integrated steel industry, with the primary markets being Asia, Europe, and North and South America. CPAWS added that the Canadian metallurgical coal market competes with Australia, Russia, and Mongolia to supply Asia, with the U.S. and Australia supplying other markets. Competition and pricing of coal is driven by the specific processes used in metallurgical coal mining, the equipment used, the value of the products, and the characteristics of the coal deposit and attributes of the coal product.

[2853] In his report, Mr. Kolijn indicated that coking coals are benchmarked and priced on an international sliding scale. The report stated that a project needs certain conditions to become a producing mine. These include sufficient product value, financial resources for exploration, development and reclamation costs, and product development and customer acceptance. The report concluded that, with the project's expected variability in quality and inconsistencies in the published information, there is significant uncertainty in the future value of Grassy Mountain's product. Under cross-examination, Mr. Kolijn acknowledged that many things that could affect the final price of coal and that he did not have access to all of the information and analyses that Benga possesses on the quality of the coal the project will yield.

[2854] Benga noted that the coal market was complex and that it was difficult to provide a simple explanation of all the considerations that can affect the quality and associated value of coal. It agreed that various factors drive the value of a coal project. These factors are predominantly pricing and the value that a potential buyer puts on a project. Benga acknowledged that the coal market was not transparent, and that coal prices are typically negotiated between a buyer and a seller.

[2855] Benga stated that it has good-quality coal at the Grassy Mountain project. Benga acknowledged that the quality of coal in any operation will vary over time, but it does not expect major changes in quality over the life of the project. Benga stated that it would blend the different coal seams as they are "complementary," and that selling a product based on one seam would devalue the resource and "doesn't make any commercial or practical sense" (CIAR 762, PDF pp. 189 and 191). Benga stated that it could not publicly state what the coal on Grassy Mountain might be worth in the marketplace because it is currently in negotiations with potential buyers, making such information commercially sensitive.

[2856] Benga's counsel asked CPAWS' expert witness whether it was possible that Benga might have access to more recent, commercially sensitive information not placed on the public record. CPAWS' expert agreed this was possible. We note, however, that we can only base our evaluation on the material on the record, and Benga submitted information in its 2016 EIA on the anticipated quality of the coal from the site.

[2857] We find that Benga did not provide clear evidence, or a robust response, to counter the assertions from CPAWS that the quality of coal produced at the mine may decline in quality later in the mine life. If this turns out to be the case, the coal produced from the project would likely sell at a lower price, which would lead to lower government revenues from the project.

Impact of global climate change policies on metallurgical coal demand

[2858] Benga did not address in its application or during the hearing the impact that stringent climate change policies could have on the project. In its final reply argument, it noted that "There is no government policy in Canada aimed at curbing the use of steel in Canada or the import of goods manufactured with steel. Steel remains the world's most important engineering and construction material." (CIAR 4917, PDF p. 4). We note that Benga's argument equated demand for steel to demand for metallurgical coal.

[2859] Mr. R. Campbell, from the Coal Association of Canada, stated that Canada was the third-largest steel-making coal-exporting economy globally. He spoke of the high demand for steel-making coal and

noted that over the next ten years he expected the amount of coal exports from Canada to increase by more than 20 million tonnes. He also stated that Canadian steel-making coal products were among the highest in quality in the export market, allowing them to be used with lower environmental emissions by customers.

[2860] When asked how global actions and policies to reduce greenhouse gases may affect the demand for steelmaking coal, Mr. Campbell responded that he did not expect it to affect the demand on steel-making coal “at all.” (CIAR 750, PDF p. 237). He stated that Canada produced a good-quality product with high ethical mining standards that put it ahead of developing countries. Benga was also questioned whether global efforts to reduce greenhouse gas emissions would affect the demand for metallurgical coal. In response, Benga stated that there were opportunities for the steel-making industry to improve and recycle, but that these measures would not replace the need or demand for metallurgical coal.

[2861] The Crowsnest Conservation Society stated that carbon concerns had to be addressed, and that this issue was already driving technology in Europe. It noted that carbon costing was leading to a conversion to glass and electric-arc furnaces. Some participants, including the Eco-Elders for Climate Action, submitted information about emerging processes in the steel industry that are attempting to create steel using alternative approaches that do not involve metallurgical coal, such as the use of hydrogen.

[2862] The Livingstone Landowners Group’s expert, Dr. Joseph, submitted two scenarios from the most recent issue of the International Energy Agency’s annual *World Energy Outlook* that suggested that global coking coal (i.e., steel-making coal) production could decline from 936 million tonnes in 2019 to either 704 or 438 million tonnes in 2040, depending on various potential scenarios.

[2863] Benga pointed out that the scenarios spoke to production, not demand. But Dr. Joseph responded that it was reasonable to think that demand would accompany production, and that the demand numbers could be provided from the *World Energy Outlook*. In its final argument, Benga suggested that the scenario of declining production reflects a situation in which prices of metallurgical coal would increase.

[2864] We note that Benga’s argument about declining production triggering higher prices would only hold true if demand did not also decline. A decline in demand for metallurgical coal could be a reasonable expectation if the steel industry is successful in developing new technologies to reduce its greenhouse gas emissions over the next two decades. The information presented by the Livingstone Landowners Group provided an independent outlook that such a decline in production and demand for metallurgical coal could be possible.

[2865] We note that Benga’s final reply argument about the ongoing importance of steel did not address the issue of which technologies will be used to make steel over the mine’s life. It also did not address whether those technologies might evolve to become less dependent on metallurgical coal in order to reduce greenhouse gas emissions, in response to global efforts to address climate change.

[2866] Benga’s scenario analysis demonstrated that lower market prices for Benga’s product would materially affect provincial and federal government revenues. Benga focused its discussion of economic impacts on the results of the US\$140/tonne price scenario. However, Benga’s US\$100/tonne low-price scenario estimated that provincial tax revenue (in Canadian dollars) would decline from an average of \$19 million to \$6 million per year, federal tax revenue would decline from an average of \$28 million to

\$10 million per year, and provincial royalties would decline from an average of \$30 million to \$3 million per year.

[2867] We find that it is likely that Benga has overstated the positive economic impacts that would flow from the project, due to

- the likelihood that Benga overestimated the royalties that the project would generate;
- the potential for negative impacts on the tourism and recreational sectors;
- the potential for coal quality from the project to decline in later years of mine life, reducing market prices government revenues; and
- the potential for negative impacts on the demand for or price of metallurgical coal later in the life of the project due to global measures to reduce greenhouse gas emissions, general economic conditions affecting the market for metallurgical coal and steel, and competition from new technologies for steel-making.

[2868] Benga presented an overly optimistic economic analysis that did not adequately consider the downside economic risks, which are likely to negatively affect the project's economic viability, employment numbers, and payments to governments later in the mine life.

The federal and provincial governments should clarify economic analysis and methodology requirements in future impact assessments

[2869] Benga's socioeconomic impact assessment, as presented in its filings, hearing evidence, and final argument, was a standard economic impact analysis based on a widely used macroeconomic input-output model. Benga used this model to generate estimates for gross domestic product, taxes, labour, and employment benefits. Benga's economic consultant, Mr. Shewchuk, suggested that the terms of reference for the EIA require taking this approach with the economic analysis.

[2870] Both the Livingstone Landowners Group and the Coalition questioned the validity of Benga's input-output model and economic impact models. They suggested that a cost-benefit analysis would be a more appropriate tool to evaluate this project. Benga did not evaluate net socioeconomic effects. The Coalition said that Benga's approach to assessing economic impacts did not capture the project's negative effects. It said a cost-benefit analysis was needed to examine the flow of benefits and costs over time. Such an analysis would have compared economic scenarios with and without the project and used a discount rate to determine a net present value. The Coalition also noted that the financial model that Benga relied on for estimates of taxes and royalties was never entered into evidence.

[2871] The Coalition said that Benga used the final version of Alberta's terms of reference to guide its socioeconomic assessment, and that those terms of reference did not include "economic benefits." Rather, they required an assessment of impacts on regional and provincial economies. The Coalition noted that, by failing to require an assessment of economic benefits, the terms of reference created a significant analytical gap that caused considerable confusion.

[2872] We find that there are different approaches for conducting economic analyses of a project for an environmental assessment. No single approach is superior to another, though each can provide different

information to decision makers. We feel that it would be useful for proponents to conduct as broad a range of economic analyses as possible within the realm of generally accepted methodologies and using reasonable economic modelling assumptions. We heard that Benga considered the provincial terms of reference to direct it to conduct one type of economic analysis. We are curious as to whether that was the intention of this terms of reference, which was developed before we were appointed to conduct this review. We note that there does not appear to be clear guidance available from either the federal or provincial governments on the type of economic analysis that should be conducted as part of an EIA.

Recommendation 6: We recommend that the federal and provincial governments clarify the requirements for economic analysis for future provincial EIAs or federal impact assessments. Proponents should be required by the terms of reference to provide both an economic impact analysis and a cost-benefit analysis that allows decision makers to make informed decisions based on both types of economic information. We also suggest that governments develop guidelines on the methodologies and assumptions that should be followed by proponents in producing these future analyses. Governments may wish to review the *Canadian Cost-Benefit Analysis Guide* produced by the Treasury Board of Canada.

Different economists expressed varied views about what type of economic analysis should be conducted in a review. We agree that different types of economic analyses yield different kinds of information. We believe that decision makers in future impact assessments would benefit from access to these different kinds of information.

24. Reclamation and Closure Liability

Alberta's Mine Financial Security Program

[2873] Were the project approved, Benga would have had to comply with Alberta's Mine Financial Security Program. This program balances protecting Albertans from closure costs for coal and oil sands mines with maximizing industry's opportunities for responsible and sustainable resource development. Under this program, the approval holder is responsible for suspending, abandoning, remediating and reclaiming surface lands disturbed by resource development. They are also responsible for the care and custody of those lands until a reclamation certificate is issued.

[2874] The approval holder reports its own assessment of the cost to reclaim disturbed lands to the AER and provides financial security as required on an annual basis. Reports under this program are audited to ensure that the estimated reclamation costs meet the criteria and guidelines set by the province. The policy design of the Mine Financial Security Program is provided by AEP, while the AER is responsible for administering the program. The *Conservation and Reclamation Regulation* provides AEP and the AER with the ability to collect security from coal and oil sands approval holders. Financial security is submitted to the AER in the form of cash or letter credit.

[2875] Were the project approved, Benga would be required to post financial security equal to the amount of liability as of December 31 of the year the approval was issued. Full financial security would be required through the construction phase of the project and must be equal to the liability existing within the project boundaries at the end of the calendar year. When the mine is close to operational, Benga can submit a request to the AER to calculate its financial security using the asset-to-liability approach. This approach uses the following four financial security deposit types:

- **Base security deposit:** Used to secure the mine and plant if the mine was orphaned until another operator assumes responsibility for the project or until all infrastructure is removed and the site is reclaimed. A deposit of \$7 million would be required for this project as an export coal mine.
- **Asset safety factor deposit:** Ensures that all liabilities are fully funded in the event a company's assets (net cash flow from remaining reserves) fall below an acceptable level. If Benga's ratio of asset to liability falls below 3 to 1 due to falling commodity prices or decreased production, financial security is required to bring the ratio back to 3 to 1. Benga's asset value would be calculated using the following formula:

$$\text{Asset value} = \text{annual netback (\$/tonne)} \times \text{reserves (tonnes)} \times \text{forward price factor}$$

Liability is equal to all environmental obligations within Benga's coal permit boundary for the life of the project.

- **Operating life deposit:** Covers project risks that coincide with the end of a mine's operations. When the mine approaches 15 years from end of reserves (year 8 for the project), the financial security required will increase by 10 per cent of the liability until the mine is fully secured at six years from end of mine reserves.

- **Outstanding reclamation deposit:** Addresses the risks posed by a company that defers reclamation of its site until the end of operations. Financial security is required for each hectare of planned reclamation that is not completed. If Benga failed to meet its reclamation targets outlined in its mine reclamation plan, it would be required to provide a site-specific per-hectare financial security deposit.

[2876] The asset safety factor deposit and operating life deposit allow oil sands and coal-mine approval holders to use their reserves to secure their projects' liability. This allows industry to develop their project in the early life-cycle stages using capital that would otherwise go toward securing liability. In turn, industry creates jobs and other economic benefits for the public.

[2877] The AER would perform periodic audits on Benga to verify the liability assessment and ensure the amount of security held is sufficient to meet mine closure requirements at the end of mine life.

If the mine were to go bankrupt prior to end of mine life, the Mine Financial Security Program assumes that sufficient assets remain in the ground or that there is a combination of both financial security held by the AER and assets in the ground for another company to purchase and operate the mine until end of mine life.

Concern exists about reclamation and closure liability becoming a public responsibility

[2878] The Eco-Elders for Climate Action noted that Alberta is already struggling with billions of dollars in environmental liabilities from orphaned wells, and that this project could add additional financial burdens that would be passed on to future generations. The Crowsnest Conservation Society said there is recurring community concern over the process of site reclamation and restoration. They asked for clarity on assurances that reclamation and restoration work would occur regardless of the future circumstances the project or proponent may face. Specifically, the community wants assurances that sufficient financial resources are available—and accessible to responsible and credible public authorities—to complete reclamation and closure work should the proponent be unable to do so.

[2879] The Crowsnest Conservation Society said they understand Benga proposes to pursue progressive reclamation as the coal mine develops, that Benga will complete reclamation and site restoration to a suitable natural or equivalent state when the mine is closed, and that financial assurance covering closure is to be provided. However, they also said that this approach is equivalent to saying “trust us, the government has this looked after.” This sentiment is not very comforting “given the history of things like orphan oil and gas well legacies” (CIAR 551, PDF p. 15).

[2880] Accordingly, the Crowsnest Conservation Society provided the following recommendations to the panel:

- Demonstrate in fully transparent documentation from the outset and periodically verify/update that any financial arrangement is sufficiently funded. It is assumed that this would be funded directly by the proponent through cash contribution to a securely held fund and/or a surety instrument. This should reasonably and conservatively cover the actual cost of reclamation and restoration during operation and upon site closure.
- Establish that financial resources are held outside of the control of the permit holder and solely assessable by a creditable regulatory authority or trust fund holder.

- Ensure that all financial obligations and liabilities are transferred to successor owners as a condition of being able to assume ownership and operating rights under applicable permits, with provisions that the successor owner demonstrates financial capacity to meet these obligations.
- Ensure a mechanism exists to provide priority access to the proceeds of disposition of assets in the event the owner closes operations indefinitely and/or declares bankruptcy.

[2881] CPAWS submitted that the key to protecting Alberta’s mountains is the full enforcement of the polluter pays principle. They stated that Canadians and Albertans should not be subsidizing the destruction of Alberta’s wilderness for the benefit of the coal industry. A key task of the joint review panel is to determine the conditions required for the project to guarantee that the proponent pays the entire cost of environmental monitoring, maintenance, and clean-up. CPAWS is concerned that tomorrow’s orphan coal mines will add to the burden of the enormous orphan-well problem Alberta already faces.

[2882] CPAWS also stated that the recent history of coal mining shows that it is an environmentally catastrophic activity that does not bring long-term, or even medium-term, benefits to communities. They pointed to examples in the U.S. in which coal companies have employed various strategies to avoid reclamation, including: spinning off underfunded subsidiaries with legal responsibility for the regulatory obligations of mines, strategic pre-bankruptcy conduct, and bankruptcy to avoid fulfilling the environmental obligations attached to their mines. CPAWS suggested this was not the result of “bad actors,” but the result of lenient regulations and the interaction of environmental obligations with bankruptcy law. This has encouraged coal-mining companies to mine for longer, and to construct larger mines because they believe they can escape their regulatory obligations to the environment and mine workers. They said that Alberta has similar problems in its regulatory environment, and are concerned Albertans will end up with the same result.

[2883] The Livingstone Landowners Group’s expert, Dr. McKenna, stated that mines are rarely fully reclaimed at closure, and in many cases, responsibility for site management and final reclamation falls to the regulator. Regulators are typically reluctant to assume control of the land and carry out the necessary reclamation. More often, the site is put into a holding pattern, perhaps with some improvements to make it “safe and stable,” but rarely meeting the original permit conditions. To reduce these risks, Dr. McKenna stated that the panel should consider requiring a faster rate of progressive reclamation than that which is currently planned. He said the panel should ensure the proponent posts full financial assurance in the event of premature closure. As well, the regulator should agree that, in the case of default, the site will be reclaimed to permit requirements in a timely manner. While the proponent and regulator may resist these conditions, the Livingstone Landowners Group stated that such measures would significantly reduce the risks to local communities.

[2884] The M.D. of Ranchland stated that it is concerned with the reclamation of the Grassy Mountain coal project land and associated liabilities. Specifically, they are concerned about who will bear the responsibility of future liabilities, reclamation, and costs if Benga or a future owner is non-compliant. Given the lack of reclamation of the historic mining site—or of other industrial sites in Alberta—the M.D. of Ranchland has little confidence that promises of future reclamation will be kept or enforced. Rather, stakeholders, the district, and the environment itself will be left with the aftermath of the disturbance.

[2885] Following mine closure, Ms. Janusz submitted that the best-case scenario is that Benga will have fulfilled its reclamation commitments and that Grassy Mountain will become a manufactured landscape. The worst-case scenario is that Grassy Mountain will be cleared of vegetation and deforested, the mine will be constructed, and after a few years of production, operations will cease to be profitable and the project will be abandoned. Ms. Janusz argued that recent court decisions have been instructive regarding the risks that taxpayers would be assuming at both the provincial and federal levels should Benga's application be approved.

[2886] We note that Dr. McKenna's recommendations align with the fundamental principles of the Mine Financial Security Program:

- Lands available for reclamation should be reclaimed and returned to the province or landowner as soon as possible.
- The Mine Financial Security Program should provide appropriate liability protection for the public at a reasonable cost to industry.
- In the event of premature closure, the remaining reserves and economic return should remain favourable until financial security is required or the suspension, abandonment, remediation and surface reclamation activity starts.
- If the project were to be approved, prior to receiving their approval Benga would be required to provide security in the form of cash or a letter of credit for historical disturbance and current disturbance caused by exploration within the mine permit boundaries. The security deposit is held by the AER and is available if the approval holder is unwilling to complete reclamation work or has become bankrupt.

Benga will comply with the requirements of Alberta's Mine Financial Security Program

[2887] Benga acknowledged that several hearing participants expressed concerns about financial security to ensure reclamation of the project. Benga submitted that Alberta has addressed concerns arising from historical mining practices by requiring all proponents of approved coal mine projects to post financial security pursuant to the Mine Financial Security Program, and confirmed its commitment to comply with the requirements of the program.

