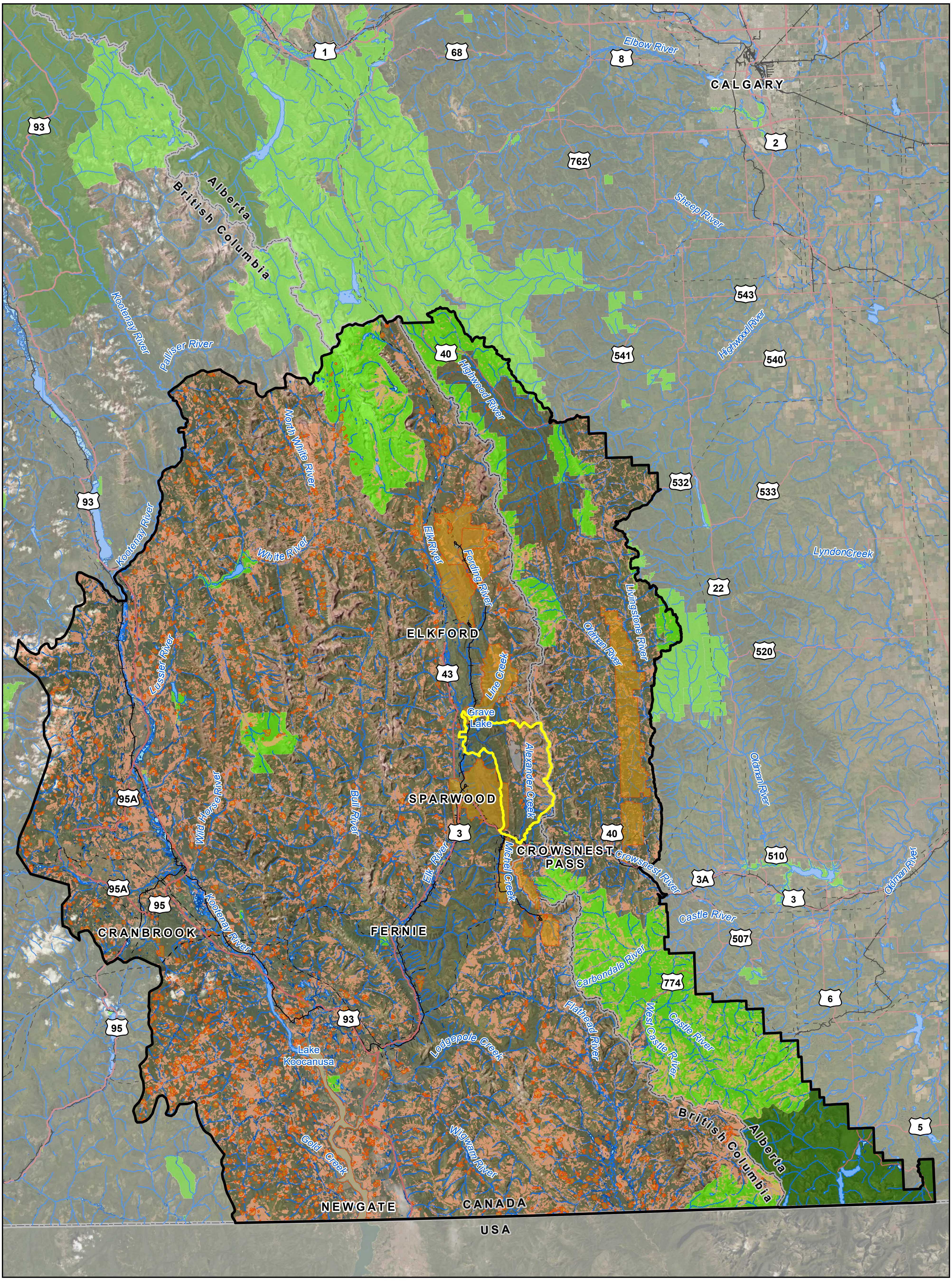


Crown Mountain Coking Coal Project

Figure 15.5-37

High-Quality American Marten Year-round Habitat and Reasonably Foreseeable Future Projects and Activities in the Terrestrial Regional Study Area

LEGEND

- High-Quality American Marten Year-round Habitat
- Reasonably Foreseeable Future Projects and Activities
- Terrestrial Regional Study Area
- Terrestrial Local Study Area
- Crown Mountain Coking Coal Project
- Highway
- Railway
- Transmission Line
- Watercourse
- Waterbody
- Wetland
- Provincial Park/Protected Area
- National Park
- British Columbia/Alberta Border

Scale 1:700,000

Map Drawing Information:
Data Provided By NWP Coal Canada Ltd, Dillon Consulting Limited, Keefer Ecological Services Ltd, Province of British Columbia GeoBC Open Data, Government of Alberta Open Data, Natural Resource Canada.
Imagery Provided By ESRI.

Map Created By: LMM
Map Checked By: HEB
Map Coordinate System: NAD 1983 UTM Zone 11N

NWP Coal Canada Ltd

Project: 12-6231

Status: FINAL

Date: 2022-01-18

Document Path: \\42dillon\CAD\GIS\2012 and Prior\126231 Crown Mountain\EA_Report\CumulativeEffects\Wildlife\126231_CE_WHmrt_HighQualityAmercianMartenHabitatRFD_TerrestrialRSA.mxd

Disruption to Movement

Many present and reasonably foreseeable future projects and activities create impermeable barriers (e.g., pits and dumps at mines) or semi-permeable barriers (e.g., roads, and other linear features) for wildlife. While each of the existing and reasonably foreseeable future projects and activities may block movements to varying degrees, they are geographically separated from the Crown Mountain Coking Coal Project such that additive barriers with the Project are limited (Figure 15.5-37).

The residual cumulative effect to American marten from disruption to movement arising from the effects of the Project in combination with those of other past, present, and reasonably foreseeable future projects or activities is characterized as follows:

- Duration: *Long-term*, as disruption to movement will continue through to the end of the Operations phases of the Crown Mountain Coking Coal Project and those of other reasonably foreseeable future projects and activities.
- Magnitude: *Low*, given the geographic distribution of current and reasonably foreseeable future projects and activities.
- Geographic Extent: *Regional*, as disruption to movement is limited to within the Terrestrial RSA.
- Frequency: *Continuous,* as the effect will continue through to the end of the Operations phases of the Crown Mountain Coking Coal Project and those of other reasonably foreseeable future projects and activities.
- Reversibility: *Reversible long-term*, the effect will decline substantially at the end of the Operations phases of the Crown Mountain Coking Coal Project and those of other reasonably foreseeable future projects and activities.
- Context: *Low,* American marten have low resilience to disruption in the receiving environment and may adapt to effects.