[2888] Benga stated that as the timing of the mine approval is uncertain, it proposes to submit the required Mine Financial Security Program report at least 90 days prior to the expected mine permit approval. At that time, calculating the asset value associated with the project and the offsetting environmental liability will be possible. The amount of security and the manner of calculating the liability to asset relationship will be assessed by the AER and reviewed on an annual basis.

[2889] Benga committed in its conservation and reclamation plan, which it substantially updated in July 2019, to engage in progressive site reclamation as early as year 2 of project operations. Benga confirmed that land disturbed by the project will be reclaimed in stages through the project's lifetime, and Alberta will grant final reclamation certificates only after the landscape has been returned to an equivalent capability.

Participant concerns about the Mine Financial Security Program

[2890] CPAWS made the case that Alberta's Mine Financial Security Program has been the subject of reports from Alberta's auditor General for this reason: in the event a mine operator cannot fulfill its reclamation obligations, and no other private operator assumes the liability, the province may have to pay a potentially substantial cost for this work to be completed. A robust and responsible system to calculate and collect security from mine operators is therefore essential.

[2891] CPAWS said the program is insufficient to enforce the polluter-pays principle. They believe it cannot ensure the mining company will cover environmental clean-up costs. They noted that in 2015, the Auditor General of Alberta found that there is a "significant risk that asset values calculated by the department are overstated within the Mine Financial Security Program asset calculation, which could result in security amounts inconsistent with the MFSP objectives" (CIAR 555, PDF p. 5)

[2892] They also noted that the program uses an asset-to-liability approach that considers the resource value associated with an approved project as a financial asset that could be used to pay for mine clean-up. They submitted that this creates a vulnerability in which Alberta will not have sufficient security for clean-up if the estimated assets are over-valued, or if the value of the asset fluctuates suddenly. They argued that the asset-to-liability approach is generating the same problem that "self-bonding" did for coal mines in the U.S. When a company's financial position deteriorates and it is no longer eligible for self-bonding, or no longer deemed to have a sufficient asset-to-liability ratio in the Albertan case, it also lacks the financial resources to post surety or collateral bonds.

[2893] CPAWS submitted that if the project were to be approved, the panel would need to recommend that Benga be required to post full security under the Mine Financial Security Program. This would be required to protect the environment and the polluter-pays principle. This security should be calculated to account for all environmental liabilities of the project, and should include: a conservative estimate of the complete costs of necessary water, air, and soil monitoring; improvements, repairs, and maintenance of the saturated backfill zone; and other repairs and maintenance work.

[2894] CPAWS argued that Benga must not be permitted to rely on the asset-to-liability system of calculating liability, which is known to be unreliable, particularly when the value of metallurgical coal may collapse due to climate change policies or international economic downturns. They further argued that the price of coal is unlikely to be stable enough to keep the project viable for the expected life of the mine. Without the recommended condition for full security, the foreseeable ongoing environmental costs of the project will become a burden on Canada and Alberta that far outweighs the short-term economic benefits of the project. They said they are also concerned that the economic case for mountain-top-removal coal mines in Alberta relies on the expectation that the operator will be able to avoid paying the full costs of environmental cleanup.

[2895] The Coalition also raised concerns about a significant liability gap with the Mine Financial Security Program. They said that the mine will not generate the economic value that proponents assume, and Albertans will again be left responsible for cleanup cost, as seen in other scenarios in the past, including orphan wells.

[2896] Eco-Elders for Climate Action expressed concerns that the financial legacy of the project is likely to be negative. They said that extraction industries have a well-established record of walking away from their responsibilities once the money stops flowing, and that if hydrogen replaces coal in steel production, this does not bode well for maintaining a profitable mining operation for the longer term.

[2897] Under the Mine Financial Security Program, when a project is close to operational status, an approval holder can apply to use the asset-to-liability approach when calculating financial security. While this approach does view the resource as a financial asset, it is our understanding that the program does not specifically rely on the asset to pay for mine cleanup. Development and production of the reserves generate revenue for the approval holder as well as taxes and royalties for the provincial government.

[2898] Revenue generated by the project is expected to allow the approval holder to post additional security if and when required. If an approval holder were to unexpectedly go bankrupt, it is expected that there would be sufficient reserves remaining or a combination of financial security and remaining reserves for a buyer to take over and bring the mine to closure. If a new approval holder does not take over the site, then the financial security held can be used for abandonment, remediation, and surface reclamation of the site.

[2899] Regardless of the method Benga uses to calculate the amount of financial security posted, we find that the estimated liability must account for the costs required for all environmental obligations. This includes suspension, abandonment, remediation, and reclamation activities, as well as associated water, soil, and vegetation monitoring and ongoing operation of the saturated backfill zones. The assessed liability would be audited annually to determine if the estimated liability is sufficient to meet closure requirements.

Benga's estimate of liability and security under the Mine Financial Security Program

[2900] As part of a supplementary information request prior to the hearing, Benga was asked to provide a detailed cost estimate to suspend, abandon, remediate, and reclaim the mine from a point of maximum disturbance to the point of certification for the following categories:

- Project management
- Care and custody (include site security, suspension costs)
- Re-contouring
- Topsoil placement
- Subsoil placement
- Seeding
- Reforestation
- Reclamation and groundwater monitoring prior to certification decommissioning of the mine and plant site, including water treatment infrastructure and plant(s) construction, maintenance, operation, and surface water monitoring for the years until reclamation certification
- Reclamation and removal of water treatment infrastructure (before reclamation certification)
- Contingency

[2901] In its response to the information request, Benga estimated its mine reclamation cost to be \$59 554 105 at the end of year 15. A summary table (Table 5.33-8, CIAR 251, Tenth Addendum, Package 5, PDF p. 180) identifying specific tasks and estimated costs was provided to support the estimate. Benga said that at the end of year 15, the project will have disturbed approximately 1521 ha, and that at this point Benga predicted that 55.2 per cent of this area will have had some level of reclamation completed. Benga said it utilized basic activities, industry practice, assumptions, and costing from other mine sites to estimate its Mine Financial Security Program liability. Benga indicated that once the mine was operational, it would use site-specific assumptions to determine its reclamation cost estimate.

[2902] At the hearing, Benga provided an update to its mine reclamation cost summary in response to an undertaking requested by CPAWS. The purpose was to compare the estimated reclamation costs and required financial security at years 10 and 15. The updated table is provided here as Table 24-1.

Table 24-1. Mine reclamation cost summary at end of years 10 and 15

Task	Year 10 estimated cost (\$)	Year 15 estimated cost (\$)
Unreclaimed or disturbed	28 056 555	17 750 916
Levelling	301 382	2 112 530
Soil replacement ^a	75 043	218 015
Revegetation	153 500	408 525
Reforestation	0	0
Decommission	4 825 761	4 825 761
Conveyor and access road	896 225	896 225
Water management	1 066 944	1 066 944
Selenium management	736 179	736 179
Project management	4 125 000	4 125 000
Care and custody	15 400 000	22 000 000
Contingency	5 563 658.85	5 414 010
Total liability	61 200,247	59 554 105
MFSP – Asset-liability requirements ^b	12 240 049	41 687 873

^a Soil replacement volumes calculated at 30 cm replacement depth; conservation and reclamation plan states only 20 cm replacement depth.

^b Financial security calculated under the asset-liability calculation as per the Mine Financial Security Program guidance documents.

Source: CIAR 863, Undertaking 14.

[2903] While the estimated liability at the end of year 10 is approximately \$1.6 million higher than at the end of year 15, the estimated financial security required at the end of year 10 is approximately \$29 million lower. The large difference in security requirements is due to the percentage of the annual security deposit at the end of year 10 compared with year 15. This is discussed below.

[2904] We recognize that reclamation plans are somewhat conceptual at this stage in the regulatory process and may change as mine plans are refined and in response to operational challenges the mine may encounter. There may also be a tendency for operators to present plans that are overly optimistic with respect to the pace and success of progressive reclamation. We understand that the cost estimates provided are subject to a high degree of uncertainty at this stage of the project life cycle and would be

refined and updated annually as the project proceeds. Liability estimates for mine approval holders are audited following mine plan approval or amendments to verify that liability is properly estimated and sufficient security provided to meet closure requirements.

Mine reclamation cost estimates do not appear to represent costs for the entire life of the project

[2905] To calculate the required financial security using the asset-to-liability approach, Benga must use the estimated liability for the life of the project. If costs listed in the levelling, soil replacement, revegetation, and care and custody categories at year 10 are for the life of the project, they should be equal to or greater than the costs listed in year 15. However, they are not. As a result, the costs included in Table 24-1 appear to be the estimated liability expected to exist at that point in time and do not represent the amount of liability required to calculate financial security using the assets-to-liability approach.

[2906] While the total liability is likely underestimated from the asset-to-liability approach, the calculation of additional financial security held at year 10 and year 15 appears to be 10 per cent per year, the required amount for the operating life deposit. Benga did not include the base security deposit that amounts to an additional \$7 million.

[2907] The transition from full financial security to the asset-to-liability security calculation approach requires an application to the AER. Benga has indicated that the highest-quality coal with the smallest strip ratio is contained in seam 1 and will be produced in the first ten years of operations. If the project were to be approved, we would recommend that the AER consider Benga's asset value from the perspective of coal quality and extraction costs over time when evaluating Benga's application to use the asset-to-liability approach for calculating financial security.

[2908] If Benga were allowed to calculate its financial security using the asset-to-liability approach, the amount of security held in the early stages of mine operation would likely be less than the estimated liabilities expected to exist at that point in time. The period between initial production and year 8 (15 years from end of mine life) will have the greatest differential between financial security held and remaining liability. It is during this period that the asset value of the mine would be at its highest and security at its lowest. As the asset value declines, financial security will increase by 10 per cent annually starting at year eight, and at year 18 the mine should be fully secured.

Treatment costs for selenium and other contaminants are poorly understood

[2909] The potential need for long-term water treatment for selenium and other contaminants of concern is discussed in the chapter on surface water quality. Benga included a lump sum of \$22 million to treat selenium at year 15 of the project, and has indicated that treatment will be required until at least 2100. Specific details are not known but Benga said it plans to evaluate costs on an annual basis. Additionally, while Benga has considered the need for long-term treatment methods for selenium and other metals in addition to the proposed saturated backfill zones, it has not included these costs in its liability estimate as the need for these additional treatment measures is uncertain. However, Benga indicated it may need to include such costs in the future. The cost to treat selenium and other contaminants over the life of the project is therefore unknown at this time.

[2910] CPAWS said that the panel should not rely on Benga's estimates for remediation costs of the project. They suggested that Benga's experts were confused by the company's own material and had difficulty determining if the estimated reclamation costs included progressive reclamation. Benga's estimates of future reclamation and monitoring costs were likely to be major underestimates, particularly the costs of monitoring the selenium management system. CPAWS said the project cannot be made compliant with the polluter-pays principle because the environmental cleanup costs are likely to exceed the total profits.

[2911] While not directly comparable due to the long history of coal mining in the Elk Valley, Teck Resources Ltd. has spent hundreds of millions of dollars to date to address selenium issues associated with its mining operations in the Elk Valley and is forecast to spend hundreds of millions more. This suggests that if a selenium problem develops, it may be expensive to address. Moreover, as discussed in the chapter on surface water quality, we are concerned that the long-term water treatment needs for selenium and other contaminants of potential concern are not well understood. The model results show a significant increase in selenium concentrations in Blairmore Creek for several decades, in the absence of continued post-closure management of water.

[2912] Benga appears to not have explicitly accounted for any of the additional water treatment approaches that may be necessary for selenium as well as other contaminants. As a result, Benga may have significantly underestimated the costs required for long-term management and maintenance of water treatment infrastructure. If long-term treatment costs for selenium and other contaminants are not understood, sufficient financial security may not be collected under the Mine Financial Security Program. Were the project approved, approval conditions related to monitoring of treatment success with clear and measurable targets would need to be included in the *EPEA* approval for the project. These conditions would be required to define Benga's outstanding environmental obligations for the purposes of calculating financial security under the Mine Financial Security Program.

Benga is a limited liability corporation in Canada

[2913] The Livingstone Landowners Group noted that Benga is a wholly owned subsidiary of Riversdale Resources Limited (Riversdale), an Australian mining company. Riversdale is in turn wholly owned by Hancock Corporation Pty Ltd (Hancock), another Australian mining company. Benga was incorporated in 2013, the year before it submitted the project description for the project to the Agency and to the AER. Benga's principal asset is Grassy Mountain.

[2914] The Livingstone Landowners Group further noted that Benga frequently referred to Riversdale when discussing its ability to carry out the project. They noted that most of Benga's documents, including their written final argument, use Riversdale letterhead. The Livingstone Landowners Group argued that Benga is not Riversdale, and as a matter of basic corporate law, a parent and subsidiary are different companies, and that the parent, as shareholder of the subsidiary, is not liable for the subsidiary's debts and obligations. Benga has acknowledged that shareholders of limited companies do not take financial responsibility for the company in which they hold shares. The group also argued that, as Riversdale and Benga are separate legal entities with separate assets and liabilities, Benga cannot claim the benefit of Riversdale's marketing or other resources while Riversdale disclaims responsibility for Benga's current and future liabilities.

[2915] The Livingstone Landowners Group noted that the project under review is Benga's project, not Riversdale's, and that the panel should disregard the so-called "deep pockets" in Australia. This major project is being advanced by Benga, a relatively small, purpose-created, single-asset company, which creates significant risk. The Eco-Elders for Climate Action also expressed concern that Benga is a subsidiary of another organization and that this type of structure enables companies to avoid future responsibilities by limiting their exposure.

[2916] We recognize that limited liability corporate structures are commonly used in many areas of business, including the mining sector. These structures are used, as the name suggests, to limit the liability of the corporation and its directors. The use of limited liability structures is a legal and generally accepted practice. The Mine Financial Security Program allows Riversdale and/or Hancock to participate in the project and provide financial security. But unless a corporate entity is the approval holder, it would not have any direct responsibilities under the program.

Compliance with the Mine Financial Security Program would reduce, but not eliminate, the risk of unfunded closure liability

[2917] The fundamental principles and intent of the Mine Financial Security Program are risk-based. The program is intended to provide a balance between protecting Albertans from the closure liability of coal and oil sands mining if a mine approval holder cannot fulfill its obligations, while maximizing the opportunities for responsible and sustainable mining development.

[2918] Benga has not made a final determination as to whether it would elect to pay full financial security or elect to use the Mine Financial Security Program assets-to-liability approach. Benga is not required to choose one over the other at this time. Compliance with the program provides financial security throughout the mining life cycle, in response to a range of economic conditions and reclamation performance. This reduces but does not eliminate the risk of unfunded liability associated with coal and oils sands mining in Alberta.

25. Other Environmental Management Issues

[2919] Alberta's *EPEA* requires Benga to address a number of environmental concerns not covered in other chapters of this report, including waste management, potable water, and secondary containment for explosives and other materials stored at the proposed mine site. Benga would dispose of non-mining waste materials, including used tires, municipal solid waste, and domestic wastewater, primarily at off-site locations.

Environmental management plan

[2920] Benga proposed developing an environmental management plan that would include actions related to spill response to reduce the potential for and mitigate the effects of any spills. It suggested that if a spill occurs, it is highly probable that the water management system will contain the spill. Benga also indicated that this plan would address risks to westslope cutthroat trout and their habitat. Benga provided a summary of the plan to Indigenous groups such as the Piikani Nation. The proponent also outlined its intentions to consult with Indigenous groups to obtain their input and recommendations on environmental management.

[2921] Benga indicated that it would continue to develop the contents of its environmental management plan and a related construction environmental management plan as the project progressed through detailed design. It planned to have these plans largely completed prior to starting construction. Benga indicated that these plans would also form part of its consultation with Indigenous groups.

[2922] Both the environmental management plan and the construction environmental management plan would help address environmental risks associated with the project. As Benga would rely on these plans to help mitigate environmental risks, regulators would need to review and understand the content and scope of these plans. This would help ensure the adequacy of Benga's proposed mitigation measures in its finalized plans.

[2923] We agree that because not all of the project design details were available, developing these plans as the design progresses would be a reasonable approach to managing environmental issues and would confirm Benga's commitment to environmental planning. We also agree that these plans did not need to be complete at this stage of the review process. We also discuss Benga's environmental management plans in the chapter on accidents and malfunctions.

Waste management (non-mining waste)

[2924] Benga indicated that it expected to provide a waste management report that meets the requirements similar to other *EPEA* approvals for Alberta coal mines. Benga committed to finalizing a more detailed waste management plan and implementing it prior to construction and operation. This plan would mitigate the attraction of wildlife to waste materials and follow Alberta's *BearSmart Best Management Practices for Camps*. Benga also stated that its responsibility as a generator of waste was to classify waste and determine the proper disposal technique in accordance with the *Alberta Users Guide for Waste Managers*.

[2925] Benga provided details on its anticipated waste streams and their quantities. It did not plan to build a landfill on site, and would only use a local regional waste transfer station for domestic waste if necessary. Benga would send industrial waste to specialized off-site disposal and recycling facilities. It committed to train all employees and contractors that work on site to ensure they understand its waste management plan.

[2926] Benga indicated that it would recycle tires that have reached the end of their life or dispose of them at appropriate offsite facilities. While it proposed retaining some tires on the mine site for other uses, such as traffic safety barriers, it committed to not burying tires on site.

Domestic wastewater

[2927] Benga stated that domestic wastewater (sewage) would be produced in the construction camp, the mine site, the train load out area, and the explosives magazine. Benga's approach to the handling of domestic wastewater evolved through the review process. It originally planned to treat domestic wastewater from the construction camp and mine site in a domestic wastewater plant and release it to the environment, and dispose of sludge from the treatment plant off-site. However, releasing treated water can increase nutrient loading and affect water quality. Benga committed during the hearing to collecting all domestic wastewater from the mine site, the train loadout area, the explosives magazine, and any other project areas, and trucking this wastewater for treatment off site.

Secondary containment

[2928] Benga proposed to construct secondary containment to reduce the likelihood and impacts of any leaks from stored materials. It indicated that fuel depots and relocatable facilities (i.e., mobile fuel depots) would have secondary containment berms, and outlined what type of secondary containment would be employed for storage tanks. For waste storage tanks, Benga indicated that it would provide further details as the project design evolved. Secondary containment approaches would include berms and the use of double-walled tanks.

[2929] Benga also indicated that facilities to treat contact water (with elevated concentrations of selenium or other contaminants of concern) could require secondary containment for the storage of additional substances used in these treatment processes. It stated that it would adhere to provincial operational best practices for storage containment. Benga indicated that

- it would store the carbon source (methanol) for the saturated backfill zone in double-walled tanks on a concrete pad surrounded by a concrete berm;
- if a hydrated lime or acid treatment facility was built, secondary containment would follow standard design practices;
- if a metals treatment plant was built, secondary containment would be similar to that used for the carbon source; and
- if a gravel-bed reactor was built, Benga would provide secondary containment.

[2930] Benga also committed to complying with the secondary containment requirements in the *Guidelines for Secondary Containment for Aboveground Storage Tanks, Industrial Waste, and Wastewater Branch*.

Potable water

[2931] The facilities at the mine site would require potable water. Benga indicated that it planned to provide potable water for the mine site from a groundwater well for the construction and operating phases of the project. It would install a packaged water treatment plant at the coal-handling and processing plant to produce an average flow rate of 30 m³ per day.

[2932] Benga committed to designing potable water facilities that complied with the *Alberta Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems*. The Crowsnest Pass municipal water system will provide potable water for the train loadout facility. We note that, because potable water is outside the jurisdiction of the *REDA*, the potable water aspects would have required a separate application to AEP.

Explosives management

[2933] Benga proposed to construct an explosives preparation and storage facility at the mine site. It planned to contract a third party to deliver explosives and all related services to the mine. Benga also proposed to develop standard operating policies and procedures for mine operations, including those associated with the use of ammonium nitrate explosives. The storage and handling of explosives would comply with NRCan's *Guidelines for Bulk Explosives Facilities*. We discuss issues relating to explosives in the chapter on coal mining, handling, and processing.

[2934] Benga proposed to reduce the impact on surface waters of any nitrogen species from the explosive area by containing runoff within the water management system. Benga also indicated that any spills related to explosives would be contained with secondary containment, and the storage magazine would include effluent containment and sumps for effluent removal.

[2935] NRCan, which administers the federal *Explosives Act* and associated regulations, stated that the information provided by Benga regarding explosives was sufficient for the requirements under the *Explosives Act*. Benga would need to obtain any licenses or permits related to explosives from NRCan. Benga indicated that it would apply to the appropriate federal regulators for such permits and authorizations. We note that the design for an explosives storage area should address the risks associated with runoff from this area. Water management plans for runoff on the mine site would need to include the explosives storage area within their scope.

Conclusion

[2936] We did not make any findings on these topics because we are denying Benga's applications under the *Coal Conservation Act* and, by extension, we are not approving Benga's applications under the *EPEA*.

26. Accidents and Malfunctions

Emergency response plans are the primary mitigation measure for accidents and malfunctions

[2937] To prevent or minimize the environmental impacts of accidents and malfunctions, Benga indicated that it would prepare all emergency response plans, contingency plans, and standard operating plans and procedures in accordance with industry standards and provincial and federal regulations and guidelines. Detailed emergency response plans would be specifically designed for various sites and made available throughout the project area (plant, office complex, maintenance and light-duty machine shops, fuelling stations, and pit operations). These specific plans would rely on personnel training, leadership, and communication among team members and all involved parties.

[2938] Benga also indicated that emergency response plans would be developed for specific emergency situations and an emergency response team would be set up and trained to respond to fires, chemical spills, wildfires, and other emergencies. The team would also extricate trapped persons and care for injured persons. For information on emergency response plans for fire suppression on- and off-site wildfire control and prevention plans, see the chapter on the effects of the environment on the project. Benga acknowledged that details of the emergency response plans, contingency plans, and standard operating policies and procedures for all identified accidents and malfunctions would be further developed and finalized at the operational readiness stage for the project and continually reviewed and updated.

[2939] Benga stated that its employees would receive health, safety, and environmental training to ensure that they understand spill notification and clean-up procedures. Benga reported that as part of its environmental protection program, a health, safety, and environmental committee will ensure that the operation regularly evaluates, and if necessary, mitigates or eliminates adverse impacts on the environment. Benga confirmed that its health and safety committee had been established, but only to the scale of current operations. Benga indicated that when the project is fully operational, the scope and scale of both the current emergency response plan and health and safety committee will be broadened.

[2940] Some participants raised concerns about Benga's lack of engagement with other parties in the development of its emergency response plans. The M.D. of Ranchland concluded that Benga lacked concrete policies and procedures for the project, including emergency response, and had failed to adequately consult with them on critical issues. The Municipality of Crowsnest Pass and the M.D. of Ranchland stated that Benga should communicate with them and other relevant stakeholders in emergency management planning and share their emergency response plans.

[2941] ECCC recommended Benga consider how third-party contractors who work with the project would need to meet Benga's due diligence standards related to oil and hazardous material spill prevention, preparedness, mitigation, response, and restoration. ECCC also stated that there is a benefit to sharing emergency response plans with interested stakeholders and Indigenous groups.

[2942] During the hearing, Benga clarified its plans for consultation during future development of its emergency response plans, based on a final design of the project and anticipated facilities. Benga stated that it would work with the Municipality of Crowsnest Pass, the M.D. of Ranchland, and Indigenous groups on its industrial-scale project emergency response plans as detailed project designs become

available. Benga indicated that, during an emergency, communication and coordination of police, fire, ambulance, and other emergency services would be fundamental to an effective emergency response plan. Benga proposed emergency preparedness exercises to test those plans with all applicable participants, the Municipality of Crowsnest Pass, the M.D. of Ranchland, and provincial ministries.

[2943] Benga indicated that prior to the operational phase of the project, it would develop a notification plan with nearby Indigenous groups and other stakeholders to distribute information in the event of an emergency. Benga stated it intended to submit the completed, non-confidential version of the emergency management plan to the AER and other relevant parties, such as local municipalities, Indigenous communities and other stakeholders. Should an incident occur on site that poses a risk to public health or safety, or the environment, Benga stated that it would enact its emergency management plan, which will inform anyone affected.

[2944] We are satisfied that Benga has considered potential accidents and malfunctions in the design of the project. We recognize that Benga's emergency response plans are at the conceptual stage, but we are satisfied Benga will prepare these plans appropriately to guide its response to potential accidents and malfunctions. We acknowledge the concerns expressed by participants, Indigenous groups, and ECCC regarding the lack of detail on emergency response and spill contingency measures generally. However, we are satisfied with Benga's proposed approach to finalizing emergency response planning and coordination by engaging with nearby communities, including Indigenous groups, municipalities, and other governments.

Methodology used to conduct the assessment for accidents and malfunctions is acceptable

[2945] Benga assessed accident and malfunction scenarios associated with project facilities and activities for their potential to cause environmental effects. Benga included the following scenarios in its assessment: explosives accident; vehicle incident; train derailment; hazardous materials spills or releases; open-pit wall failure; waste rock disposal area failure; and water management dam failure. For each scenario, Benga provided a description of the accident or malfunction and a description of the project design measures and operational safeguards proposed to mitigate risk. Benga identified and described the interactions between each identified accident or malfunction and the potentially affected valued components. It identified the potential effects on the environment if mitigation measures and operational safeguards were ineffective.

[2946] Benga used a matrix to characterize the risk associated with the interaction between each identified accident or malfunction and the potentially affected valued components. Benga expressed the risk rating as a function of the likelihood of the accident occurring and the magnitude of the effects to the valued components. We find that the methodology Benga used to conduct the assessment for accidents and malfunctions is acceptable.

Benga's assessment of low- to medium-risk accidents and malfunctions is reasonable

[2947] Benga stated that potential accidents and malfunctions involving an explosives accident, a vehicle incident, a hazardous materials spill or release, and a trail derailment would be low to high in magnitude, but unlikely. If one did occur, it would be unlikely to interact with the surrounding environment or other

valued components. Benga assigned a low to moderate risk rating. Benga provided specific mitigation for each of these four accident and malfunction scenarios.

[2948] At the hearing, several participants expressed concerns about the potential effects of possible accidents and malfunctions related to a release of substances such as diesel fuel, flocculant, and ammonium nitrate–fuel oil. Benga stated it evaluated various products to be used in the project area and their potential risk of exposure to the general public and biota. Based on its review of three purchased products (diesel fuel, ammonium nitrate, and flocculants) and two mining by-products (coal dust/PM₁₀ and suspended sediment), Benga concluded that, with spill response and cleanup procedures in place, the products used in the mining of the project area would not affect the general public or biota. Benga stated that a spill response plan would be established as part of standard operating policies and procedures prior to mine operations to ensure a rapid clean-up and remediation of any hydrocarbon or chemical spill. Containment, absorption, reporting, and disposal would be incorporated into its plan.

[2949] Benga reported that blast sites would be largely contained by secondary containment systems and earth berms. Any spills related to explosives would be within these secondary containment systems, and the storage magazine would include a retaining wall for effluent containment and sumps for effluent removal. Benga indicated that in the event of an accidental spill or blasting accident related to ammonium nitrate–fuel oil, the facility would designate safe evacuation routes to designated muster points, contain all spills, and have the proper equipment available to quickly respond and clean up the spill. Site procedures would focus on minimizing storage and limiting access to only those personnel trained in the management of the facility. Benga noted that the industry is heavily regulated and it would be contracting out the work to experts.

[2950] We are satisfied that Benga has considered and assessed the environmental effects of the release of diesel fuel, flocculant, ammonium nitrate–fuel oil and other constituents of concern from spills or blasting accidents. The mitigation proposed by Benga is appropriate and we recognize that it is standard practice for emergency response plans to be refined as project designs are finalized. The types of accidental spills associated with this project are generally limited to the site of the incident and contained to the project footprint. We conclude that they are unlikely to result in adverse environmental effects with implementation of mitigation.

[2951] With respect to an explosives accident that may occur as a result of improper blasting storage and techniques, Benga stated that the Explosives Safety and Security Branch of NRCan administers the *Explosives Act* and associated permits. Benga stated that it would be following the branch's guidelines related to storage volumes and locations of explosives magazines and manufacturing areas. Benga also stated that a standard operating plan and procedures for drilling and blasting would be developed to include blast clearance limits, pit clearing procedures, and other safety requirements.

[2952] In the event of a coal spill from a train derailment near the rail loadout facility, Benga stated that it would capture and treat the water and whatever was spilled, whether coal or fuel from the train, before it reached the receiving environment.

[2953] Benga stated that a vehicle incident could occur, likely as a result of human error resulting in human injury or fatality. Benga stated it would implement mitigation measures such as driver safety and

training, avoiding the transport of material in hazardous conditions or conditions with limited visibility, setting of speed limits, and conducting regular vehicle and road maintenance to reduce the risk of a vehicle incident occurring.

[2954] We agree with Benga that the effects of an explosives accident, a vehicle incident, a hazardous material spill or release, or a train derailment would be limited to the project footprint or the immediate vicinity of the incident. Each of these accidents or malfunctions would be of short duration. We agree that these accidents and malfunctions would generally be low in magnitude, although the location, size of spill or vehicle load, and potential for fatality could result in a moderate- to high-magnitude effect on specific valued components in the immediate vicinity of the incident. We accept Benga's risk ratings of low to moderate for these scenarios. We find that the environmental effects will be prevented or minimized through the implementation of design standards and operation safeguards. Benga's adherence to regulatory and industry standards, in combination with the mitigation measures proposed by Benga, are appropriate, and sufficient to mitigate the risk of an explosives accident, a vehicle accident, a hazardous material spill or release, and a train derailment.

Potential for open-pit wall and waste rock slope failure is low

[2955] Benga stated that three scenarios had the potential for medium- or high-magnitude effects on a large number of valued components: open-pit wall failure; waste rock disposal failure; and water management dam failure. Although these scenarios were given a moderate risk rating, Benga noted that the likelihood of these scenarios occurring was rare or low.

[2956] With regard to open-pit wall failure, Benga evaluated the stability of the rock slopes for the Grassy Mountain open pit against two different failure mechanisms: structurally controlled failure mechanisms and rock mass strength failure. The evaluation determined that improperly designed pit walls or poor drilling and blasting practices could result in failures of the open-pit walls and cause safety concerns for mine personnel. Large failures, should they occur at the ultimate pit wall as opposed to an interim wall, could lead to an increased mine footprint.

[2957] In the event of a wall failure, Benga identified these potential effects:

- Dust is likely to be generated for a short duration and dissipate fairly rapidly.
- Noise levels would increase for a short duration and be partially attenuated by the walls of the open pit.
- Risks to human life could arise should mining occur below the failure zone.
- A slightly larger disturbance area may result with effects on soil and vegetation.

[2958] Risks to hydrology, water quality, or aquatic resources would be minor as it would still be possible to pump water collected at the toe of the failure zone to the nearest sediment pond for treatment before release back to the environment.

[2959] Although the magnitude of the environmental effect of an open-pit wall failure would be moderate, Benga stated that the likelihood of occurrence would be rare because of its design standards and mitigation measures.

[2960] As discussed in the chapter on coal mining, handling, and processing, Benga said that it will perform routine geologic mapping during excavation. This mapping will compare the orientation of the structure in the pit walls against what was expected in the geologic model, and look for the presence and orientation of faults in the pit walls. In that chapter, we find that the geotechnical design of the open pit walls is acceptable. The number of benches and their respective minimum widths meet the minimum target factor for safety. We expect that during mining operations Benga would monitor pit-wall stability, collect additional information, and implement mitigation measures if stability issues were identified.

[2961] In the event of an open-pit wall failure, we agree with Benga's characterization of the potential environmental effects. Notably, they would be of short duration and primarily related to the safety of personnel and the generation of dust. We accept Benga's risk rating of moderate for this scenario, and that the likelihood of open-pit wall failure would be rare. We find that the environmental effects would be prevented or minimized through the implementation of design standards. We also find that Benga's proposed mitigation measures are appropriate. Benga's adherence to regulatory standards and operating safeguards, in combination with implementation of mitigation measures, would be sufficient to mitigate the risk of an open-pit wall failure.

Waste rock disposal area slope failure

[2962] Benga's mine plan includes external rock disposal areas where it has indicated that a major slope failure could result in rock falling into either Gold or Blairmore Creeks, as far as 600 to 1100 m from the disposal area. Benga also noted that a significant runout of the south rock disposal area could affect the plant site and its operations.

[2963] In the event of such a failure, Benga identified these potential effects:

- An increase in particulate emissions in the form of a large dust plume for a relatively short period of time (hours), after which regional air quality would return to background conditions.
- Noise would be generated but return to background levels once movement ceased.
- Fish habitat and fish passage could be affected by rocks covering the stream, resulting in changes to riparian and instream fish habitat and potentially causing mortality.
- Water quality including total suspended solids, in the stream would increase significantly but would eventually dissipate.
- Contaminants, including metals, could leach out of the deposited rock should there be a long delay in cleanup measures.
- Vegetation, wildlife, and land use would all be negatively affected by activity in the disturbance area.

[2964] Benga confirmed that its waste rock disposal areas were designed to minimize the potential for slope failure. Benga stated that rock disposal areas would be equipped with monitoring devices to alert the mine operator of any potential issues. In the event of an issue, mitigation measures such as directing the rock to alternate disposal areas and lowering the height of each successive dump lift would be initiated. Benga noted that, as disposal areas are completed, they would be resloped to 23 degrees, which will help with disposal area integrity.

[2965] Given the large number of valued components that would be affected during failure, Benga assessed the magnitude of environmental effects as high. Benga assessed the likelihood of slope failure as unlikely, given the high factor of safety assigned to these disposal areas in the preliminary geotechnical assessment. After applying its risk criteria matrix, Benga concluded that the overall risk rating for waste rock disposal area slope failure is moderate.

[2966] As we describe in the chapter on coal mining, handling, and processing, we find the preliminary design of waste rock dumps used appropriate engineering and safety factors. Overall, we find that reasonable assumptions were made for material parameters, including the unit weight, friction angle, cohesion, and water table. We agree with Benga's interpretation of the results of the analyses that confirmed the adequacy of the provided slopes for the selected cross-sections, and boundary and foundation conditions for waste rock disposal areas.

[2967] We recognize the geotechnical design parameters used for the stability analyses were derived from limited field investigations, observations, and index testing. We accept that it is industry practice to collect additional data during operations and refine the design parameters as the project progresses.

[2968] We agree with Benga's characterization of the potential environmental effects that may result from a waste rock disposal area slope failure. We accept Benga's statement that, while the magnitude of effects resulting from such an event could be high, the likelihood would be rare. We therefore accept Benga's risk rating of moderate. We find that the environmental effects will be prevented or minimized through design standards, operating safeguards, and mitigation measures, such as installing monitoring devices in the rock disposal areas.

[2969] However, we find that there is a possibility that a waste rock disposal area failure will reach property not owned by Benga, and for the potential effects of a failure to extend to these properties even if the rocks from the failure themselves do not.

Potential for water management dam failure is rare but consequences could be significant

[2970] Benga indicated that all water from the open-pit dewatering and surface runoff programs would be captured on the mine site in four sediment ponds (west, east, northeast, and plant site sediment ponds). This water would be treated to remove total suspended solids and released back into Gold and Blairmore Creeks. In addition, three surge ponds (northwest, southeast, and raw water surge ponds) would be constructed to collect potentially selenium-enriched water that would require on-site attenuation before being released back into the environment. These three ponds would continue to pump water into the saturated zones until selenium levels reached acceptable limits.

[2971] Benga stated that a fourth surge pond (southwest) would be used to collect water from the initial mining area and pumped to the raw water surge pond or the west sediment pond for treatment prior to release into receiving waters. Each of the eight ponds will have a containment dam between 8.5 m to 23 m in height. In relation to dam safety, Benga stated that sediment and surge ponds would have emergency overflow spillways sized to convey the inflow design flood, which was estimated for the largest catchment area reporting to each of the ponds during its operating life.

[2972] The technical details of these dams, including size, volumes, and dam classification ratings, are discussed in the chapter on coal mining, handling, and processing. Dam safety and design are also discussed in the chapter on surface water quantity and flow.

[2973] Benga identified a variety of factors that could contribute to the catastrophic failure of one of the water management dams, including

- overflow as a result of flooding, pump failure, or a combination of the two;
- slope failure as a result of engineering design or geological/tectonic instability;
- foundation failure as a result of shear stress;
- liquefaction; and
- erosion as a result of heavy rainfall or subsurface erosion through seepage along pipes.

[2974] Benga stated it would develop an emergency response plan detailing the necessary procedures to be implemented in the event of a failure during the construction and operation of the dams, including any failure of a water management dam structure. Benga stated that it would review the emergency response plan and update it throughout the construction and operations phases of the project to incorporate changes in site conditions, ensure continual environmental improvement, and if deemed warranted by monitoring implement adaptive management.