Determination of Significance

High-quality American marten habitat in the interior of B.C. may support a minimum winter population density of 33 individuals/100 km^2 (Mowat and Paetkau, 2002) and a maximum of 200 individuals/100 km^2 (Lofroth and Steventon, 1990 cited in Government of B.C., 1994). Population trends are not well understood. However, based on the characterization of the residual cumulative effects and regional American marten density estimates, the Project in combination with reasonably foreseeable future projects and activities would not limit the ability of American marten to persist and maintain self-sustaining populations in the Terrestrial RSA, including within Alberta and the federal Dominion Coal Block Parcels 73 and 82. The residual cumulative effects of habitat loss and degradation, sensory disturbance, and disruption to movement on American marten arising from the Project in combination with other past, present, and reasonably foreseeable future projects and activities during all phases are therefore considered not significant.

Likelihood and Confidence

Effects that are determined to be not significant do not require a characterization of likelihood.

There is a good understanding of American marten ecology, their habitat availability and distribution, known occurrences, and abundance in the Terrestrial RSA. The confidence in the determination of the significance of residual cumulative effects to American marten is therefore high.

15.5.4.4.6 Canada Lynx

Many present and future projects and activities occur within the distributional range of Canada lynx and in suitable habitat. The residual effects of habitat loss and degradation, sensory disturbance, and disruption to movement could potentially have a cumulative effect on Canada lynx.

Characterization of Residual Cumulative Effects

Habitat Loss and Degradation

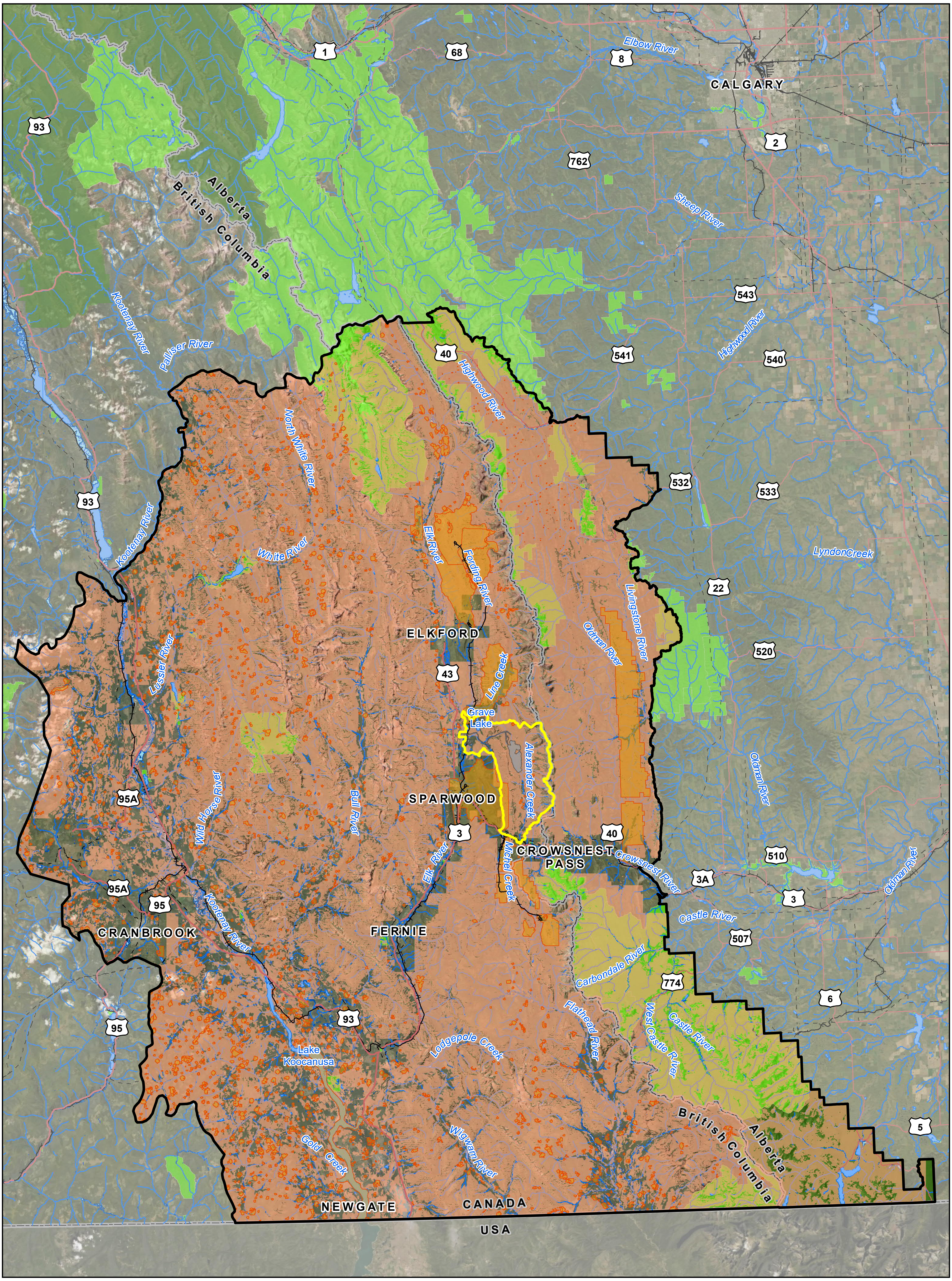
Most present and reasonably foreseeable future projects and activities occur within the range of Canada lynx and in potentially suitable habitat and thus involve loss or alteration of Canada lynx habitat (Figure 15.5-38). The Base Case incorporates the cumulative loss or alteration of Canada lynx habitat as a result of past and present projects and was the basis for the assessment of the Project Case. For the Future Case that includes both the Project and other reasonably foreseeable future projects and activities, approximately 5.7% of year-round high-quality Canada lynx habitat is predicted to be lost within the Terrestrial RSA (Table 15.5-44). The Project is predicted to contribute 0.08% of that loss.