[2975] Benga stated that qualified staff would be in place to implement the emergency response plan. Benga indicated that it would maintain an inventory of surface water users and other potential users along Blairmore and Gold Creeks and on the Crowsnest River for a reasonable distance downstream. If an incident did occur, Benga would notify communities downstream of the project. Benga noted it would contact as many of the users as possible by telephone and simultaneously dispatch employees to contact nearby water users in person. It would also post signs at recreational areas such as campgrounds to warn of any water quality issues. Benga committed to conducting an annual exercise to test the accuracy and effectiveness of its notification protocols, and to keeping water users updated. Benga also stated it would implement site-specific standard operating policies and procedures to prevent a failure.

[2976] Benga stated the primary method of preventing catastrophic failure of a water management dam is through engineering design and site selection, including appropriately sized pond capacities, discharge pipes, and emergency overflow spillways. Benga indicated that other mitigation measures involving sediment and surge ponds would include routine inspections.

[2977] Benga acknowledged that the failure of a dam could result in the release of large quantities of untreated water and trapped sediment from one or more of these ponds into the receiving environment. It also stated that the magnitude of the impact on the environment would range from moderate to high, depending on the quantity of water being stored in each pond, how many dams fail simultaneously, the height and location of each dam, the duration of the release, and whether the failure is of a surge pond containing selenium-enriched water or a sediment pond.

[2978] In the event that water is released from one of these ponds, Benga indicated that the potential effects to the aquatic environment could include

- an increase in water volume that results in flooding and altering of fish habitat;
- a decline in water quality resulting from an increase in total suspended solids, which may result in adverse effects on aquatic life, including damage to fish gills and interference with feeding and egg incubation;
- a decline in water quality resulting from the release of selenium-contaminated water, which may result in adverse effects on fish and fish habitat including sediment quality, benthic invertebrates, and aquatic vegetation;
- scouring and erosion of soils and vegetation in the immediate vicinity of the release; and
- safety concerns for the public and wildlife in the immediate vicinity of the water release.

[2979] Benga noted that, in the event that water is released from one of the surge ponds, the magnitude of the environmental effect would be moderate to high, depending on the size, location, and duration of the release.

[2980] Benga stated that any release is likely to last for less than two weeks and be local in extent, and that the contaminated water would be flushed downstream and get diluted to background levels quickly. However, Benga noted that Gold and Blairmore Creeks ultimately drain into the Crowsnest River. And it stated that releases from water management ponds would likely exceed established water quality guidelines. The downstream receiving environment would be monitored as part of a water quality monitoring program. Benga did not provide any quantitative modelling or information to support its assessment of effects. Benga stated that it would remediate any damage as a result of scouring and erosion as soon as possible after an event occurred, and committed to restoring any terrestrial and aquatic habitat damaged by a dam or spillway failure.

[2981] Benga initially stated in the EIA that the “worst case” scenario would involve a release of large quantities of untreated, selenium-contaminated water from the surge ponds into Gold Creek. Benga stated that Gold Creek also flows through private property, is a drinking water source for eastern communities, supports wildlife, and provides habitat for the *SARA*-listed westslope cutthroat trout. Benga did not evaluate this worst-case scenario in the EIA. Benga later clarified that the selenium-contaminated water would also flow into the downstream receiving environment, which includes private and municipal properties, and drain into the Oldman Reservoir, which is a water source for communities.

[2982] In response to a request for further information from the Agency on this worst-case scenario, Benga identified the failure of the raw water pond more specifically as the worst-case scenario. Benga stated that the raw water pond is the largest dam structure, with a height of 23 m, a length of 330 m, and a storage capacity of 1 200 000 m³. Benga stated that the raw water pond dam consequence classification was raised from high to very high during engineering design workshops. Benga noted that this was the equivalent of raising the accident and malfunction magnitude classification from high to severe. Benga implemented additional design features into the dam design based on this rating, and stated that with these updates, the likelihood of dam failure is rare.

[2983] Benga stated that although the effects of a water management pond failure would be reversible, both Blairmore Creek and Gold Creek are classified as class B habitat under the *Water Act* Code of Practice maps, and Gold Creek is listed as critical habitat under the *Fisheries Act* and *SARA*. As a result, the magnitude of the effect for fish and fish habitat would be considered high. Benga committed that, in the event of a raw water pond dam failure, it would implement a monitoring plan to ensure proper reclamation and monitor recolonization of affected fish habitat in Gold and Blairmore Creeks. As a result of proposed implementation of mitigation measures, such as an engineering design, site selection, routine inspection, and implementation of emergency response plans, Benga considered a water management dam failure a rare probability. After applying its risk criteria matrix, Benga concluded the overall risk rating for water management dam failure to the aquatic environment was moderate.

[2984] Benga indicated that the effects on wildlife, human health, and public safety from a worst-case scenario, or any water management dam failure, would be mitigated by immediate implementation of its emergency response plans. Benga assessed the magnitude of these effects as low, and the likelihood as rare. After applying its risk criteria matrix, Benga concluded the overall risk rating for water management dam failure to wildlife, human health, and public safety was low.

[2985] Benga stated that the detailed dam design would be in accordance with the *Alberta Dam and Canal Safety Directive*, and follow the Canadian Dam Association guidelines. During the hearing, Benga stated it would adhere to the regulatory requirement to submit detailed designs, including final design criteria and calculations for each dam, within the dam safety applications to the AER for approval as part of the Canadian dam safety application process.

[2986] ECCC recommended that Benga ensure that it was prepared for a worst-case accident scenario. ECCC stated that emergency response plans should assume that a major incident is not only possible, but likely to occur during the lifespan of the project. ECCC noted that final emergency response plans should demonstrate an ability to prevent, prepare for, respond to, and recover from all plausible accidents and malfunctions.

[2987] The Timberwolf Wilderness Society expressed concerns regarding the lack of mitigation measures proposed by Benga for a potential dam breach. They took issue with Benga's characterization of what they viewed as good engineering practice as a mitigation strategy. In their closing argument, they reiterated these concerns, highlighting that neither inundation studies nor detailed engineering for the dam were submitted as evidence. They also indicated that Benga's hearing response stated that it "would have in place an 'appropriate' emergency response plan but confirmed that those emergency response plans have not been prepared and are not in evidence in the Proceeding" (CIAR 1346, PDF p. 18).

[2988] At the hearing, we asked Benga about potential public safety issues that could arise downstream from a release during a dam failure. Benga noted that the next step in dam design and approval is the completion of an inundation study that would look at the volumes of water, silt, and any other material that would be released during any event. Benga indicated that this study would be done as part of its application under the *Alberta Dam and Canal Safety Directive*, and it would drive the design standard for the dam structure itself. Benga stated that this would be the next step in the approval process and would be carried out in conjunction with the AER so a design standard could be agreed upon.

[2989] We agree with Benga's characterization of the potential environmental effects that may result from a water management dam failure. We accept Benga's statement that the likelihood of a water management dam failure occurring would be rare. Although not explicitly stated by Benga, we note that if the magnitude was adjusted to severe, and the likelihood was rare, Benga's risk criteria matrix indicates that the risk rating would be high. We find that the risk rating for the failure of a water management dam scenario is high, as opposed to moderate.

[2990] We accept that detailed or final engineering designs for dams are not required at this stage of the review. Prior to constructing any structure, including in-pit structures, that meets the definition of a dam under the *Alberta Water (Ministerial) Regulation*, Benga is required to submit detailed engineering plans to the AER for approval. We accept Benga's commitment that all such structures would be designed and constructed to meet the most recent version of the Canadian Dam Association guidelines and the *Alberta Dam and Canal Safety Directive*. We find this is an appropriate mitigation measure to minimize the risk of potential dam failures.

[2991] We accept Benga's assessment that proper design and implementation of mitigation measures make the likelihood of a water management dam failure rare. Despite that, we find there would be little time to warn downstream communities should a sudden or catastrophic failure occur, and there may be little Benga could do to reduce the effect on the downstream communities and the environment.

[2992] We recognize that Benga's emergency response plan for a water management dam failure is at the conceptual stage, and that detailed or final engineering designs for water management dams are not required at this stage of the review. We also acknowledge the concerns expressed by participants. We agree with ECCC's recommendation that Benga prepare its emergency response plans to prevent and respond to a worst-case accident and malfunction scenario.

[2993] If the project was approved, Benga would be required to further demonstrate its ability to prevent, prepare for, respond to, and recover from all plausible accidents and malfunctions, particularly the worst-case scenario. A detailed design report, including final design criteria and calculations for each dam, would need to be provided to the AER prior to construction as part of the *Alberta Dam and Canal Safety Directive* application process. An emergency management plan and emergency preparedness plan, including inundation maps and other maps related to emergency scenarios and planning, would be required to support the applications to construct new dams. This would occur as part of a subsequent regulatory process, if the project were approved.

[2994] We find that while it is unlikely, the release of selenium-enriched waters following failure of a dam could result in a high-magnitude effect on surface water quality, westslope cutthroat trout, and other valued components. We received little information on the size of potential releases and extent of inundation areas and downstream effects resulting from one or more dam failures. Based on the information we did receive, we conclude that any dam failure would result in residual effects on fish, fish habitat, and surface water quality. We do not have the quantitative information necessary with respect to specific valued components to further characterize this residual effect.

[2995] We find a worst-case dam failure at the raw water pond or multiple water management structures in Gold Creek would result in a significant adverse effect on westslope cutthroat trout. We are unable to determine how far downstream water quality would be affected, or how far the resulting effect on westslope cutthroat trout or other fish species would extend. We recognize a robust design and regulatory system is in place to minimize the risk of dam failure, as well as additional mitigation proposed by Benga. Given this, we find that a significant effect is unlikely.

Risk of the project triggering a failure on Turtle Mountain is very low

[2996] Turtle Mountain is approximately 12 km south of the proposed project along the Turtle Mountain thrust fault area. On April 3, 1903, a rockfall from Turtle Mountain covered the town of Frank, Alberta, killing a large number of people. The caved face of Turtle Mountain has long parallel fractures, which pose a persistent hazard for continued rock failure. Below Turtle Mountain are railroad lines, gas pipelines, and the main provincial highway.

[2997] The Alberta Geological Survey (AGS) was tasked in 2003 with establishing an early warning monitoring system for Turtle Mountain. In 2005, the AGS initiated the Turtle Mountain Monitoring Program, consisting of a monitoring system and an associated alert system that ensure the safety of residents living in the Municipality of Crowsnest Pass by providing advanced warning of mass movements on the mountain. The AGS stated that they work with leading experts on landslide monitoring to provide a near-real-time remote evaluation of large mass movements on the mountain, as well as the rate of the movement.

[2998] This monitoring system is integrated with a four-stage alert system (green, yellow, orange, and red) that indicates a low- to high-level risk of imminent failure and is incorporated into the Alberta Emergency Management Agency's emergency response protocol for public safety response. At present, Turtle Mountain is in a low-risk (green) state of large rock block displacement and has remained in that state since 2005. The role of the AGS is monitoring and notification. Emergency response is the responsibility of the Municipality of Crowsnest Pass and the Alberta Emergency Management Agency.

[2999] No studies completed or identified by the AGS evaluated or quantified the effects of seismic loading (for example, earthquakes or shaking from nearby blasts or noise) on the slow-moving rock blocks, rocks perched on the cliff face, or the stable parts of the mountain. Evaluating the effects of seismic loading/vibration/shaking on the mountain face requires specialized expertise in geotechnical engineering that is unavailable to the AGS. NRCan confirmed it was not conducting active research or monitoring related to Turtle Mountain at this time.

[3000] In response to questioning at the hearing, the Municipality of Crowsnest Pass provided a map illustrating the boundaries of the provincially and municipally regulated restricted development areas on, and at the base of, Turtle Mountain. Several participants expressed concerns that the project's blasting operations could trigger another rock avalanche or landslide at Turtle Mountain. They stated these activities could lead to seismic waves affecting the stability of the site, which is situated near private properties, near Highway 3, and near the Canadian Pacific Railway line. Ms. M. Field indicated that regardless of the project's activities, Turtle Mountain's continuing instability is unknown. This instability adds a risk to an already dangerous, unpredictable situation. Ms. Field noted that given the mountain's current rate of movement, it could be a long time before another rock avalanche occurs, unless the area

experiences an earthquake or other significant seismic event, in which case the mountain could fail without warning.

[3001] Benga committed to adopting measures to prevent any possible project-triggered stability concerns at Turtle Mountain, including the latest blasting equipment, products, and technology appropriate for construction and operation requirements. In response to our questions related to Turtle Mountain, Benga pointed to the accuracy of modern blasting technologies and blast efficiency, noting that the size of a blast can be fine-tuned to manage both blast noise and vibration to agreed-upon criteria. Benga also indicated that it will work closely with the AGS to ensure real-time monitoring is in place. Benga stated this monitoring will ensure it understands the relationship between blast size and design and the vibrations measured on Turtle Mountain, so it can develop appropriate benchmarks and refine its blasting practices.

[3002] We accept that Turtle Mountain has been in a low-risk (green) state for large block rock displacement for more than 15 years. We find the risk of project-related blasting or other activities triggering a failure on Turtle Mountain to be very low. We acknowledge that the AGS, through the Turtle Mountain Monitoring Program, continues to monitor large block movements to allow for early warning of rock movement that may be of concern, including any movement triggered by project-related blasting.

[3003] We recognize that the Municipality of Crowsnest Pass has implemented restricted development areas at Turtle Mountain, in addition to provincially regulated restricted development areas. We find that, in the unlikely event that Turtle Mountain experiences rock falls, rock movement, or large rock-block displacement resulting in a failure, the municipally and provincially regulated restricted development areas would act to prevent or reduce damage. If the project was approved, Benga would be required to work with the AGS to ensure ongoing monitoring and reporting.

[3004] We present further information on the project's sensitivity to geophysical and geotechnical hazards and blasting methods in the chapter coal mining, handling, and processing and the chapter on effects of the environment on the project.

27. AER Public Interest Determination and Decisions

[3005] Benga submitted application 1844520 under section 10 of the *Coal Conservation Act* for a mine permit and under section 11 for mine licences to construct, operate, and reclaim an open-pit mine and three rock disposal areas. Benga also submitted application 1902073, which updates and amends application 1844522 under section 23 of the *Coal Conservation Act* for approval to construct and operate a new coal-handling and processing plant, as part of the Grassy Mountain Coal Project. The project would also include a rail loadout facility in the town of Blairmore, a covered conveyor system to transport coal from the mine to the loadout facility, and other infrastructure necessary to operate the mine. Benga proposed to start construction in 2021 and begin producing coal in 2023.

[3006] The project is located in the eastern slopes of the Rocky Mountains, on a site where coal mining occurred in the past but has been absent for many decades. The mine footprint is bounded on the east and west by streams that are home to westslope cutthroat trout, which is a fish species native to Alberta that has witnessed dramatic declines in its habitat and population numbers over the last century. These fish are listed as threatened under the federal *SARA*, and also protected under Alberta's *Wildlife Act*.

[3007] In support of its *Coal Conservation Act* applications, Benga provided its preliminary mine plan, a preliminary plan for the coal-handling and processing plant and associated infrastructure, and an environmental impact assessment (including a socioeconomic impact assessment). These submissions were intended to satisfy the requirements of all relevant provincial regulations and directives, as well as the terms of reference of the joint provincial-federal environmental assessment.

[3008] Benga selected conventional, commercially proven technology to mine, process, and handle coal and waste rock. Benga also provided preliminary geotechnical design of earthen structures, including the pit walls, external rock disposal areas, and water management structures. Benga submitted information and proposed mitigation measures to ensure the safe and efficient operation of the mine, processing plant, rail loadout, and associated infrastructure. It proposed to finalize an emergency response plan following project approval, and to collaborate with key stakeholders and Indigenous groups.

[3009] Benga noted the need to manage water associated with the project, both for use in the mine operations, as well as the flows and potential for contamination in the receiving waters downstream of the project. It applied to obtain new and existing water licences under the Alberta *Water Act*, and submitted plans for a water management system, with a focus on mitigating releases of selenium from the project.

[3010] Benga submitted that its proposed water management system was based on well-understood treatment principles for the removal of selenium from effluent waters, and identified a similar water treatment system which had been operating as a large-scale pilot for the past few years at Teck's metallurgical coal mines in the Elk Valley of British Columbia. It suggested that the results achieved by Teck indicate that a similar system at Grassy Mountain would be effective. Benga's modelling results demonstrated that the water management system at Grassy Mountain would need to be extremely effective at removing selenium to avoid significant adverse environmental effects.

Public interest determination

[3011] The mandate of the AER under the *REDA* is to provide for the efficient, safe, orderly, and environmentally responsible development of energy resources in Alberta. The AER achieves this through directives, bulletins, orders, and other regulatory instruments. However, meeting those AER requirements alone may not ensure that a proposed development is in the public interest. Section 3 of the *REDA General Regulation* requires us, as a panel of AER hearing commissioners deciding *Coal Conservation Act* applications, to consider: (a) the social and economic effects of the energy resource activity; (b) the effects of the energy resource activity on the environment; and (c) the impacts on a landowner as a result of the use of the land on which the energy resource activity is or will be located.

[3012] We must also consider section 4(c) of the *Coal Conservation Act*, which sets out that one of its purposes is to ensure the orderly, efficient, and economic development of Alberta’s coal resources in the public interest. Section 8.1(2) of the *Coal Conservation Act* gives further direction that, in considering an application, we shall not grant a permit, licence, or approval under this Act unless, in our opinion, it is in the public interest to do so. Section 4(e) of the *Coal Conservation Act* states that a purpose of that Act is to assist the Government to control pollution and ensure environmental conservation in the development of the coal resources in Alberta.

[3013] No step-by-step guidance is available to evaluate the public interest. However, as we find in many submissions to the review process, there is widespread general understanding that evaluating the public interest involves comparing and weighing the potential positive and negative impacts that a project might cause across economic, environmental, and social domains. Evaluating the public interest also requires considering the distribution of these positive and negative impacts among the various individuals and groups that constitute “the public.”

[3014] Benga’s final argument reflected this concept of considering positive and negative effects to determine the public interest. It juxtaposed the projected positive economic impacts with the lack of significant negative impacts: “Benga has proposed a project that will deliver economic development at the local, regional, and national levels.... The robust review ... has shown that the project will not cause significant adverse environmental effects, taking into account Benga’s proposed mitigations” (CIAR 962, PDF p. 8). Benga therefore concluded that the Grassy Mountain project serves the public interest.

[3015] Other participants also adopted the concept of weighing positive and negative effects to determine the public interest, but they arrived at a different conclusion. For example, the Coalition put it succinctly in its final argument: “There are no terms or conditions under which the Project benefits could ever outweigh the Project’s costs” (CIAR 1339, PDF p. 8).