Table 15.5-44: Change in High-Quality Canada Lynx Habitat for the Base Case, the Project Case, and the Future Case in the Terrestrial RSA

VC	Season	Amount (ha) of High-Quality Habitat (Change from Base Case in Brackets)			Change as Proportion of Terrestrial RSA	
		Base Case	Project Case	Future Case	Base Case to Project Case	Base Case to Future Case
Canada Lynx	Year-round	1,422,227	1,421,067 (-1,159)	1,340,847 (-81,380)	-0.08%	-5.7%

The residual cumulative effect to Canada lynx from habitat loss and degradation arising from the effects of the Project in combination with those of other past, present, and reasonably foreseeable future projects and activities is characterized as follows:

- Duration: *Long-term*, as lost habitat will begin to be restored prior to the Post-Closure phase.
- Magnitude: *Moderate*, there will be an overall 5.7% loss of high-quality year-round Canada lynx habitat in the Terrestrial RSA due to the development of the Project and other reasonably foreseeable future projects and activities. The Project will contribute only 0.08% of that loss.
- Geographic Extent: *Regional*, as the effect of habitat loss of the Future Case will be in the Terrestrial RSA.
- Frequency: *Continuous*, the effect of habitat loss and degradation is expected to be continuous until lost habitat is restored.
- Reversibility: *Reversible long-term*, the effect of habitat loss is anticipated to be reversed, though not fully for many years after Post-Closure.
- Context*: High*, Canada lynx utilize a variety of landscapes, have moderate resilience to habitat loss, and may adapt to effects.



Crown Mountain Coking Coal Project

Figure 15.5-38

High-Quality Canada Lynx Year-round Habitat and Reasonably Foreseeable Future Projects and Activities in the Terrestrial Regional Study Area

LEGEND

- High-Quality Canada Lynx Year-round Habitat
- Reasonably Foreseeable Future Projects and Activities
- Terrestrial Regional Study Area
- Terrestrial Local Study Area
- Crown Mountain Coking Coal Project
- Highway
- Railway
- Transmission Line
- Watercourse
- Waterbody
- Wetland
- Provincial Park/Protected Area
- National Park
- British Columbia/Alberta Border

0 15 30

Kilometres

Scale 1:700,000

N E S W

Map Drawing Information:
Data Provided By NWP Coal Canada Ltd, Dillon Consulting Limited, Keefer Ecological Services Ltd,Province of British Columbia GeoBC Open Data, Government of Alberta Open Data, Natural Resource Canada.
Imagery Provided By ESRI.

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Document Path: \\42dillon\CAD\GIS\2012 and Prior\126231 Crown Mountain\EA_Report\CumulativeEffects\Wildlife\126231_CE_WHlynx_HighQualityCanadianLynxHabitatRFD_TerrestrialRSA.mxd

Sensory Disturbance

Many present and reasonably foreseeable future projects and activities generate noise, vibration, light, and dust which may affect suitable Canada lynx habitat. A quantitative approach could not be used for the cumulative effects of sensory disturbance because of the difficulty in assigning zones of influence or avoidance to other reasonably foreseeable future projects and activities when design details (and resulting noise, vibration, light, and dust) of those other projects or activities are not available. All other reasonably foreseeable future projects and activities included in the future case are either new coal mines or coal mine expansions. The effect of sensory disturbance is highly dependent on the distribution of Canada lynx habitat, project activities, and on topography and land cover; however, it may be reasonable to use the results of the Crown Mountain Coking Coal Project-level sensory disturbance analysis for Canada lynx (Section 15.5.3.4.6) as an indication of the amount of Canada lynx habitat that may be affected by noise from other reasonably foreseeable future projects or activities. The Project-level sensory disturbance analysis for Canada lynx found that the area potentially affected by continuous noise outside the Project footprint is up to 80% of the amount of high-quality Canada lynx habitat within the Project footprint. If these proportional estimates are applied to the proportional loss of high-quality habitat for the Future Case (presented in the previous section in Table 15.5-37), then roughly up to 4.6% of high-quality Canada lynx habitat may be affected by sensory disturbance outside of the project footprints. This may be an overestimate as sensory disturbance is not generated continuously from all portions of any given project area, and furthermore, not all projects are likely to be generating noise in overlapping time periods.

The residual cumulative effect to Canada lynx from sensory disturbance arising from the effects of the Project in combination with those of other past, present, and reasonably foreseeable future projects or activities is characterized as follows:

- Duration: *Long-term*, as sensory disturbance will continue through to the end of the Operations phases of both the Crown Mountain Coking Coal Project and those of other reasonably foreseeable future projects and activities.
- Magnitude: *Low*, as up to 4.6% of high-quality habitat will be affected in the Terrestrial RSA.
- Geographic Extent: *Regional*, as the effect of sensory disturbance will be within the Terrestrial RSA.
- Frequency: *Continuous,* though at varying levels until the end of Operations phases of the Crown Mountain Coking Coal Project and those of other reasonably foreseeable future projects and activities
- Reversibility: *Reversible long-term*, the effect of noise will decline substantially at the end of the Operations phases of the Crown Mountain Coking Coal Project and those of other reasonably foreseeable future projects and activities.
- Context: *High,* as Canada lynx utilize a variety of landscapes, and having moderate resilience to habitat loss and may adapt to effects.

Disruption to Movement

Many present and reasonably foreseeable future projects and activities create impermeable barriers (e.g., pits and dumps at mines) or semi-permeable barriers (e.g., roads, and other linear features) for wildlife. While each of the existing and reasonably foreseeable future projects and activities may block movements to varying degrees, they are geographically separated from the Crown Mountain Coking Coal Project such that additive barriers with the Project are limited (Figure 15.5-38).

The residual cumulative effect to Canada lynx from disruption to movement arising from the effects of the Project in combination with those of other past, present, and reasonably foreseeable future projects or activities is characterized as follows:

- Duration: *Long-term*, as disruption to movement will continue through to the end of the Operations phases of the Crown Mountain Coking Coal Project and those of other reasonably foreseeable future projects and activities.
- Magnitude: *Low*, given the geographic distribution of current and reasonably foreseeable future projects and activities.
- Geographic Extent: *Regional*, as disruption to movement is limited to within the Terrestrial RSA.
- Frequency: *Continuous,* as the effect will continue through to the end of the Operations phases of the Crown Mountain Coking Coal Project and those of other reasonably foreseeable future projects and activities.
- Reversibility: *Reversible long-term*, the effect will decline substantially at the end of the Operations phases of the Crown Mountain Coking Coal Project and those of other reasonably foreseeable future projects and activities.
- Context: *Neutral*, as Canada lynx has moderate resilience and may adapt to effects.

Determination of Significance

There is limited data on Canada lynx population trends in the region, though a minimum population density from hair snagging found 0.74 Canada lynx per 100 km^2 in the Elk Valley (Apps et al., 2007). High-quality Canada lynx habitat is available throughout the Terrestrial RSA. Based on the characterization of the residual cumulative effects and regional Canada lynx density estimates, the Project in combination with reasonably foreseeable future projects and activities would not limit the ability of Canada lynx to persist and maintain self-sustaining populations in the Terrestrial RSA, including within Alberta and on federal lands located within the RSA. The residual cumulative effects of habitat loss and degradation, sensory disturbance, and disruption to movement on Canada lynx arising from the Project in combination with other past, present, and reasonably foreseeable future projects and activities during all phases are therefore considered not significant.

Likelihood and Confidence

Effects that are determined to be not significant do not require a characterization of likelihood.

There is a good understanding of Canada lynx ecology, their habitat availability and distribution, known occurrences, and abundance in the Terrestrial RSA. The confidence in the determination of the significance of residual cumulative effects to Canada lynx is therefore high.

15.5.4.4.7 Summary of Cumulative Effects

Residual cumulative effects and the selected mitigation measures, characterization criteria, significance determination, likelihood, and confidence for carnivore VCs are summarized in Table 15.5-45.

Table 15.5-45: Summary of Cumulative Effects on Carnivore VCs

Valued Component	Residual Cumulative Effect	Mitigation Measures	Summary of Cumulative Residual Effects Characterization	Significance (Significant, Not Significant)	Confidence (High, Moderate, Low)
Grizzly Bear	Habitat Loss and Degradation	• Minimizing local Project-related effects • Participate in regional initiatives, where relevant and appropriate, and adoption of new management practices and measures to meet regional planning objectives, where possible	Duration: Long-term and permanent Magnitude: Low Geographic Extent: Regional Frequency: Continuous Reversibility: Reversible long-term Context: Low	Not Significant	Moderate
Grizzly Bear	Sensory Disturbance	• Minimizing local Project-related effects • Participate in regional initiatives, where relevant and appropriate, and adoption of new management practices and measures to meet regional planning objectives, where possible	Duration: Long-term Magnitude: Low Geographic Extent: Regional Frequency: Continuous Reversibility: Reversible long-term Context: Low		
Grizzly Bear	Disruption to Movement	• Minimizing local Project-related effects • Participate in regional initiatives, where relevant and appropriate, and adoption of new management practices and measures to meet regional planning objectives, where possible	Duration: Long-term Magnitude: Low Geographic Extent: Regional Frequency: Continuous Reversibility: Reversible long-term Context: Low		
Grizzly Bear	Increased Mortality Risk	• Minimizing local Project-related effects • Participate in regional initiatives, where relevant and appropriate, and adoption of new management practices and measures to meet regional planning objectives, where possible	Duration: Long-term Magnitude: Negligible Geographic Extent: Regional Frequency: Intermittent Reversibility: Reversible long-term Context: Low		

Valued Component	Residual Cumulative Effect	Mitigation Measures	Summary of Cumulative Residual Effects Characterization	Significance (Significant, Not Significant)	Confidence (High, Moderate, Low)
Wolverine	Habitat Loss and Degradation	• Minimizing local Project-related effects • Participate in regional initiatives, where relevant and appropriate, and adoption of new management practices and measures to meet regional planning objectives, where possible	Duration: Long-term and permanent Magnitude: Low Geographic Extent: Regional Frequency: Continuous Reversibility: Reversible long-term Context: Low	Not Significant	Moderate
Wolverine	Sensory Disturbance	• Minimizing local Project-related effects • Participate in regional initiatives, where relevant and appropriate, and adoption of new management practices and measures to meet regional planning objectives, where possible	Duration: Long-term Magnitude: Low Geographic Extent: Regional Frequency: Continuous Reversibility: Reversible long-term Context: Low		
Wolverine	Disruption to Movement	• Minimizing local Project-related effects • Participate in regional initiatives, where relevant and appropriate, and adoption of new management practices and measures to meet regional planning objectives, where possible	Duration: Long-term Magnitude: Low Geographic Extent: Regional Frequency: Continuous Reversibility: Reversible long-term Context: Low		
American Badger	Habitat Loss and Degradation	• Minimizing local Project-related effects • Participate in regional initiatives, where relevant and appropriate, and adoption of new management practices and measures to meet regional planning objectives, where possible	Duration: Long-term Magnitude: Moderate Geographic Extent: Regional Frequency: Continuous Reversibility: Reversible long-term Context: Moderate	Not Significant	High

Valued Component	Residual Cumulative Effect	Mitigation Measures	Summary of Cumulative Residual Effects Characterization	Significance (Significant, Not Significant)	Confidence (High, Moderate, Low)
American Badger	Sensory Disturbance	• Minimizing local Project-related effects • Participate in regional initiatives, where relevant and appropriate, and adoption of new management practices and measures to meet regional planning objectives, where possible	Duration: Long-term Magnitude: Moderate Geographic Extent: Regional Frequency: Continuous Reversibility: Reversible long-term Context: High		
American Badger	Disruption to Movement	• Minimizing local Project-related effects • Participate in regional initiatives, where relevant and appropriate, and adoption of new management practices and measures to meet regional planning objectives, where possible	Duration: Long-term Magnitude: Low Geographic Extent: Regional Frequency: Continuous Reversibility: Reversible long-term Context: Moderate		
American Badger	Increased Mortality Risk	• Minimizing local Project-related effects • Participate in regional initiatives, where relevant and appropriate, and adoption of new management practices and measures to meet regional planning objectives, where possible	Duration: Long-term Magnitude: Negligible Geographic Extent: Regional Frequency: Intermittent Reversibility: Reversible long-term Context: Low		
American Marten	Habitat Loss and Degradation	• Minimizing local Project-related effects • Participate in regional initiatives, where relevant and appropriate, and adoption of new management practices and measures to meet regional planning objectives, where possible	Duration: Permanent Magnitude: Moderate Geographic Extent: Regional Frequency: Continuous Reversibility: Permanent Context: Low	Not Significant	High

Valued Component	Residual Cumulative Effect	Mitigation Measures	Summary of Cumulative Residual Effects Characterization	Significance (Significant, Not Significant)	Confidence (High, Moderate, Low)
American Marten	Sensory Disturbance	• Minimizing local Project-related effects • Participate in regional initiatives, where relevant and appropriate, and adoption of new management practices and measures to meet regional planning objectives, where possible	Duration: Long-term Magnitude: Low Geographic Extent: Regional Frequency: Continuous Reversibility: Reversible long-term Context: Low		
American Marten	Disruption to Movement	• Minimizing local Project-related effects • Participate in regional initiatives, where relevant and appropriate, and adoption of new management practices and measures to meet regional planning objectives, where possible	Duration: Long-term Magnitude: Low Geographic Extent: Regional Frequency: Continuous Reversibility: Reversible long-term Context: Low		
Canada Lynx	Habitat Loss and Degradation	• Minimizing local Project-related effects • Participate in regional initiatives, where relevant and appropriate, and adoption of new management practices and measures to meet regional planning objectives, where possible	Duration: Long-term Magnitude: Moderate Geographic Extent: Regional Frequency: Continuous Reversibility: Reversible long-term Context: High	Not Significant	High
Canada Lynx	Sensory Disturbance	• Minimizing local Project-related effects • Participate in regional initiatives, where relevant and appropriate, and adoption of new management practices and measures to meet regional planning objectives, where possible	Duration: Long-term Magnitude: Low Geographic Extent: Regional Frequency: Continuous Reversibility: Reversible long-term Context: High		