[3016] In making our public interest determination, we considered the social, economic, and environmental effects of the project. We also considered impacts on constitutionally protected Aboriginal and treaty rights, which are a unique component of the public interest determination. Those expressing an interest in the project were diverse and had unique interests and needs, which were sometimes conflicting. In this chapter, we summarize the diverse views of the groups that constitute “the public”: Indigenous groups; nongovernmental organizations; municipal, provincial, and federal governments; local citizens in the Crowsnest Pass and surrounding areas; and citizens of Alberta.

Indigenous groups

[3017] The project would be within the traditional territory of a number of different Indigenous groups, but particularly the First Nations of Treaty 7. The project will have negative impacts on the cultural heritage and the use of the area by Indigenous groups for traditional purposes. We determined that the impacts on cultural heritage are likely to be significant for some groups. The ACO advised us that consultation was adequate with all the First Nations of Treaty 7. The ACO did not require Benga to consult with any other Indigenous groups.

[3018] Indigenous groups who are the most affected by the project (Treaty 7 First Nations and the Métis Nation of Alberta – Region 3) have signed agreements with Benga and withdrawn their objections to the project. This includes all of the Indigenous groups for which we found that the project will likely result in adverse and significant effects. Some of these groups expressed support for the project, and indicated that the implementation of the agreements will lead to positive effects in their communities. Other Indigenous groups indicated that they have resolved their project-specific concerns through agreements with Benga. Benga stated that it would continue to work with Indigenous groups to address project concerns through implementation of agreements. Stoney Nakoda Nations expressed conditional support for the project—if we determine that the project can proceed in a manner that will protect the environment while providing economic and social benefits, and if Benga fulfills its commitments.

[3019] Because the agreements between Benga and Indigenous groups are private and were not shared with us, we do not know what measures they contain. However, as some Indigenous groups affected by the project have a positive view of their agreement and have withdrawn their objections, it is reasonable to assume that these agreements include measures that address aspects of the social, environmental, and economic interests of the different Indigenous groups.

[3020] Two other Indigenous groups that participated in the hearing, the Ktunaxa Nation and Shuswap Indian Band, reported that they had not concluded agreements with Benga to address their concerns about the project. However, we heard from these groups and Benga that discussions about possible agreements were either ongoing or that the parties were open to such discussions. We find no significant adverse effects from the project are expected on these Indigenous groups.

[3021] We respect the ability and right of Indigenous groups to determine for themselves how best to balance the positive and negative impacts of the project on their use of the land, their cultural practices, and the practice of their rights.

Nongovernmental organizations

[3022] A number of nongovernmental organizations participated in the hearing, some of which included local residents in their membership. These organizations generally argued that the project would not be in the public interest, and that the economic benefits of the project would not be significant. They suggested that Benga had overstated the positive impacts while ignoring the negative economic implications for other important sectors, such as tourism and recreational activities. They also identified serious concerns about the environmental impacts of the project on valued components, such as water quality and fish, air quality, and vegetation. Many of these organizations also expressed concerns about long-term liabilities associated with the mine after closure, and whether these liabilities might fall to future Alberta taxpayers.

[3023] For example, the Livingstone Landowners Group told us that “the adverse environmental effects of Benga’s proposed mountaintop removal, open-pit coal mine are significant. The question is, then, are they worth it? [Livingstone Landowners Group] submits the answer, clearly, is No.” (CIAR 1351, PDF p. 101, It later added: “... the Grassy Mountain project is not in the public interest, having regard to its social and economic effects and its effects on the environment and landowners” (CIAR 1351, PDF p. 120).

[3024] Similarly, CPAWS suggested that the panel should conclude that the project is not a “reasonable balance of environmental effects and economic benefits” (CIAR 1347, PDF p. 3). It argued that “Although CPAWS considered proposing a list of conditions required for [the project], CPAWS does not believe any set of conditions would be sufficient to allow the [project] to serve the public interest.” (CIAR 1347, PDF p. 3 and p. 33).

[3025] Benga disagreed with the views expressed by these nongovernmental organizations, stating that the implementation of its proposed mitigation measures would prevent significant adverse environmental effects from the project. It also stated during the hearing that providing approximately 300 well-paying jobs for the region would be a significant positive impact, and that the project would enhance tourism-based economic activity in the region. Benga indicated that it expected demand for metallurgical coal to produce steel would be strong in the future, and described the project as an opportunity for Alberta and Canada to benefit economically. “Through Benga’s local hiring practices, implementation of modern mining technologies, and plans for progressive reclamation and the restoration of previously disturbed land, the Grassy Mountain project serves the public interest” (CIAR 962, PDF p. 8).

[3026] The Coal Association of Canada, which represents the coal sector in Canada and includes Benga as a member, spoke in favour of the project and the economic benefits that would flow from its approval.

Municipal, provincial, and federal governments

[3027] We heard conflicting views from the most-affected municipalities.

[3028] The M.D. of Ranchland would contain most of the project footprint, and Benga confirmed that it expected to pay the district about \$1 million per year in property taxes. Yet the M.D. of Ranchland told us that they are firmly opposed to the project. They indicated that the district “is not concerned about the economic ‘advantages’ of the coal mine, but instead the M.D.’s primary concern is preserving a unique way of life within its borders.” They further told us that “Benga’s position that the region needs ‘investment in its natural resources and its people’, is paternalistic and ignores the concerns of the residents of the MD” and that they are in a better position than Benga to understand their needs (CIAR 1337, PDF pp. 5–6).

[3029] The closest urban centre to the project, where the majority of future employees would likely live, is the Municipality of Crowsnest Pass. No councillors or representatives appeared at the hearing, but the municipality submitted a letter of support for the project, citing the anticipated economic benefits, as long as any environmental impacts would be appropriately managed. One other nearby municipal government also expressed its support for the project. The Town of Pincher Creek anticipated economic benefits would accrue to neighbouring municipalities outside the immediate area of Crowsnest Pass.

[3030] The governments of Alberta and Canada have an economic interest in the development of natural resources. Royalties and taxes from resource development fund government programs and provide services to citizens and businesses. These governments also have an interest in responsible resource development and environmental protection.

[3031] We note that governments with an interest in the project expressed no consistent view on the potential development of the project. Each of these representatives of “the public” weighed the balance between potential positive economic impacts and potential negative environmental or social impacts differently.

Citizens of the Crowsnest Pass and surrounding areas

[3032] A number of local citizens participated in the review process, either as full or partial participants in the hearing, or by submitting letters expressing their views. Some of these citizens participated as members of nongovernmental organizations such as the Coalition or the Crowsnest Conservation Society. Some hearing participants supported the project because of the potential economic benefits that would accrue to the region. A small number of letter writers who identified as residents of the area also expressed support for the project, typically for the same reason.

[3033] However, the majority of local residents who participated in the hearing were opposed to the project. This is also true of those who submitted letters and identified as local residents. They identified various reasons, but generally questioned whether the potential economic benefits of the project justify the negative environmental impacts and long-term liability risks that could arise.

[3034] The Crowsnest Conservation Society argued that “the one factor that should guide the panel’s decision related to the project being in the broader public interest is the degree to which there is public support or at least acceptance for it, particularly within the host communities where citizens are directly impacted” (CIAR 1487, PDF p. 4). They submitted a survey, which the Municipality of Crowsnest Pass undertook for future planning purposes, that suggested that there was general support for a balance between tourism and resource extraction among residents, with a higher number favouring tourism and environmental protection over industry. Benga commented on this survey in its final argument, noting the balance in responses between resource extraction and tourism, but emphasizing the response that supported “a thriving economy, including a booming private sector” (CIAR 962, PDF p. 36).

[3035] This review process is not a popularity contest or a referendum. We understand that the balance of voices does not necessarily reflect the overall views of the community. We note that there are clearly different views and concerns among the residents of Crowsnest Pass and nearby areas. This is not a surprise. The balancing of economic, environmental, and social concerns can look different to each person, and without a mutually agreed-upon basis to compare and weigh the different projected impacts of the project, we cannot simply “tally up” the pros and cons of those most affected by the project to determine the public interest. Our mandate is to consider and weigh the evidence before us, and make our own determination about whether the project is in the public interest.

Citizens of Alberta

[3036] The citizens of Alberta have diverse interests. They are interested in jobs and economic opportunities. They buy and use products made from steel, the vast majority of which is produced using metallurgical coal. They are concerned about the environment, species at risk, and climate change.

Conclusions

[3037] Our review takes into account all the views expressed by different participants on how to weigh the economic, environmental, and social impacts that we expect the project to cause. We determine that for a number of environmental valued components, the project is likely to result in adverse effects that range in magnitude from low to high. We find that some of these negative effects, in particular the impacts on surface water quality, and westslope cutthroat trout and their aquatic habitat, would be significant. We disagree with Benga's assertion that the project would not result in any significant adverse environmental effects.

[3038] In the chapter on surface water quality, we identify several optimistic, non-conservative assumptions made by Benga that undermine our confidence in the results it presented. Our findings include several key points:

- The current project as proposed would need to capture 95 and 98 per cent of selenium-rich contact water from the waste rock dumps to achieve modelled selenium concentrations in the effluent and receiving streams. We find such a capture rate is unlikely. Applying a lower capture rate as part of a conservative approach would result in significantly higher concentrations of selenium in the effluent, and in both Blairmore and Gold Creeks, in the absence of further mitigation.
- Benga overestimated the effectiveness of its primary mitigation approach for managing selenium—the saturated backfill zones. We find that these structures are unlikely to achieve the extremely high performance level (removal of 99 per cent of influent selenium concentrations, or producing effluent with selenium concentrations below 15 µg/L) that would be needed to achieve Benga's modelled selenium concentrations in the effluent and receiving streams. Benga did not provide sufficient evidence to demonstrate that the saturated backfill zones can achieve the necessary effectiveness at the scale of this project. Even a modest reduction in effectiveness from Benga's assertions would result in a relatively large increase in the selenium in saturated backfill zone effluent. Even if the saturated backfill zone did work as effectively as Benga suggested, modelled selenium concentrations in Blairmore Creek would eventually exceed Benga's proposed site-specific objective for selenium.
- We find that Benga did not adequately describe or assess the additional alternative selenium mitigation measures it would pursue, if the saturated backfill zones are not sufficiently effective. Benga provided limited information on alternative treatment measures, and only intended to implement them "if needed" based on monitoring results. This introduces the possibility of an unacceptable delay between discovery of a contamination problem and implementation of an alternative treatment approach. The strategy of relying on saturated backfill zones, which are unproven, does not give us confidence that significant adverse environmental impacts can be avoided, even if additional mitigation measures were later put in place.

- We find that other sources of selenium could exist and affect the surrounding environment, such as from pit-wall runoff captured in sedimentation ponds, or from unassessed sources like rock from the Fernie Formation or contaminated groundwater plumes.
- We find that Benga predicted slight but chronic exceedances for a number of non-selenium contaminants of potential concern, despite not taking a conservative approach to modelling water quality or capturing all the potential sources of metal leaching in its model. In particular, Benga's water quality modelling predictions assumed a metals treatment plant would be implemented, but Benga did not commit to building such a plant. Instead, it planned to monitor and manage this issue through adaptive management.
- We were not persuaded that Benga's sulphate-adjusted site-specific water quality objective for selenium in receiving waters would be protective of water quality. In particular, it did not adequately consider the potential presence of non-selenate forms of selenium in water released to Blairmore Creek. Benga's risk assessment assumed that all selenium would be released as selenate, which may not be correct. Benga proposed to implement, if necessary, an advanced oxidation process to convert selenium in waters exiting the saturated backfill zone to selenate. But it provided no details that would allow us to evaluate whether this process would be effective. We note that through the review process, both we and ECCC requested that Benga revisit its risk assessment using more conservative and established methods, but Benga did not provide a revised assessment. ECCC submitted that no jurisdiction in the world has approved a sulphate-adjusted guideline for selenium.

[3039] In summary, we found that the project is likely to result in significant adverse environmental effects on surface water quality.

[3040] For westslope cutthroat trout, the project poses a risk to one of the few remaining populations in the province with a reasonable chance of long-term survival. In the chapter on fish and aquatic habitat, we identify key findings with respect to this species:

- This species is listed as threatened under both the provincial *Wildlife Act* and *SARA*. The project would affect federally protected critical habitat in Gold Creek, as well as Blairmore Creek, which the 2019 Recovery Strategy-Action Plan for this species identifies as important.
- Recent population estimates for this species in these streams are a concern and highlighted the need to adopt a high degree of precaution. We also need to have confidence in Benga's analysis and proposed measures to avoid negative impacts on these fish and their habitat.
- Benga did not adequately assess the amount of critical habitat that the project would affect, in accordance with the 2019 Recovery Strategy-Action Plan, which was important to fully assess the potential impacts of the project.

- Benga's hydrology model did not provide sufficiently detailed estimates of impacts of the project on flows in Blairmore and Gold Creeks, particularly in periods of low flow, and did not provide changes to instantaneous flows. This increased the level of uncertainty in estimating the project's impacts on the habitat of westslope cutthroat trout in these streams.
- Selenium releases from the project into these streams would affect westslope cutthroat trout.
- Calcite precipitation would likely cause damage to westslope cutthroat trout habitat in Blairmore Creek. The concretion of substrates is likely to reduce benthic invertebrate productivity as well as habitat suitability and availability for spawning. Once calcite precipitates onto substrates in the creeks, it would remain in place, as there are no proven treatments to remove instream calcite.
- Benga's inadequate assessment of both changes in stream temperatures and changes in food supply and sediment transport increased our uncertainty about potential project impacts on habitat suitability in Gold and Blairmore Creeks.
- Benga's proposed draft offsetting plan did not adequately demonstrate that the proposed habitat-offsetting program would successfully mitigate project impacts on this habitat. This was Benga's main mitigation measure for addressing residual effects on westslope cutthroat trout habitat, and we are not convinced that the offsetting plan is technically feasible and likely to be effective.

[3041] In summary, we found that the project is likely to have significant adverse environmental effects on westslope cutthroat trout and their aquatic habitat.

[3042] We find that the project would result in some positive economic impacts. We explored the economic impacts of the project in the chapter on social and economic effects.

[3043] Benga based its economic impact analysis on an average benchmark price for metallurgical coal of US\$140/tonne over the life of the project. It submitted that the project would generate Cdn\$210 million in gross domestic product growth during the construction phase. Over the 23-year operational lifetime of the mine, Benga submitted that the project would pay, on average, royalties of about Cdn\$30 million per year to Alberta, and income or corporate taxes to Alberta and Canada of about \$47 million per year. As well, Benga expected to pay about \$1.5 million per year in property taxes, split between the two affected municipalities, and create about 400 new jobs in the region.

[3044] In the socioeconomic impact assessment completed as part of its original EIA, Benga assessed the magnitude of these economic effects as moderate at the regional level and low at the provincial and national levels. At the hearing and in final arguments, several participants and Benga disputed whether these effects could or should be considered significant, but we do not need to determine the significance of these economic impacts. We agree that the project would generate some positive economic impacts, although the magnitude of these impacts would be low or, at most, low to moderate.

[3045] We find it likely that Benga overstated the positive economic impacts of the project. In the chapter on social and economic effects and below, we explore several ways in which Benga may have overestimated these impacts, including:

- Benga estimated its payments to governments from a financial feasibility model that it did not submit into evidence, and its projected royalty payments appear unusually high when compared with royalties paid by other bituminous coal mines in Alberta. Benga did not adequately explain this discrepancy. We find that the royalty projections were likely overestimated.
- Benga did not explicitly assess the potential for the project to negatively affect other important economic sectors in the region, particularly tourism and recreation. It provided an unconvincing explanation to support its contention that the project would have a positive impact on this sector. Other participants submitted that the project as proposed would likely have a negative impact on the recreation and tourism sector in the Crowsnest Pass, reducing income and employment in that sector. We find that the project has the potential to impose a negative economic impact on the tourism and recreation sector.
- Benga did not provide any clear evidence, or a robust response, to counter assertions by CPAWS' expert that the quality of coal produced at the mine may decline over the mine's lifetime. Should this come to pass, the value of the coal, along with government revenues, would decrease.
- Benga did not consider the potential for decreases in the demand or the price of metallurgical coal later in the life of the project, due to global efforts to reduce greenhouse gas emissions, general economic conditions affecting the market for metallurgical coal and steel, and competition from new technologies for steel-making.

[3046] In summary, Benga presented an overly optimistic economic analysis that did not adequately consider these downside economic risks. These risks have the potential to undermine project economic viability, employment opportunities, and payments to governments later in the mine life.

[3047] Furthermore, it is likely that Benga underestimated the long-term treatment costs necessary to protect water quality at and downstream of the site. The evidence suggests that elevated levels of selenium and sulphate could be released from the site for decades following mine closure. Monitoring and treatment would likely be necessary for decades following mine closure. Benga was not able to determine for how long active management of water quality at the site would be required, nor has it carefully evaluated its ability to pay for long-term water treatment. Benga appeared to rely heavily on its participation in the province's Mine Financial Security Program to respond to concerns about long-term treatment. We are concerned that the liability for long-term water quality management could fall on the future taxpayers of Alberta.

[3048] Overall, we conclude that the project is likely to result in significant adverse environmental effects on westslope cutthroat trout and surface water quality, and these negative impacts outweigh the low to moderate positive economic impacts of the project. Accordingly, we find that the project is not in the public interest. In making this determination, we understand that this means that the expected employment, related spending, and economic benefits for the region will not be realized. However, even if the positive economic impacts are as great as predicted by Benga, the character and severity of the environmental impacts are such that we must reach the conclusion that approval of the *Coal Conservation Act* applications are not in the public interest.

[3049] While we found the project is likely to result in additional significant adverse effects beyond those on surface water quality and westslope cutthroat trout and their habitat, we find that these effects, in and of themselves, would not have been sufficient to determine that the project is not in the public interest. It is the nature and magnitude of effects on surface water quality and westslope cutthroat trout and their habitat that drive our public interest determination.

Approval decision

[3050] Exercising our authority as the AER, we deny Benga's applications 1844520 and 1902073 under the *Coal Conservation Act*.

[3051] As we are not approving the project under the *Coal Conservation Act*, there is no need to approve Benga's related applications under the *Environmental Protection and Enhancement Act*, the *Water Act*, and the *Public Lands Act*, and therefore we also deny these applications.

28. Federal Findings and Recommendations

[3052] The terms of reference for the joint review panel agreement between the federal Minister of Environment and Climate Change and the CEO of the AER required us to conduct an assessment of the effects of the Grassy Mountain Coal Project in a manner consistent with the requirements of *CEAA 2012*, *REDA*, the *Coal Conservation Act*, the *EPEA*, the *Water Act*, and the *PLA*.