Valued Component	Residual Cumulative Effect	Mitigation Measures	Summary of Cumulative Residual Effects Characterization	Significance (Significant, Not Significant)	Confidence (High, Moderate, Low)
Canada Lynx	Disruption to Movement	• Minimizing local Project-related effects • Participate in regional initiatives, where relevant and appropriate, and adoption of new management practices and measures to meet regional planning objectives, where possible	Duration: Long-term Magnitude: Low Geographic Extent: Regional Frequency: Continuous Reversibility: Reversible long-term Context: Neutral		

15.5.5 Follow-up Strategy

A follow-up program is used to verify environmental effects predictions or to verify the effectiveness of mitigation measures where there is uncertainty (i.e., low to moderate confidence). Where environmental effects exceed that predicted under the effects assessment, or mitigation measures prove to be ineffective, alternative strategies are developed to adaptively manage the Project's effects on wildlife VCs.

Two mitigation measures were identified as having uncertainty in their effectiveness: the overland conveyor underpasses, and traffic-related mitigations at Grave Creek Canyon. Along the conveyor, underpasses will be created by elevating the conveyor to at least 2.4 m above ground (or higher where terrain can be used to create more clearance) at intervals of two per 1,000 m. Use of the conveyor underpasses and habitats adjacent to the conveyor will be dependent on the sensitivity of carnivore VCs to the physical presence of the conveyor and the noise that is generated. A program will be developed to monitor carnivore and other wildlife use of underpasses and areas immediately adjacent, using remote wildlife cameras.

A north-south corridor that connects Erickson Ridge to Sheep Mountain through Grave Creek Canyon is known to occur. Measures to mitigate the effects of increased traffic volume along Grave Creek Road on the frequency of crossing by wildlife will be implemented; however, there is uncertainty on their effectiveness. A program will be developed to monitor carnivore and other wildlife movement across Grave Creek Road at Grave Creek Canyon and in areas immediately adjacent (for comparison) using remote wildlife cameras, similar to the program for the overland conveyor.

Other wildlife monitoring outlined in the Wildlife Management and Monitoring Plan (Chapter 33, Section 33.4.1.13) to support the verification of mitigation measures and effects predictions relating to carnivore VCs will include:

- Monitoring of footprint and habitat losses/gains to track and compare the planned footprint with the actual footprint and to track ecological restoration;
- Recording and reporting on wildlife mortality, incidents, accidents, or near misses; and
- Monitoring of species occurrence at the local level by Project personnel documenting incidental observations of wildlife (i.e., wildlife sighting and incidents).

15.5.6 Summary and Conclusions

Grizzly bear, wolverine, American badger, American marten, and Canada lynx were selected as carnivore VCs. The potential effects of the Project on carnivore VCs were determined to be habitat loss and degradation, sensory disturbance, disruption to movement, and increased mortality risk (for grizzly bear and American badger only). The effect of potential contaminants of concern on carnivores was included in Chapter 22.

Various mitigation measures will avoid or minimize potential effects to carnivore VCs, though potential residual effects may remain. These residual effects were determined to be not significant. The residual cumulative effects of habitat loss and degradation, sensory disturbance, disruption to movement, and increased mortality risk on carnivore VCs arising from the Project in combination with other past, present, and reasonably foreseeable future projects and activities were considered not significant. The confidence in the determination of significance was considered moderate to high. Follow-up monitoring for carnivore VCs will include monitoring wildlife movement across Grave Creek Road at Grave Creek Canyon, monitoring of use of the overland conveyor wildlife underpasses and footprint, and facility monitoring.

15.6 Bat Community

15.6.1 Introduction

Sixteen species of bats occur within B.C., and over half of these species are considered to be at risk (Brigham, 2020; B.C. MOE, 2016). Bats are an ecologically and economically valuable component of B.C.'s ecosystems as they control pest insect populations that affect agriculture and forestry (Craig and Holroyd, 2013). Bats are good indicators of climate change and habitat deterioration as their low reproductive rates make them sensitive to changes in the environment (e.g., loss of insect production from habitat loss, accumulation of toxins and pesticides; B.C. MOE, 2016). Bats are sensitive to human activities such as resource extraction activities, transportation corridor expansions, and urban developments, resulting in the loss of roosting and foraging habitat (Craig and Holroyd, 2013). In addition to human-related threats, white-nose syndrome is a natural species-specific threat impacting bat populations across Canada (ECCC, 2018). At-risk bat species are considered a receptor VC, as per the AIR (EAO, 2018).

Bat species of the Vespertilionidae family, such as the little brown myotis, northern myotis, and eastern red bat, have the potential to occur within the Terrestrial LSA and are therefore considered receptor VCs related to the Project. The northern myotis and the little brown myotis were both federally listed on Schedule 1 of the *Species At Risk Act* (2002) as Endangered as their survival is imminently threatened by white-nose syndrome (ECCC, 2014). Northern myotis are also provincially Blue-listed. The eastern red bat is not federally or provincially listed but was considered in this assessment because detections within B.C. are rare and are becoming of increasing interest (Isaac, 2018).

The little brown myotis has a wide-ranging distribution in B.C. and has been found in the East Kootenay region (B.C. CDC, 2015d). Little brown myotis are insectivores that inhabit a wide range of habitats, from dry open forests to wet riparian areas, and forage in-flight over water, along the margins of waterbodies, or in woodlands near water (B.C. CDC, 2015d). These are non-migratory, colonial bats that roost in warm structures and tree hollows, and hibernate in caves, tunnels, and abandoned mines (B.C. CDC, 2015d).

The distribution of the northern myotis is limited to eastern B.C., with only three substantiated locality records occurring in northern and central B.C. (Nagorsen and Brigham, 1993). The northern myotis are insectivores that inhabit late-successional forests, and forage by gleaning from dead or decaying trees and the forest floor, and in-flight along forest edges, openings, and occasionally over water (B.C. CDC, 2014). These bats are migratory, roost either singly or in small colonies (< 10) in partially dead or decaying trees, and hibernate colonially in caves, tunnels, and mines (B.C. CDC, 2014).

Eastern red bats are insectivores that inhabit boreal forests, where they forage in-flight in the open canopy, over water, and in woodlands. These are solitary bats that roost in tree foliage, making them susceptible to avian predators. They migrate seasonally and do not hibernate (B.C. CDC, 2015e).