[3053] We followed the interim principles and approach under *CEAA 2012*, as directed by the Minister of Environment and Climate Change in our mandate letters dated August 17, 2018. We made our decisions based on science, traditional knowledge of Indigenous peoples, and other relevant evidence.

[3054] This report presents our conclusions about potential effects on the environment of the Grassy Mountain Coal Project. In accordance with *CEAA 2012*, we took into account potential environmental effects that may be caused to the components of the environment that are within the legislative authority of Parliament: fish and fish habitat as defined in the *Fisheries Act*, aquatic species as defined in the *SARA*, and migratory birds as defined in the *Migratory Birds Convention Act, 1994*. Our terms of reference also required us to consider the effects of the project on *SARA*-listed wildlife species and their critical habitat.

[3055] We assessed whether changes that may be caused to the environment would occur on federal lands, in a province other than Alberta, or outside Canada, in accordance with *CEAA 2012*. We find that there are no such effects. However, the project's greenhouse gas emissions would contribute to global greenhouse gas emissions and increase atmospheric concentrations of greenhouse gases.

[3056] The project is subject to permitting and authorization by DFO under the *Fisheries Act* and the *SARA*, and by NRCan under the *Explosives Act*. In accordance with *CEAA 2012*, we took into account additional environmental effects in the context of the federal authorizations required for the project.

[3057] We assessed all incremental air pollutant and greenhouse gas emissions that are directly attributable to the project, including those generated by rail transport to the west coast of British Columbia and marine emissions within Canadian territorial waters in accordance with our terms of reference. We find that the project's air emissions would be moderate in magnitude and local in geographic extent. No transboundary effects from air emissions are anticipated. We find that the project's greenhouse gas emissions would have an adverse, but not significant effect. The project's contribution to annual federal and provincial cumulative greenhouse gas emissions would be minimal.

[3058] We assessed the manner in which the project may adversely impact asserted or established Aboriginal or treaty rights as described by Indigenous persons or groups and other parties, including any measures that may reduce or avoid potential impacts to asserted or established Aboriginal or treaty rights. We provided a summary of information received from participants, including, where possible, the perspectives of Indigenous groups or peoples on the potential infringement that the project may cause on asserted or established Aboriginal or treaty rights, and provided a rationale for our conclusions.

[3059] We considered and summarized evidence received with respect to any potential adverse effects that may be caused by the project on the health, social, or economic conditions of Indigenous people; any measures proposed to avoid, mitigate, or accommodate the potential adverse environmental effects of the project and the potential adverse impacts on asserted or established Aboriginal or treaty rights; cumulative

environmental effects and cumulative impacts on asserted or established Aboriginal or treaty rights and related interests; historic, current, and intended future uses of lands and resources; and information on determining thresholds for the significance of those environmental effects defined under section 5 of *CEAA 2012* and the severity of impacts on asserted or established Aboriginal or treaty rights.

[3060] We considered all records relating to the review, including submissions, correspondence, hearing transcripts, exhibits, and other information received and posted to the public registry. We considered evidence from the parties regarding the potential effects of the project and the measures identified as necessary to mitigate those effects. Taking those measures into account, we determined the significance of those effects.

[3061] We set out the rationale, conclusions, and recommendations relating to the environmental effects of the project as defined in section 5 of *CEAA 2012*. We applied the precautionary principle as a component of the careful and precautionary approach under *CEAA 2012*. We assessed Benga's planned mitigation measures to determine if they would effectively manage risks to valued components, with a view to avoiding significant adverse environmental effects on matters within federal jurisdiction. Where relevant and available, we considered guidance documents from the Impact Assessment Agency of Canada in our assessment.

[3062] We find that in some instances, Benga made overly optimistic assumptions of the effectiveness of its proposed mitigation measures. This does not represent the conservative approach appropriate for the sensitive environmental setting of the project.

[3063] As a brief summary of our findings on matters related to federal jurisdiction, we find that:

- The project would likely result in significant adverse environmental effects on surface water quality, westslope cutthroat trout and their habitat, and whitebark pine.
- For some Indigenous groups, the project would result in adverse effects on their current use of land for traditional purposes and physical and cultural heritage, but the effects would not be significant.
- For some Treaty 7 First Nations (Káínai, Piikani, and Siksika) the project would result in significant adverse effects on physical and cultural heritage, but these groups entered into agreements with Benga and withdrew their objections to the project.
- Impacts on Aboriginal or treaty rights would be low to moderate for the Treaty 7 First Nations, Métis Nation of Alberta Region 3, and Ktunaxa Nation.

[3064] We note that ECCC has drafted *Coal Mining Effluent Regulations* under the *Fisheries Act* that would have implications for this project, when and if implemented. We discuss this issue in the chapter on surface water quality. We note that, if these regulations come into force, the currently proposed end-of-pipe discharge limit could pose a challenge for the project given its current design.

[3065] Furthermore, the project would likely require permits under *SARA*, given its potential to affect critical habitat for westslope cutthroat trout. We note that, during the hearing, DFO submitted that the available information suggests it is unlikely that the *SARA* preconditions can be met for the project as currently proposed, and that these conditions must be met before the necessary permits can be

issued. Benga suggested that DFO's policy regarding permits issued under section 73 of *SARA* is consistent with Benga's proposed impacts, mitigation measures, and offsets concerning westslope cutthroat trout habitat. We discuss this issue in the chapter on fish and aquatic habitat.

[3066] We do not provide mitigation measures for consideration by the Minister, should the project proceed. In our capacity as a panel of the AER hearing commissioners, we denied Benga's applications under the *Coal Conservation Act* and related applications under the *EPEA*, the *Water Act*, and the *PLA*. Without approval of the provincial applications, the project cannot proceed.

[3067] We made several recommendations to the federal and provincial governments relating to the effects of the project. These recommendations address limitations that we observed during the review process associated with (1) the guidance available for the environmental assessment (or impact assessment) process, or (2) the regulatory framework as it relates to areas of federal authority. Implementation of the recommendations may improve the effectiveness of the review process and/or provide helpful direction to future decision makers, proponents, and members of the public.

[3068] Given that we found that the project is likely to cause a number of significant adverse environmental effects, we included information that we consider relevant to the question of whether those effects are justified in the circumstances. We recognize that, for the purpose of our review under *CEAA 2012*, we do not have a mandate to make any conclusions or recommendations with respect to the justifiability of any significant adverse environmental effects.

[3069] We summarize the diverse views of the different groups that we heard from in the chapter on the AER public interest determination and decisions. This includes Indigenous groups; nongovernmental organizations; municipal, provincial, and federal governments; citizens in the Crowsnest Pass and surrounding areas; and other citizens of Alberta. The same chapter summarizes the information we received on justifiability for the purposes of our federal mandate.

[3070] Benga's analysis estimated that the project would have the following key economic impacts: gross domestic product growth during construction of \$210 million, more than 200 construction jobs, about 400 new operations jobs in the region, annual revenues to all levels of government (taxes and royalties) of \$77 million, and annual gross domestic product growth during operations of \$133 million. In our review, we found that Benga adopted optimistic assumptions in its economic analysis, likely overestimated some of the benefits, and did not consider a number of potential downside risks to its projected economic benefits.

[3071] The final 15 months of this review unfolded during the unprecedented global COVID-19 pandemic. We held an online public hearing in the fall of 2020 that lasted approximately six weeks. To the best of our knowledge, it is the longest online public hearing ever conducted by a regulatory tribunal in Canada. Although the pandemic forced us to seek an extension to our original timeline, the additional time proved to be well justified. Participants told us that, despite the challenges presented by COVID-19, we successfully conducted a fair, transparent, and effective review that allowed for a full examination of the project and its potential impacts. We appreciate the additional time granted us to complete our work. We also appreciate the cooperation of all participants in the review process as we responded to the challenges posed by the pandemic.

Recommendations

[3072] In this report, we make a number of recommendations to the federal government. Here, we present them in one place for ease of reference.

Chapter 2: Panel Approach to Determining the Significance of Effects

Recommendation 1: We recommend that the Impact Assessment Agency of Canada direct proponents to provide a pre-industrial (historical) baseline in their EIA report. This should be incorporated into the tailored impact statement guidelines for future impact assessments.

A pre-industrial baseline would have improved our ability to consider the effects of previous activities in an area when assessing cumulative effects.

Recommendation 2: We recommend that the Impact Assessment Agency of Canada and the Alberta Energy Regulator consider modifying their EIA requirements to require proponents provide a consolidated impact assessment that incorporates all project modifications and information updates into a single package prior to public hearings and decisions by regulators and responsible authorities.

A number of participants reported that the format of Benga's application information was confusing because information was spread over an original application package submitted in 2016 and 12 addenda submitted between 2017 and 2020. In these addenda, Benga updated or revised some information presented in the original application package.

Chapter 13: Surface Water Quality

Recommendation 3: We recommend that the Government of Canada finalize and implement *Coal Mining Effluent Regulations* under the *Fisheries Act* as soon as possible.

We recognize that there was uncertainty about whether the project as proposed could satisfy the requirements of these regulations. We also recognize that Benga did not have clear regulated effluent limits (such as those proposed in the draft regulation) to incorporate into its project design and planning. Finalizing the *Coal Mining Effluent Regulations* would help proponents and decision makers evaluate the acceptability of proposed discharges from coal mines.

Chapter 16: Vegetation and Wetlands

Recommendation 4: We recommend that the Government of Canada finalize and implement the federal recovery strategy for whitebark pine under *SARA* as soon as possible.

Several participants noted that this strategy is overdue. Finalizing the recovery strategy and providing further clarity around the definition and location of critical habitat for whitebark pine would provide clarity for industry, decision makers, and the public.

Chapter 18: Wildlife Health

Recommendation 5: We recommend the Impact Assessment Agency of Canada develop regulatory guidance for proponents conducting wildlife health risk assessments on how to address the cumulative effects of multiple stressors. We also recommend that the analysis be required in the tailored impact statement guidelines for future impact assessments.

Benga provided limited evidence regarding the potential combined effects of chemicals and habitat loss or degradation in its evaluation of project impacts on wildlife health. Such information would improve the quality of information available to decision makers.

Chapter 23: Social and Economic Effects

Recommendation 6: We recommend that the federal and provincial governments clarify the requirements for economic analysis for future provincial EIAs or federal impact assessments. Proponents should be required by the terms of reference to provide both an economic impact analysis and a cost-benefit analysis that allows decision makers to make informed decisions based on both types of economic information. We also suggest that governments develop guidelines on the methodologies and assumptions that should be followed by proponents in producing these future analyses. Governments may wish to review the *Canadian Cost-Benefit Analysis Guide* produced by the Treasury Board of Canada.

Different economists expressed varied views about what type of economic analysis should be conducted in a review. We agree that different types of economic analyses yield different kinds of information. We believe that decision makers in future impact assessments would benefit from access to these different kinds of information.

Dated in Calgary, Alberta, on June 17, 2021.

Alberta Energy Regulator

Alex Bolton, P.Geol.
Presiding Hearing Commissioner

Dean O’Gorman, M.Sc.
Hearing Commissioner

Hans Matthews B.Sc. P.Geol.
Hearing Commissioner

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Appendix 1. Joint Review Panel Process Timeline

Date	Process Step
March 19, 2015	The Alberta Energy Regulator (AER) issued the <i>Final Terms of Reference for the Environmental Impact Assessment Report for the Grassy Mountain Coal Project</i>
March 20, 2015	Benga Mining Limited (Benga) submitted a project description for the Grassy Mountain Coal Project (the project) to the Canadian Environmental Assessment Agency (the Agency)
March 27, 2015	The Agency determined that the project met the definition of a designated project under the <i>Canadian Environmental Assessment Act, 2012</i> and that the project description met the requirements of the <i>Prescribed Information for a Description of a Designated Project Regulations</i>
March 30, 2015	The Agency announced a 20-day public comment period (starting April 1, 2015) on the project description and the potential of the project to cause adverse environmental effects
May 14, 2015	The Agency determined that a federal environmental assessment was required for the project and issued a notice of commencement
May 14, 2015	The Agency announced a 30-day public comment period on the draft environmental impact statement guidelines for the project
July 6, 2015	The Agency issued the <i>Guidelines for the Preparation of an Environmental Impact Statement</i> for the project
July 16, 2015	The Minister of Environment and Climate Change referred the environmental assessment of the project to an independent review panel
November 10, 2015	Benga submitted its Environmental Impact Assessment (EIA) report for the project to the AER and the Agency
November 30, 2015	The Agency announced allocation of federal funding for the environmental assessment of the project
January 13, 2016	The Agency requested additional information from Benga regarding the EIA (Package 1)
February 4, 2016	Comments received from federal departments on the conformity of the EIA
March 21, 2016	The Agency requested additional information from Benga regarding the EIA (Package 2)
August 12, 2016	Benga submitted an updated EIA and associated applications
December 5, 2016	The Agency requested additional information from Benga regarding the EIA
January 31, 2017	Benga submitted the First Addendum to the EIA
May 16, 2017	The Agency requested additional information from Benga regarding the EIA (Package 3)
October 16, 2017	Benga submitted the Second Addendum to the EIA
October 25, 2017	Benga submitted an integrated application to the AER
November 9, 2017	Benga submitted the Third Addendum to the EIA and associated AER Public Lands applications
November 27, 2017	Benga submitted the Fourth Addendum to the EIA
December 20, 2017	The AER requested supplemental information from Benga regarding the EIA and associated AER applications (Supplemental Information Request 1)
February 14, 2018	The Agency announced the start of a 30-day public comment period on the draft <i>Agreement to Establish a Joint Review Panel for the Grassy Mountain Coal Project between the Minister of the Environment and Climate Change and the Alberta Energy Regulator</i> , including the terms of reference. Comment period ended March 16, 2018
February 28, 2018	The Agency requested additional information from Benga regarding the EIA (Package 4)
February 28, 2018	Benga submitted the Fifth Addendum to the EIA in response to AER Supplemental Information Request 1

March 20, 2018	The AER requested additional information in follow-up to supplemental information provided by Benga in response to AER Supplemental Information Request 1
April 30, 2018	Benga submitted the Sixth Addendum to the EIA in response to additional information requests from the Agency and other federal agencies
May 28, 2018	Benga submitted the Seventh Addendum to the EIA and associated AER applications
August 3, 2018	The Agency requested additional information from Benga regarding the EIA (Package 5)
August 10, 2018	The AER requested additional information in follow-up to supplemental information provided by Benga regarding the EIA and associated AER applications (Supplemental Information Request 2)
August 16, 2018	The Joint Review Panel (the panel) for the project is established and the <i>Agreement to Establish a Joint Review Panel for the Grassy Mountain Coal Project Between the Minister of the Environment, Canada, and the Alberta Energy Regulator, Alberta</i> (the Joint Review Panel Agreement and Terms of Reference) is released
August 22, 2018	The panel determined that the outstanding information requested by the Agency and the AER is required
October 17, 2018	Benga submitted the Eighth Addendum to the EIA
November 2, 2018	The panel notified Fisheries and Oceans Canada (DFO) and Environment and Climate Change Canada (ECCC) that the project has the potential to affect listed wildlife species and their critical habitat. The panel requested that DFO and ECCC provide information regarding the listed wildlife species potentially affected by the project
November 2, 2018	The panel requested that federal departments provide a description of their knowledge and expertise related to the review of the project
November 5, 2018	The panel announced the start of a comment period regarding the sufficiency and technical merit of the information found in the EIA and the addenda submitted for the project. The comment period closed on January 21, 2019
November 21, 2018	DFO submitted information on westslope cutthroat trout, a listed species at risk
December 21, 2018	The panel requested additional information from Benga regarding Indigenous traditional land use
January 18, 2019	The Agency informed the panel that three additional Indigenous groups (Louis Bull Tribe, Montana First Nation, and Ermineskin Cree Nation) had been invited to participate in Agency consultation activities for the project
January 21, 2019	Benga submitted the Ninth Addendum to the EIA
January 28, 2019	ECCC submitted information on terrestrial species at risk
March 21, 2019	The panel requested additional information from Benga – issued their first information request package
April 4, 2019	The panel requested additional information from Benga – issued their second information request package
April 15, 2019	The panel requested additional information from Benga – issued their third information request package
May 3, 2019	The panel requested additional information from Benga – issued their fourth information request package
May 14, 2019	The panel requested additional information from Benga – issued their fifth information request package
August 21, 2019	The panel advised participants of its plans to conduct a site visit and aerial tour and solicited input on what the panel should see during its visit
August 30, 2019	Benga submitted the Tenth Addendum to the EIA

September 9, 2019	The panel announced the start of a public comment period regarding the sufficiency and technical merit of the information found in the EIA and the addenda submitted for the project. The comment period closed on October 24, 2019
September 25, 2019	Panel conducted its site visit and aerial tour of the Grassy Mountain area
October 17, 2019	The panel issued a report on its site visit and aerial tour
November 28, 2019	The panel requested additional information from Benga – issued their sixth information request package
March 13, 2020	Benga submitted the Eleventh Addendum to the EIA
March 19, 2020	The panel announced the start of a public comment period regarding the sufficiency and technical merit of the information found in the EIA and the addenda submitted for the project. The comment period closed on May 4, 2020
March 19, 2020	The panel requested comments from provincial departments on the completeness of the EIA
April 3, 2020	The Minister of Environment and Climate Change extended the time limit for the assessment of the project by 90 days
May 22, 2020	The panel requested additional information from Benga concerning minor information deficiencies
June 19, 2020	Benga submitted the Twelfth Addendum to the EIA
June 25, 2020	The panel announced that it has deemed the EIA complete pursuant to section 53 of the <i>Environmental Protection and Enhancement Act</i> . The panel determined that the information on the public registry was sufficient to proceed to a public hearing
June 29, 2020	Notice of hearing issued
August 10, 2020	The panel issued hearing participation decisions
August 24, 2020	Benga submitted its hearing submission
September 9, 2020	Notice of scheduling of hearing issued
September 16, 2020	The panel requested submission of the Alberta Aboriginal Consultation Office adequacy report(s) for the project
September 24, 2020	The panel issued detailed electronic hearing procedures
October 16, 2020	The panel requested an extension to June 18, 2021 to deliver the joint review panel report on the project
October 23, 2020	Alberta Aboriginal Consultation Office submitted its preliminary reports on consultation adequacy
October 27, 2020	Hearing began
December 2, 2020	Hearing adjourned
December 3, 2020	Alberta Aboriginal Consultation Office submitted its hearing reports and final consultation adequacy decisions
December 11, 2020	Benga submitted its written final argument
December 17, 2020	Governor in Council extended the time limit for the assessment of the project by 135 days
January 8, 2021	Deadline for hearing participants to submit their written final arguments
January 15, 2021	Benga submitted its reply argument
January 15, 2021	The panel closed the hearing record