All three of the VC bat species are nocturnal, with foraging activity at dusk and/or dawn (B.C. CDC, 2014; 2015d, 2015e).

15.6.1.1 Regulatory and Policy Considerations

The little brown myotis and the northern myotis are listed as Endangered on Schedule 1 of the federal *Species at Risk Act* (2002; COSEWIC, 2013a) and are therefore legally protected. Provincially, bats of the Vespertilionidae family are protected under the *B.C. Wildlife Act* (1996); as such, it is illegal to remove, injure, or kill bats in B.C. The little brown myotis and the northern myotis are also listed as Endangered by COSEWIC, whereby targeted population management and conservation planning is undertaken for both species (COSEWIC, 2013a). Furthermore, bat habitats such as hibernacula and nursery roosts are protected under the Wildlife Habitat Feature Order for the Kootenay Boundary Region of B.C. (B.C. MOE, 2016).

15.6.2 Existing Conditions

15.6.2.1 Existing Regional and Local Information

Existing bat data for the region were reviewed to aid in determining the presence and distribution of bats in the vicinity of the Terrestrial LSA. Information was obtained from the Kootenay Community Bat Project, the Canadian Species at Risk Public Inventory, the B.C. CDC Species and Ecosystems Explorer and iMap (B.C. CDC, 2019a; 2019b), and other studies undertaken in the vicinity of the Project.

Little is known about the populations of the three at-risk bat VCs within the Project study areas. A search of the B.C. CDC iMap did indicate occurrences of the three at-risk bat species in the Terrestrial LSA. The B.C. CDC are confident or certain that the little brown myotis occurs in the following areas: ESSF and MS BEC units, Kootenay Ministry of Environment (MOE) Environment Region, Rocky Mountain Forest District (DRM), and the East Kootenay Regional District. The B.C. CDC are confident or certain that the northern myotis occurs in the following areas: Kootenay MOE Environment Region and the Rocky Mountain Forest District (B.C. CDC, 2019b).

The dominant biogeoclimatic (BGC) units within the Terrestrial LSA are the Dry Warm Montane Spruce (MSdw) in the lower-elevation areas and Elk Dry Cool Englemann Spruce-Subalpine Fir (ESSFdk1) above, at about 1,600 m asl (see Section 15.3.1). Bat foraging and roosting habitats found in the MSdw include grasslands, rocky substrates (cliffs, talus, and rock outcrops), wetlands, and forests. In the ESSFdk1, bat foraging and roosting habitats include subalpine grasslands, meadows, avalanche chutes, and subalpine forests (Craig and Holroyd, 2013). Above the ESSFdk1 is the Dry Cool Woodland Engelmann Spruce Subalpine Fir (ESSFdkw), and this is the variant where the majority of the Project footprint exists. Bat habitat in this BGC unit would likely be restricted to rocky substrates and avalanche chutes. Winter hibernacula is likely present in the Terrestrial LSA, including caves and cracked bedrock cliff faces for the little brown myotis and northern myotis. The eastern red bats will hibernate in leaf litter in sub-zero temperatures, but otherwise do not hibernate (B.C. CDC, 2015e).

Baseline studies for bat hibernacula were conducted in the vicinity of Teck's Elkview Operations in 2014 (Golder Associates Ltd., 2015a) located approximately 8 km southwest of the Project. There were no active winter hibernacula identified in the area based on the visual inspection of potential hibernacula and monitoring with acoustic detectors. One active bat was identified but was considered to be flying past and not using the identified hibernaculum. The timing of the detectors may have been too early, and bats may have still been largely hibernating in mid-April (Golder Associates Ltd., 2015a).

15.6.2.1.1 Transboundary Considerations

Bats are highly mobile and for those species that are migratory, spend a substantial amount of the year outside Canada. Bat populations within the Terrestrial LSA and Birds, Bats, and Amphibians RSA are likely part of larger populations that span across both the B.C./Alberta and the Canada/U.S.A. borders.

15.6.2.2 Baseline Programs

15.6.2.2.1 Methods

Acoustic bat surveys following the *Inventory Methods for Bats* (RISC, 1999d) were conducted as part of the wildlife baseline surveys for the Project. The survey methods are briefly summarized below. Additional details can be referenced within Appendix 15-B.

Acoustic Monitoring

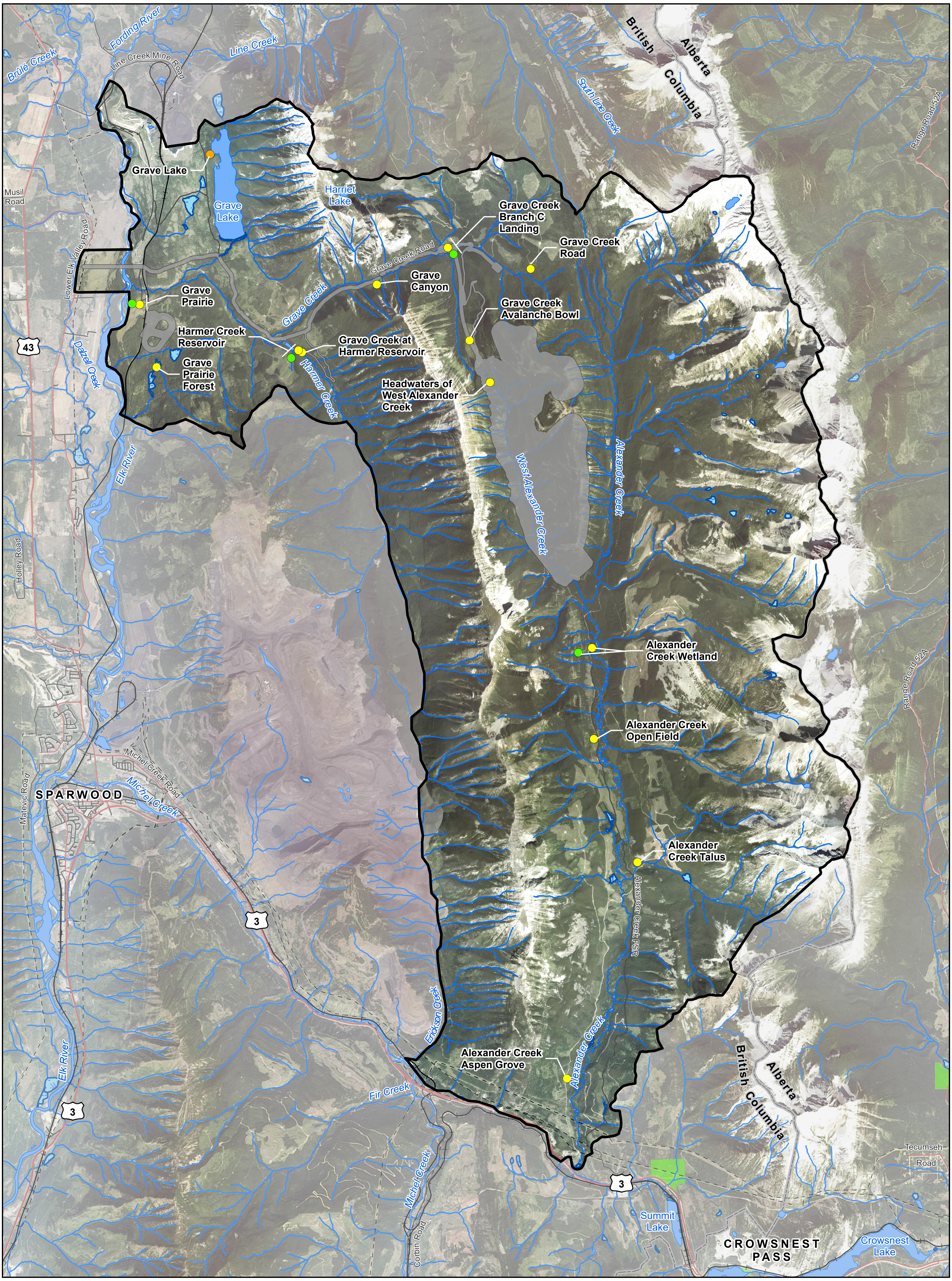
Twelve acoustic detectors (Anabat SD2 [Titley Electronics Ltd.] and SM2 BAT [Wildlife Acoustics Inc.]) were deployed in representative habitat types throughout the Grave Creek and Alexander Creek drainages to identify bat species presence and use (RISC, 1999d; Isaac, 2018). Seven of the eleven detectors were located within the Project footprint. Sampling effort at each site varied from one to sixteen nights. Additional detectors (n=3) were later deployed during fall 2019 to winter 2020. The site names and respective habitat types and sampling dates are presented in Table 15.6-1 and the acoustic monitoring station locations are presented on Figure 15.6-1.

Live-Capture Surveys

To confirm identification of bat species from the acoustic files, live capture and subsequent genetic testing of bats was conducted (RISC, 1999d; Isaac, 2018). The little brown myotis was the focal species because its identification cannot be confirmed by acoustics alone, in addition to its conservation status and likelihood to exist in the Terrestrial LSA. Mist nets were erected between August 8 to 10, and August 14, 2017 in foraging habitats for the little brown myotis (fly-ways leading to water bodies, edge of water bodies) at the Alexander Creek wetland site, the Harmer Reservoir site, and near the Grave Prairie site and the Grave Creek Branch C landing site (Figure 15.6-1). Captured bats were morphologically identified, weighed, sexed, and their reproductive status was determined. Wing tissue samples from bats morphologically identified as little brown myotis were taken and submitted to Wildlife Genetics International (WGI) for DNA sequencing for positive identification. Additionally, one guano sample from a suspected little brown myotis colony in a bat house installed on a cabin at Grave Lake was submitted to WGI for DNA sequencing (Isaac, 2018).

15.6.2.2.2 Results

The results of the bat baseline surveys are briefly summarized below. Additional details can be referenced within Appendix 15-B.



Crown Mountain Coking Coal Project

Figure 15.6-1
Bat Monitoring Locations

LEGEND

- Acoustic Detector Location
- Guano Sample Location
- Mist Netting Location
- Terrestrial Local Study Area
- Project Footprint
- Highway
- Arterial/Collector Road
- Local/Resource Road
- Railway
- Transmission Line
- Watercourse
- Waterbody
- Wetland
- Provincial Park/Protected Area
- British Columbia/Alberta Border

0 2 4
Kilometres
Scale 1:85,000

Map Drawing Information:
Data Provided By NWP Coal Canada Ltd, Dillon Consulting Limited, Keefer Ecological Services Ltd, Province of British Columbia GeoBC Open Data, Government of Alberta Open Data, Natural Resource Canada.
Imagery Provided By Landsat 8 (Aug 2018), and GeoBC Ortho Imagery (Aug 2016).

Map Created By: LMM/RB
Map Checked By: HEB
Map Coordinate System: NAD 1983 UTM Zone 11N

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Project: 12-6231
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Table 15.6-1: Summary of 2017 Bat Acoustic Monitoring Locations

Site Name	Habitat Types	Sampling Dates
Grave Prairie	Open grassland prairie	June 16-June 26, 2017 (11 nights)
Grave Prairie Forest	Mixed forest adjacent to grassland prairie	June 28-July 12, 2017 (15 nights)
Harmer Creek Reservoir	Riparian shrubs leading into lake	June 15-June 18, 2017 (4 nights)
Grave Canyon	Rock face with talus slope	June 15-June 18, 2017 (4 nights)
Grave Creek Branch C Landing	Forest clearing adjacent to forest service road	July 18-Aug 4, 2017 (18 nights)
Grave Creek Avalanche Bowl	High elevation site overlooking avalanche chutes	July 18-Aug 4, 2017 (18 nights)
Grave Creek Road	Coniferous forest on edge of unused forest service road	July 18-Aug 3, 2017 (17 nights)
Grave Creek at Harmer Reservoir	Adjacent to reservoir	Oct 22-25, 2019 (4 nights) Oct 22-25, 2019 (4 nights) Jan 30-Feb 3, 2020 (5 nights)
Alexander Creek Talus	Talus slope	June 16- 26, 2017 (11 nights)
Alexander Creek Wetland	Wetland	June 16 - 25, 2017 (10 nights) Oct 21- Nov 11, 2019 (22 nights) Jan 30-31, 2020 (2 nights) April 10-11, 2020 (2 nights)
Headwaters of West Alexander Creek	Wetland	Oct 22-29, 2019 (8 nights) Jan 1- 8, 2020 (8 nights) Jan 30-Feb 3, 2020 (5 nights)
Alexander Creek Open Field	Open meadow adjacent to Alexander Creek	June 22-26, 2017 (5 nights)
Alexander Creek Aspen Grove	Edge of grove of aspen trees near Alexander Creek	July 27, 2017 (1 night)

Acoustic Monitoring

After the removal of high ambient noise files, a total of 9,289 acoustic files detecting bats were recorded. The three at-risk bat species selected as VCs were acoustically identified in the Terrestrial LSA. The little brown myotis was acoustically identified at nine sites, suggesting this species occurs throughout the Terrestrial LSA. The northern myotis was acoustically identified at eight sites suggesting this species also occurs throughout the Terrestrial LSA, although in relatively lower abundance. The eastern red bat was acoustically detected at four sites in low abundance, suggesting it only occurs in select portions of the Terrestrial LSA.