Appendix 2: Hearing Participants**Joint Review Panel/Secretariat (abbreviations used in report)**

Joint Review Panel

Alex Bolton (panel chair)	Dean O’Gorman	Hans Matthews
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Counsel

Meighan LaCasse (AER)	Barbara Kapel-Holden (AER)	Kirk Lambrecht (IAAC)
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Hearing coordinators/panel managers

Elaine Arruda (AER)	Tracy Utting (IAAC)
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Impact Assessment Agency of Canada analysts

Brenna Belland	Jason Patchell	Robyn-Lynne Virtue
Céline Monfils	Kate Witherly	Samantha Sabo
Élise Lacaille	Kierney Leach	

Alberta Energy Regulator technical experts

Africa Geremew	Doug Koroluk	Margaret Magai
Agnes Wajda-Plytta	Elena Zimmerman	Mike Hunka
Aman Ahlawat	Ernst Kerkhoven	Nellshah Khakoo
Blair Bailey	Jason Cao	Todd Shipman
Camille Almeida	Jennifer Filax	Tiffany Playter
Chris Teichreb	Keri Rose	Wally Qiu
Claude Eckert	Krista Boychuk	Werner Herrera
Donna Hovsepian	Leanne Erickson	Zareen Omar
Stella Swanson	André Sobolewski	

Benga Mining Limited

Counsel

Martin Ignasiak	Coleman Brinker
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Witnesses

Gary Houston	Randy Rudolph	Dr. Leif Burge
Mike Bartlett	Vadim Lyzhin	Stephen Day
Pearce Shewchuk	Janet Bauman	Nancy Grainger
Mike Youl	Cory Bettles	Steve Bilawchuk
Dane McCoy	David DeForest	Ian Mitchell
Keith Bott	Dr. Soren Jensen	John Kansas
Dr. Dan Bewley	Martin Davies	Lindsey Mooney

Stoney Nakoda Nations

Witness

Bill Snow

Metis Nation of Alberta – Region 3

Witness

Kirk Poitras

Ktunaxa Nation

Counsel

Tim Howard

Witnesses

Raymond Warden

Dr. Craig Candler

Jesse Sinclair

Nicole Kapell

Marlene Machmer

Chris Burns

Shuswap Indian Band

Witness

Chief Barbara Cote

Municipality of Crowsnest Pass

Counsel

Alifeyah Gulamhusein

Witness

Mark Wittrup

Government of Canada

Counsel

Robert Drummond

Sydney McHugh

Witnesses

Dr. Emma Watson

Graham Irvine

Michael Takeda

Dr. Brian Asher

Luigi Lorusso

Peter Thompson

Marie-Claude Sauve

Margaret Yole

Melanie Toyne

Anne Wilson

Brenda Woo

Ashley Gillespie

Aimee Zweig

Tom Hoggarth

Dr. Alain Plouffe

Lukas Mundy

Stephanie Martens

Dr. John Cassidy

Paul Gregoire

Brandi Mogge

Jessica Coulson

Margaret Fairbairn

Laura Phalen

Dr. Miroslav Nastev

Jody Small

Robyn Kutz

Phoebe Miles

Marie-Eve Héroux

Eva Enders

Charles Gauthier

Guillaume Colas

Ken Glasbergen

Martyn Curtis

Melissa Gorman

Ben Plumb

Coalition of Alberta Wilderness Association and Grassy Mountain Group (The Coalition), including Berdina Farms Ltd., Donkersgoed Feeders Ltd., and Suncured Alfalfa Cubes Inc.

Counsel

Ifeoma Okoye Richard Secord

Witnesses

John Thompson	Edward Donkersgoed	Lorne Fitch
Brian Gettel	Larry Donkersgoed	Dr. Jon Fennell
Fran Gilmar	Kari Lehr	Clifford Wallis
John Redekopp	David Rothlin	Vern Emard
Rae Redekopp	Jim Farquharson	Shirley Kirby
Norman Watmough	Allan Locke	
Tyler Watmough	Dr. John Robert Post	

Timberwolf Wilderness Society

Representative

Mike Sawyer

Witnesses

Dr. Kabir Rasouli Dr. Ann-Lise Norman David Mayhood

Livingstone Landowners Group

Counsel

Gavin Fitch Cesar Agudelo

Witnesses

Bill Trafford	Sid Marty	Dr. James Young
John Lawson	Dr. Chris Joseph	Dr. John Dennis
Bobbi Lambright	Dr. Gord McKenna	

Canadian Parks and Wilderness Society, Southern Alberta Chapter (CPAWS)

Counsel

Drew Yewchuk

Witnesses

Cornelis Kolijn Martin Olszynski Marc Bowles

Crowsnest Conservation Society

Witnesses

Richard Cooke Heather Davis Stephanie Duarte-Pedrosa

Town of Pincher Creek

Witness

Brian McGillivray

Municipal District of Ranchland No. 66

Counsel

Michael Niven

Ryan Barata

Jasdeep Nijjer

Witnesses

Cameron Gardner

Ron Davis

Dr. Terry Osko

Alberta Chapter of the Wildlife Society

Witnesses

Dr. Sarah Elmeligi

Sara Milligan

Dr. Mark Boyce

Dr. Andrea Morehouse

Eco-Elders for Climate Action

Witnesses

Janet Gourlay-Vallance

Oldman Watershed Council

Witnesses

Shannon Frank

Andrew Hurly

Trout Unlimited Canada

Lesley Peterson

Coal Association of Canada

Robin Campbell

Individuals

Barbara Janusz

Alistair Des Moulins

Ken Allred

James (Jim) Rennie

David McIntyre

Mike Judd

Monica Field

Fred Bradley

(represented by Mike Sawyer)

Gail Des Moulins

AGREEMENT
to Establish a Joint Review Panel
for the Grassy Mountain Coal Project
Between

The Minister of the Environment, Canada
- and -
The Alberta Energy Regulator, Alberta

PREAMBLE

WHEREAS the Alberta Energy Regulator (the AER) has statutory responsibilities pursuant to the *Responsible Energy Development Act* (REDA); and

WHEREAS the Minister of Environment, Canada (the federal Minister of the Environment) has statutory responsibilities pursuant to *the Canadian Environmental Assessment Act, 2012* (CEAA 2012); and

WHEREAS the proposed Grassy Mountain Coal Project (the Project) requires a public hearing and approvals from the AER pursuant to REDA and the *Coal Conservation Act* (CCA), the *Environmental Protection and Enhancement Act* (EPEA), the *Water Act*, the *Public Lands Act*, and is subject to an assessment under CEAA 2012; and

WHEREAS the Federal Minister of the Environment has referred the environmental assessment of the Project to a review panel in accordance with section 38(1) of CEAA 2012 and has determined that pursuant to section 40(1) of CEAA 2012 a review panel should be jointly established to consider the Project; and

WHEREAS the Government of the Province of Alberta and the Government of Canada established a framework for conducting joint review panels through the *Canada-Alberta Agreement on Environmental Assessment Cooperation (2005)* signed on May 17, 2005; and

WHEREAS the AER and the Federal Minister of the Environment have determined that a joint review of the Project will ensure the Project is evaluated according to the spirit and requirements of their respective authorities while avoiding unnecessary duplication, delays and confusion that could arise from individual reviews by the Government of Canada or the AER; and

WHEREAS the AER and the Federal Minister of the Environment have determined that a joint review of the Project should be conducted in a manner consistent with the provisions of Appendix 2 of the *Canada-Alberta Agreement on Environmental Assessment Cooperation (2005)* to the extent reasonable; and

WHEREAS the AER has determined that pursuant to section 18 of REDA a joint review panel cooperative proceeding should be established and that the Project should be considered in a cooperative proceeding by the AER and the Agency.

THEREFORE, the AER and the Federal Minister of the Environment hereby establish a Joint Review Panel for the Project in accordance with the provisions of this Agreement and the Terms of Reference attached as an Appendix to this Agreement.

1. Definitions

For the purpose of this Agreement and of the Appendix attached to it,

"Aboriginal" describes those Aboriginal peoples of Canada as defined in the *Constitution Act, 1982*, subsection 35(2) including the Indian, Inuit and Métis peoples of Canada;

"Agency" means the Canadian Environmental Assessment Agency;

"environment" means the components of the Earth, and includes

- (a) land, water and air, including all layers of the atmosphere,
- (b) all organic and inorganic matter and living organisms, and
- (c) the interacting natural systems that include components referred to in (a) and (b);

"environmental effect" means those effects described in section 5 of CEAA 2012;

"federal authority" means a Minister, agency or department of the Government of Canada;

"follow-up program" means a program for

- (a) verifying the accuracy of the environmental assessment of the Project, and
- (b) determining the effectiveness of any mitigation measures;

"Indigenous" describes an Aboriginal group or Aboriginal peoples;

"interested party" means any person who the Joint Review Panel determines, with respect to the Project, may be directly affected by the carrying out of the Project or has relevant information or expertise or is allowed to participate in the hearing;

"Joint Review Panel" refers to the Joint Review Panel established by the AER and the Federal Minister of the Environment through this Agreement, and is both a panel of AER hearing commissioners making decisions for the AER and a CEAA review panel;

"mitigation measures" means, in respect of the Project, the methods used for the elimination, reduction or control of the adverse environmental effects of the Project, and include restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means;

"parties" means the signatories to this Agreement;

"project" means the proposed Grassy Mountain Coal Project described in Part 1 of the Terms of Reference;

"proponent" has the meaning provided in section 2 of CEAA 2012;

"public registry" means the Canadian Environmental Assessment Registry established under section 78 of CEAA 2012;

"report" means the document produced by the Joint Review Panel, which contains decisions pursuant to REDA, the CCA, the EPEA, the *Water Act*, and the *Public Lands Act*, and the Joint Review Panel's rationale, conclusions and recommendations relating to the environmental effects of the Project including any mitigation measures and follow-up program pursuant to CEAA 2012 and a summary of comments received from the public, including Indigenous persons and groups.

2. Establishment of the Joint Review Panel

- 2.1** A process is hereby established to create a co-operative proceeding pursuant to section 18 of REDA, and a Joint Review Panel pursuant to sections 38, 39, 40 and 42 of CEEA 2012, for the purposes of the joint review of the Project.
- 2.2** The Joint Review Panel established under this Agreement will carry out its assessment in accordance with the Terms of Reference appended to this Agreement.
- 2.3** The AER and the Agency will make arrangements to coordinate the announcements of a joint review of the Project by both the AER and Canada.

3. Constitution of the Joint Review Panel

- 3.1** The Joint Review Panel will consist of three members who will serve as Hearing Commissioners under section 12 of REDA and as panel members under CEEA 2012. The Chief Hearing Commissioner of the AER shall appoint the chairperson and shall appoint one other member of the Joint Review Panel, with the approval of the Federal Minister of the Environment. The third Joint Review Panel member will be appointed by the Federal Minister of the Environment in accordance with article 3.2 of this Agreement.
- 3.2** The third Joint Review Panel member will be selected by the Federal Minister of the Environment, who will recommend the selected candidate as an individual who may serve as a potential hearing commissioner of the AER. If acceptable to the Lieutenant Governor in Council of Alberta and the Chief Hearing Commissioner of the AER, the Lieutenant Governor in Council of Alberta will nominate this candidate to serve as a hearing commissioner of the AER and the Chief Hearing Commissioner of the AER will appoint this candidate as a member of the Joint Review Panel.
- 3.3** The Joint Review Panel members shall be unbiased and free from any conflict of interest relative to the Project and have knowledge or experience relevant to the anticipated environmental effects of the Project. In the event that a Joint Review Panel member resigns or is unable to continue to work, the remaining members shall constitute the Joint Review Panel unless the Federal Minister of the Environment and the AER determine otherwise. In such circumstances, the Federal Minister of the Environment and the AER may choose to replace the member.

4. Secretariat

- 4.1** Administrative, technical, and procedural support requested by the Joint Review Panel shall be provided by a Secretariat, which shall be the joint responsibility of the AER and the Agency. The Secretariat will consist of staff involved in the joint review process from the Agency and the AER.
- 4.2** The Secretariat will report to the Joint Review Panel and will be structured so as to allow the Joint Review Panel to conduct the joint review in an efficient and cost-effective manner.
- 4.3** The AER will provide its offices, when required, for the conduct of the activities of the Joint Review Panel and the Secretariat.
- 4.4** Costs for conducting the joint review will be shared between the Agency and AER. The details of a cost-sharing agreement will be negotiated between the Agency and the AER.

5. Record of the Joint Review and Report

- 5.1** A public registry will be maintained by the Agency during the course of the joint review in a manner that provides for convenient public access and for the purposes of compliance with sections 79 to 81 of CEAA 2012.
- 5.2** The public registry will include relevant documents submitted or produced during the environmental assessment under CEAA 2012 and documents placed on the AER's public record prior to the referral to the Joint Review Panel.
- 5.3** Subject to sections 45(3), (4), and (5) and 79(3) of CEAA 2012, the public registry will include all records relating to the review, including submissions, correspondence, hearing transcripts, exhibits and other information, received by the Joint Review Panel and all public information produced by the Joint Review Panel relating to the joint review of the Project.
- 5.4** On completion of the joint review of the Project, the Joint Review Panel shall prepare a report. The report shall include an executive summary in both official languages of Canada. The report will set out the rationale, conclusions and recommendations of the Joint Review Panel relating to the environmental effects of the Project, including any mitigation measures and follow-up programs, and a summary of comments received from the public, including Indigenous persons and groups. The report will be conveyed to the Federal Minister of the Environment within the overall time limit for the review established by the Federal Minister of the Environment. The report will also include the Joint Review Panel's written decision, with reasons, as required under section 35 of REDA.
- 5.5** After the report is submitted, the Agency will maintain the public registry in accordance with its normal practices and procedures. The AER will continue to maintain records of the proceedings and the report in accordance with its normal practices and procedures. In relation to the conduct of the environmental assessment, the registry will include all documents considered in the environmental assessment from the referral of the Project to a review panel until the issuance of the Final Decision Statement by the Federal Minister of the Environment.
- 5.6** The Agency will be responsible for the translation of public notices and releases and the report prepared by the Joint Review Panel, into both of the official languages of Canada. The Agency will use all reasonable efforts to expedite the translation of the report following its submission by the Joint Review Panel.

6. Other Government Departments

- 6.1** The Joint Review Panel may request federal and provincial authorities having specialized information or knowledge with respect to the Project to make that information or knowledge available to the Joint Review Panel. The Joint Review Panel may also retain the services of independent non-government experts to provide advice on certain subjects within the Joint Review Panel's Terms of Reference.
- 6.2** Nothing in this Agreement will restrict the participation by way of submission to the Joint Review Panel by federal or provincial government departments or bodies, subject to article 6.1 above, under section 20 of CEAA 2012 and section 49 of REDA.
- 6.3** The names of any experts retained by the Joint Review Panel and any documents obtained or created by the experts and that are submitted to the Joint Review Panel will

be placed on the Public Registry. This shall exclude any information subject to solicitor-client privilege.

- 6.4 The Joint Review Panel may, in its sole discretion, require any expert referred to in articles 6.1 and 6.3 to appear before the Joint Review Panel at the public hearing and testify in regard to the documents they have created or obtained and that were submitted to the Joint Review Panel and made public in accordance with the preceding paragraph.

7. Participant Funding

- 7.1 Decisions regarding participant funding by the Agency under the federal Participant Funding Program, and decisions on participant funding by the AER as provided for in REDA, the AER *Rules of Practice* and the AER's *Directive 031: REDA Energy Cost Claims* will, to the extent practicable, take into account decisions of the other party.

8. Amending this Agreement

- 8.1 The terms and provisions of this Agreement may be amended by written memorandum executed by both the Federal Minister of the Environment and the Chief Executive Officer of the AER.
- 8.2 Subject to sections 49 and 62 of CEEA 2012, this Agreement may be terminated at any time by an exchange of letters signed by both parties.

9. Signatures

WHEREAS the parties hereto have put their signatures

<Original signed by>

<Original signed by>

The Honourable Catherine McKenna
Minister of the Environment

MAY 23 2018

Date

Jim Ellis
Chief Executive Officer
Alberta Energy Regulator

Date

July 9, 2018

Appendix 1

Terms of Reference

PART I - SCOPE OF PROJECT

Benga Mining Ltd. (the proponent), a wholly owned subsidiary of Riversdale Resources Limited, proposes to construct and operate the Grassy Mountain Coal Project (the Project), an open-pit metallurgical coal mine near the town of Blairmore in the Crowsnest Pass in southwestern Alberta.

The Project would be located on the east side of the continental divide, approximately 150 km southwest of Calgary and approximately 13 kilometres from the Alberta border with British Columbia. As proposed, the mine would occupy an area of approximately 2,800 hectares and have the capacity to produce a maximum of 4.5 million tonnes of metallurgical coal per year over a mine-life of approximately 24 years.

Components of the Project would include the surface coal mine pits and waste disposal areas, a coal preparation plant, and associated infrastructure including a coal conveyor system, an access corridor, maintenance shops, a rail load-out facility and other pertinent facilities. Coal would be brought from the Project area to the processing plant where it would be cleaned and loaded into trains for transport to market.

PART II - SCOPE OF THE ENVIRONMENTAL ASSESSMENT OF THE PROJECT

The Joint Review Panel shall conduct an assessment of the environmental effects of the Project referred to in the Scope of the Project (Part 1) in a manner consistent with the requirements of the *Canadian Environmental Assessment Act, 2012* (CEAA 2012), the *Responsible Energy Development Act* (REDA), the *Coal Conservation Act*, the *Environmental Protection and Enhancement Act* (EPEA), the *Water Act* and the *Public Lands Act* and these Terms of Reference.

As per section 19(1) of CEAA 2012, the assessment must include a consideration of the following factors:

- a) the environmental effects of the Project, including the environmental effects of malfunctions or accidents that may occur in connection with the Project and any cumulative environmental effects that are likely to result from the Project in combination with other projects or activities that have been or will be carried out;
- b) the significance of the effects referred to in paragraph a);
- c) comments from the public, including Aboriginal groups and peoples, that are received during the joint review;
- d) mitigation measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the Project;
- e) the requirements of the follow-up program in respect of the Project;
- f) the purpose of the Project;
- g) alternative means of carrying out the Project that are technically and economically feasible and the environmental effects of any such alternative means; and
- h) any change to the Project that may be caused by the environment.

In examining factors listed above, the Joint Review Panel shall take into account any community knowledge and Aboriginal Traditional Knowledge (such as, but not limited to,

traditional use studies) received during the environmental assessment. The Joint Review Panel shall also consider information provided to it on how to appropriately incorporate Aboriginal Traditional Knowledge into its assessment.

In addition to the factors listed above, pursuant to paragraph 19(1)(j) of CEEA 2012, the Minister of the Environment requires the following matters that are relevant to the environmental assessment to be taken into account:

- All incremental air pollutant and greenhouse gas emissions that are directly attributable to the Project, including rail to the west coast of B.C. and marine emissions within Canadian territorial waters; and
- Information on the manner in which the Project may adversely impact asserted or established Aboriginal or Treaty rights as described by Indigenous groups or peoples, the proponent, government bodies, the public and other interested parties including any measures that may reduce or avoid potential impacts to asserted or established Aboriginal or Treaty rights.

In conducting its review, the Joint Review Panel shall uphold the principle that Aboriginal Traditional Knowledge is an important component in understanding potential effects to the environment and potential impacts of the Project on asserted or established Aboriginal or Treaty rights.

PART III – SCOPE OF THE FACTORS

The scope of the factors includes those specified in the final “Guidelines for the preparation of the Environmental Impact Statement” (final Guidelines) for the Benga Mining Limited Grassy Mountain Coal Project issued by the Canadian Environmental Assessment Agency on June 24, 2015. These final Guidelines were prepared under CEEA 2012.

In considering the factors outlined in Part II, the Joint Review Panel shall have regard for the following:

A. Aboriginal Rights

The Joint Review Panel shall consider and include in its report the effects of the Project on asserted or established Aboriginal or Treaty rights, to the extent the Joint Review Panel receives such information as provided in Part III. The Joint Review Panel must invite Indigenous groups and peoples to provide information related to:

- the nature, scope, location and extent of asserted or established Aboriginal or Treaty rights that could be impacted by the the Project,
- the potential adverse environmental effects and the potential impacts that may be caused by the Project on asserted or established Aboriginal or Treaty rights,
- any potential adverse effects that may be caused by the Project on the health, social or economic conditions of Indigenous people,
- any measures proposed to avoid, mitigate or accommodate the potential adverse environmental effects of the Project and the potential adverse impacts on asserted or established Aboriginal or Treaty rights,
- cumulative environmental effects and cumulative impacts to asserted or established Aboriginal or Treaty rights and related interests,
- historic, current and intended future uses of lands and resources, and
- information on determining thresholds for significance of environmental effects as defined under s. 5 of CEEA 2012, and for severity of impacts to asserted or established Aboriginal or treaty rights, including Indigenous perspectives and criteria.

The Joint Review Panel may also receive information in this regard provided by the proponent, government bodies, the public and other interested parties.

The Joint Review Panel shall summarize in its report the information provided regarding the manner in which the Project may adversely impact asserted or established Aboriginal or Treaty rights, and where appropriate, may summarize information received on the perspectives of Indigenous groups or peoples on the potential infringement that the Project may cause on asserted or established Aboriginal or Treaty rights.

The Joint Review Panel may use this information to make conclusions and recommendations that relate to the manner in which the Project may adversely impact asserted or established Aboriginal or Treaty rights as described by Indigenous persons or groups and may incorporate any Indigenous perspective and Traditional Aboriginal Knowledge that it has received into its report. The Joint Review Panel should describe its rationale for how it came to its conclusions.

The Joint Review Panel, based on its assessment of the environmental effects of the Project, may recommend measures to mitigate any potential adverse environmental effects that may be caused by the Project that could adversely impact the asserted or established Aboriginal or Treaty rights that were identified.

The Joint Review Panel shall not make any determinations as to:

- the validity of asserted or established Aboriginal or Treaty rights asserted by an Indigenous group or peoples or the strength of such claims;
- the scope of the Crown's duty to consult an Indigenous group;
- whether the Crown has met its respective duties to consult or accommodate in respect of rights recognized and affirmed by section 35 of the *Constitution Act, 1982*; or
- any matter of Treaty interpretation.

Nothing in these Terms of Reference limits the application of section 21 of REDA or Part 2 of the *Administrative Procedures and Jurisdiction Act* to the AER, and the Joint Review Panel (in its capacity as a panel of AER hearing commissioners) remains at all times subject to the requirements of those provisions, and is entitled to exercise the powers under Part 2 of the *Administrative Procedures and Jurisdiction Act*, including but not limited to section 13 thereof.

B. Cumulative Effects Assessment

The cumulative effects assessment should take into consideration the approach described in the latest version of the Agency's "Technical Guidance for Assessing Cumulative Environmental Effects under CEAA 2012", and in the Operational Policy Statement "Assessing Cumulative Environmental Effects under CEAA 2012".

The Joint Review Panel should focus its consideration of cumulative effects on key valued components.

Cumulative effects assessment should include effects from projects or activities that have been or will be carried out, including a consideration of accidents or malfunctions, as of the issuance of the Joint Review Panel's Terms of Reference.

C. Accidents & Malfunctions

In considering the environmental effects of malfunctions or accidents that may occur in connection with the Project, the Joint Review Panel should consider potential malfunctions or accidents associated with the Project, including the following components:

- tailings management;
- surface water diversion and management;
- waste management and disposal;
- use, handling or spills of chemicals and hazardous materials on-site;
- the increase in road traffic, and the risk of road accidents;
- any other project components or systems that have the potential, through accident or malfunction, to adversely affect the environment.

The Joint Review Panel should consider the likelihood of potential occurrence of a malfunction or an accident and the sensitive elements of the environment (*e.g.* communities, homes, natural sites of interest, critical habitat for species at risk, areas of major use, or areas of interest to Aboriginal peoples) that may be affected in the event of any such malfunction or accident.

Measures to reduce the potential occurrence of a malfunction or accident, as well as the effects or consequences that would result from any such malfunction or accident, should be considered in the assessment.

D. Species at Risk

The Joint Review Panel shall consider the effects of the Project on *Species at Risk Act* listed wildlife species and their critical habitat and identify measures that could be taken to avoid or lessen those effects and to monitor them. The measures must be taken in a way that is consistent with any applicable recovery strategy and action plans.

E. Change to the Project Caused by the Environment

In considering any change to the Project that may be caused by the environment, as required under s. 19(1)(h) of CEAA 2012 and Part II of this Terms of Reference, the Joint Review Panel will consider environmental changes and hazards that may occur and may affect the Project. The Joint Review Panel should also take into account the potential influence of climate change scenarios presented by the proponent, Indigenous groups or peoples, government bodies, the public and other interested parties on climate parameters (*e.g.* precipitation, temperature), and physical environmental processes.

The Joint Review Panel shall consider the influence that these environmental changes and hazards may have on the Project as predicted and described by the proponent, Indigenous groups or peoples, government bodies, the public and other interested parties.

F. Additional Information Available for Consideration

If the Joint Review Panel concludes that, taking into account the implementation of mitigation measures, the Project is likely to cause significant adverse environmental effects, it may include in its report a summary of any information it has received and that may be relevant to

a determination by the Governor in Council with respect to the justifiability of any such significant adverse environmental effects. However, the Joint Review Panel does not have a mandate to make any conclusions or recommendations with respect to the justifiability of any significant adverse environmental effects for the purpose of the review under CEAA 2012.

PART IV – JOINT REVIEW PANEL MANDATE

The Joint Review Panel shall conduct the joint review in a manner that discharges the responsibilities of the AER under REDA, the requirements set out in CEAA 2012, and the requirements set out in this Terms of Reference that were fixed and approved by the Federal Minister of Environment and the AER.

The Joint Review Panel shall have all the powers and duties of a panel described in section 45 of CEAA 2012, a panel of hearing commissioners described in REDA, and the rules and regulations thereunder.

A majority of the Joint Review Panel members constitutes a quorum for the purposes of the proceeding to be conducted by the Joint Review Panel. When a public hearing or meeting, or other activity is conducted by the Joint Review Panel and a member of the Joint Review Panel for any reason does not attend on any day or part of a day, the other members who are sitting at the public hearing or meeting or other activity may continue as fully and effectively as though the absent member were present.

PART V – ENVIRONMENTAL ASSESSMENT PROCESS

The environmental assessment for the Project consists of three stages. These stages are referred to as the Pre-Panel Stage, the Joint Review Panel Stage and the Post-Panel Stage.

Pre-Panel Stage

This description of the joint review process is limited to those activities occurring from the referral of the environmental assessment to a review panel under CEAA 2012 to the appointment of the Joint Review Panel members. The main steps of the joint review process during the Pre-Panel stage of the environmental assessment will be as follows:

1. The proponent will prepare its EIA report in accordance with the Provincial Terms of Reference and the Agency's EIS Guidelines and submit it to the Agency and the AER. The Agency will make the EIA report available to the public in a timely manner.
2. Prior to the establishment of the Joint Review Panel, the Agency and the AER will evaluate the EIA report against the requirements of the Provincial Terms of Reference and the Agency's EIS Guidelines and applicable legislation. The AER and the Agency will determine if the required information is present and if there is enough information to enable the Joint Review Panel to commence its assessment of the EIA report. This will ensure adequate information is available for the Joint Review Panel to start the joint review of the EIA report, upon the members' appointments, in an efficient manner.

3. If the Agency or AER determines that the EIA report does not contain the information required in the provincial Terms of Reference and the Agency's EIS Guidelines, they shall request additional information from the proponent. Upon receipt of the additional information, the Agency or AER shall determine if additional review is required, and if so, will conduct the additional review.
4. The procedures above will apply until such time as the Agency and the AER determine that there is enough information for the Joint Review Panel to commence its assessment of the EIA report.
5. When the Agency and AER determine that there is enough information for the Joint Review Panel to commence its review of the EIA report, the Joint Review Panel will be appointed in accordance with sections 3.1 and 3.2 of the Joint Review Panel Agreement.
6. If the Agency or AER determine that additional information is required from the proponent but the information deficiency is minor in nature, and the Agency and AER receive a commitment from the proponent to provide outstanding information in a timely manner, the Joint Review Panel may be appointed in accordance with sections 3.1 and 3.2 of the Agreement.
7. The Pre-Panel review of the EIA report does not affect or predetermine the result of the assessment of the proponent's EIA report by the Joint Review Panel, and in particular the Joint Review Panel may decide that the proponent must provide additional information.

Joint Review Panel Process

The main steps of the joint review process during the Joint Review Panel stage of the environmental assessment will be as follows:

8. The Joint Review Panel shall undertake its mandate in three stages:

Stage 1 – Review of the EIA report and any Supplemental Information;
Stage 2 – Conduct of a public hearing; and
Stage 3 – Preparation of a report and submission to the Federal Minister of Environment
9. The Joint Review Panel shall fulfill its mandate and submit its report to the Federal Minister of the Environment within 420 days (14 months) following the date of establishment of the Joint Review Panel. The 420 days does not include the time period(s) between a request for information from the Joint Review Panel to the proponent and receipt of the requested information by the Joint Review Panel.

Stage 1 - Review of the EIA Report and Supplemental Information

10. As soon as possible following its appointment, the Joint Review Panel will initiate a public comment period on whether the information available on the public registry, including the EIA report, is sufficient to allow a joint review that complies with the Joint Review Panel's Terms of Reference and to proceed to the public hearing stage of the process. The public, Indigenous groups or peoples and government departments and agencies will have a minimum of 60 days to provide comments.

11. If the Joint Review Panel determines that the EIA report, including supplemental information on the public registry, is not sufficient after review of the documentation and comments received outlined in article 10 above, it shall request additional information to be provided by the proponent.
12. Information gathering is not limited to a written process and the Joint Review Panel has the discretion to hold oral information gathering sessions in or near an Indigenous community or communities. If the Joint Review Panel decides to hold oral information gathering sessions, the Joint Review Panel will seek input from the proponent, Indigenous groups or peoples, government bodies, the public and other interested parties on appropriate locations, duration and timing.
13. The Joint Review Panel will allow for the public review of and comment on any additional information it receives. The length of the public comment period on the additional information will be determined by the Joint Review Panel.
14. The process described above will apply, with any necessary adjustments, until such time as the Joint Review Panel determines it has sufficient information to proceed to the public hearing stage of the process.
15. If the Joint Review Panel is of the view that it requires additional information from the proponent, Indigenous groups, government bodies, the public or other interested parties, but the information deficiency is minor in nature and the Joint Review Panel receives a commitment to provide the outstanding information in a timely manner, the Joint Review Panel may issue the Notice of Hearing.
16. The Joint Review Panel may request specialist or expert information or knowledge with respect to the Project from federal or provincial authorities in possession of such information or knowledge.
17. The Joint Review Panel may retain the services of independent non-government experts to provide advice on certain subjects with respect to the environmental assessment of the Project to meet its mandate.
18. The Joint Review Panel shall post on the registry names of experts retained by the Joint Review Panel, and any relevant documents obtained or reports prepared by the experts that are submitted. For greater certainty, this shall exclude any information subject to solicitor-client privilege.
19. The Joint Review Panel may require any expert to appear at the public hearing to address the report(s) they have created or relevant documents obtained and that were submitted to the Joint Review Panel and made public in accordance with the preceding paragraphs.
20. Comments received during all comment periods will be made available to the public through the public registry as soon as possible.

Stage 2 – Public Hearing

21. If, after reviewing the information on the record including any written comments from the public, Indigenous groups and peoples, government departments or agencies, or other technical experts, the Joint Review Panel determines that it has sufficient

information to proceed to the public hearing, it will announce the hearing, providing for a minimum notice of 45 days prior to the commencement of the hearing.

22. The Joint Review Panel shall conduct its hearing in accordance with the AER's *Rules of Practice*.
23. The public hearing shall provide opportunities for timely and meaningful participation by the public, including Indigenous groups and peoples, in accordance with CEAA 2012, subsection 34(3) of REDA, and section 9 of the AER *Rules of Practice*. The Joint Review Panel will make the hearing as accessible as reasonably possible for individuals or groups who are not represented by legal counsel or who may lack experience with the quasi-judicial nature of the hearing process.
24. The Joint Review Panel shall hold at least a portion of the public hearing sessions in the area(s) in proximity to the Project.
25. The Joint Review Panel shall take into account the timing of traditional activities in Indigenous and local communities when setting the time and location of the public hearing session, having due regard for the timelines set out in articles 9 and 26 of this Part V.
26. The Joint Review Panel shall make best efforts to conduct a public hearing and close the hearing record within 45 days of commencing the public hearing.

Stage 3 - Joint Review Panel Report

27. Following the completion of the public hearing, the Joint Review Panel shall prepare and submit to the Federal Minister of the Environment a report as required in article 5.4 of the Agreement. The Joint Review Panel shall provide the executive summary of the report in both official languages of Canada. The report will include:
 - An executive summary;
 - A summary description of the Joint Review Panel's process;
 - The rationale, conclusions, and recommendations of the Joint Review Panel relating to the environmental assessment of the Project, including any mitigation measures and follow-up programs;
 - The rationale, conclusions and recommendations that relate to the manner in which the Project may adversely impact asserted or established Aboriginal or Treaty rights as described by Indigenous persons or groups and other parties including any measures that may reduce or avoid potential impacts to asserted or established Aboriginal or Treaty rights;
 - A summary of any comments received including those from Indigenous groups, government bodies, the public and other interested parties;
 - An identification of those conclusions that relate to the environmental effects defined in section 5 of CEAA 2012;
 - An identification of recommended mitigation measures and follow-up programs that relate to environmental effects, socio-economic impacts, , including impacts on asserted or established Aboriginal or treaty rights and related interests, including,

- as appropriate, any commitments identified by the proponent in the EIA report or during the joint review panel process; and
- A summary of the information received from participants as set out in Part III (A) on Aboriginal rights above.
28. If the Joint Review Panel concludes that, taking into account the implementation of mitigation measures, the Project is likely to cause significant adverse environmental effects, it may include in its report a summary of any information it has received on the justifiability of any such significant adverse environmental effects.
29. Under its authority as the AER, the Joint Review Panel shall make a decision on the Project applications and as appropriate for the purposes of that decision, shall include conclusions about the justifiability of any significant adverse effects. In relation to its role as a review panel under CEAA 2012, the Joint Review Panel shall not make any conclusions or recommendations with respect to the justifiability of any significant adverse environmental effects. The Federal Minister of the Environment will determine the significance of adverse environmental effects under CEAA 2012. If the Federal Minister of the Environment decides that the Project is likely to cause significant adverse environmental effects, the matter is referred to the Governor in Council (Cabinet) who must decide whether these environmental effects are justified in the circumstances.
30. The report shall take into account and reflect the views of all Joint Review Panel Members.
31. The Joint Review Panel may consider any request made by an Indigenous group to have the executive summary of the report translated into its Indigenous language. If the Joint Review Panel agrees with such a request, it must recommend to the Agency and the AER that such translation be provided by the Agency and the AER in a timely manner.
32. The Joint Review Panel will submit its report to the federal Minister of the Environment at the earliest possible date, and within the overall time limit established by the Federal Minister of the Environment for the Joint Review Panel process provided in Part V, article 9.
33. Upon receiving the report submitted by the Joint Review Panel, the Federal Minister of Environment and the AER will make the report available to the public and will advise the public that the report is available.
34. In accordance with paragraph 43(1)(f) of CEAA 2012, the Joint Review Panel may be required to clarify any of the conclusions and recommendations set out in its report with respect to the environmental assessment.

PART VI - AMENDMENTS

1. The Joint Review Panel may request clarification of its Terms of Reference by sending a letter signed by the chairperson to the President of the Agency and the Chief Executive Officer of the AER, setting out the request. Upon receiving such a request, the President is authorized to act on behalf of the Federal Minister of the Environment and collaborate with the AER to provide to the Joint Review Panel such clarification. The President and the AER shall use best efforts to provide a response to the

Joint Review Panel within 14 calendar days. The Joint Review Panel shall continue with the joint review to the extent possible while waiting for the response in order to adhere to the timelines of these Terms of Reference. The Joint Review Panel shall notify the public of any clarifications to its Terms of Reference.

2. Subject to articles 9 and 26 above, the Joint Review Panel may seek an amendment to its Terms of Reference by sending a letter signed by the chairperson to the Federal Minister of the Environment and the AER setting out the request. As appropriate, the Federal Minister of the Environment may delegate to the President of the Agency the authority to act on the Federal Minister of the Environment's behalf and, in collaboration with the AER, consider and respond to any request from the Joint Review Panel to amend the Terms of Reference. The Federal Minister of the Environment, or the President in case of such delegation, and the AER shall use best efforts to ensure a response is provided to the Joint Review Panel's letter within 14 calendar days. The Joint Review Panel shall continue with the joint review to the extent possible while waiting for the response in order to adhere to the timelines of these Terms of Reference. Any requests for amendments under this article, as well as any amendments to these Terms of Reference, shall be posted on the Public Registry.