Accounting for survey effort, the highest relative number of acoustic files were recorded at the Grave Creek Branch C landing site, followed by the Grave Prairie forest site and the Alexander Creek wetland site. The highest species diversities were recorded at the Grave Prairie forest site, followed by the Alexander Creek wetland site, the Grave Creek Branch C landing site, and the Grave Creek Road site. Based on the species diversity and relative abundances from the acoustic data, the Grave Creek Branch C landing site, the Grave Prairie forest site, and the Alexander Creek wetland site were identified as high occurrence areas for bats, including the VC species (Figure 15.6-2).

The bat species detected during winter months (November to February) were silver haired bat, big brown bat, and little brown myotis (in order of relative abundance). Acoustic detectors recorded a total of 37 unique bat passes. While accounting for survey effort, the highest relative number of acoustic files recorded during winter was at the West Alexander Creek headwaters site, followed by the Alexander Creek wetland, with only one recording of a silver haired bat at the Harmer Creek Reservoir.

Refer to Appendix 15-B for additional description of the acoustic monitoring results and discussion.

Live-Capture Surveys

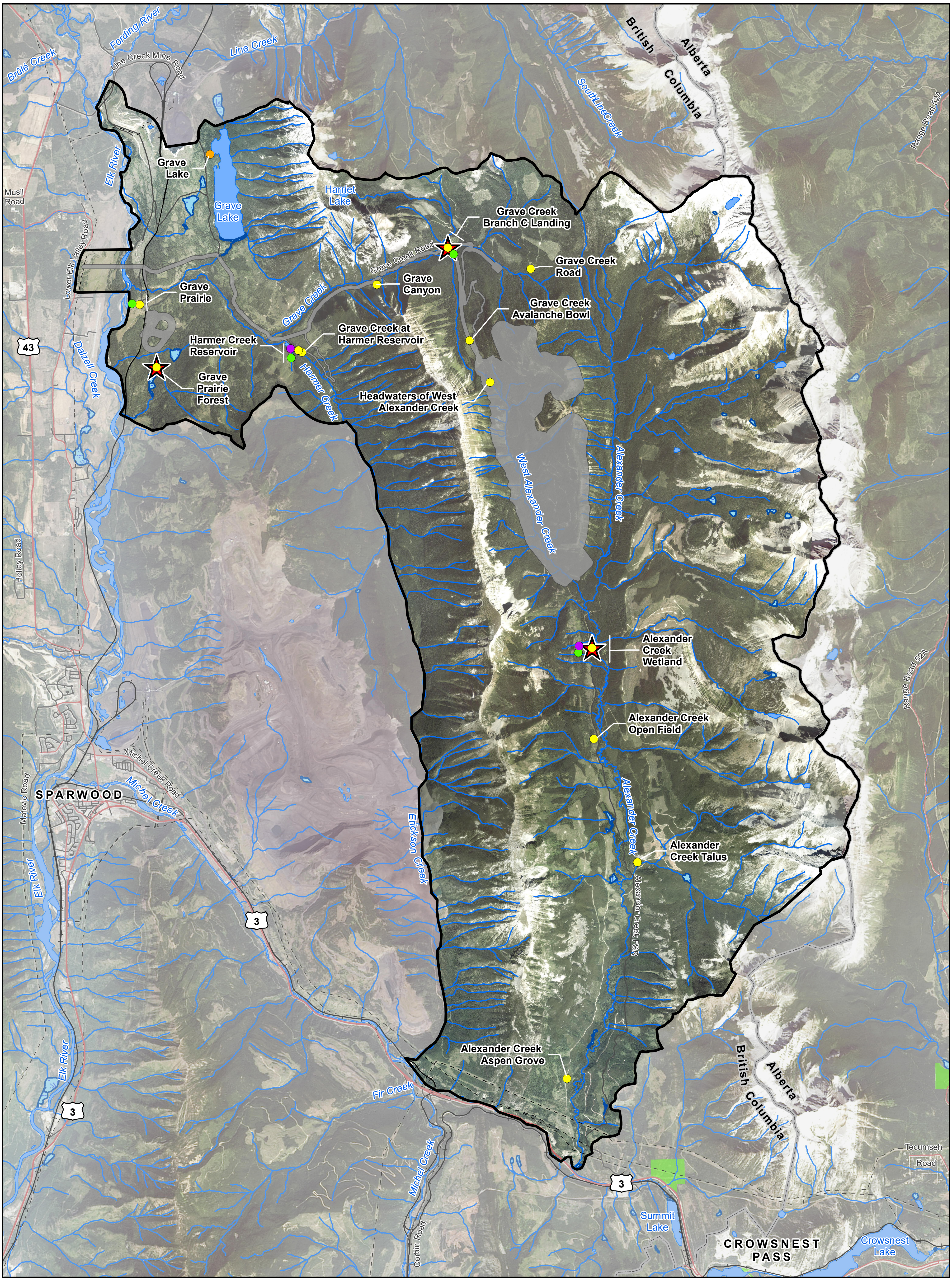
A total of 44 bats of six bat species were live captured, with the little brown myotis being captured and genetically confirmed at the Alexander Creek wetland site and the Harmer Creek Reservoir site. At the Alexander Creek wetland site, 14 adult and one volant juvenile little brown myotis were captured, with an even mix of males and females. Of the females captured, one was post-lactating, and the rest had reproduced in the past (parous). At the Harmer Creek Reservoir site, two adult female little brown myotis were captured, one of which was post-lactating, and the other was parous. A little brown myotis colony was also genetically confirmed at a cabin on the northwest side of Grave Lake. The presence of post-lactating females at both sites suggests that a maternity roost is nearby, and the presence of a volant juvenile at the Alexander Creek wetland site suggests that successful reproduction occurred at the maternity roost.

Since live-capture surveys targeted the little brown myotis, a data gap is present for both the northern myotis and the eastern red bat with respect to live-capture confirmation of their presence within the Terrestrial LSA. These two species were detected acoustically within the Terrestrial LSA, as described above. Refer to Appendix 15-B for additional description of the live-capture survey results and discussion.

15.6.2.3 Modelling

15.6.2.3.1 Methods

At-risk bat habitat availability and distribution was quantified using a habitat suitability index (HSI) model. Due to the limited information available for northern myotis and eastern red bat, and because of the overlapping habitat characteristics of the three bat VCs, the HSI model was developed for little brown myotis and used to represent potential habitat for all three at risk bat species. The HIS model was developed based on 16 predictor variables chosen based on *a priori* knowledge of habitat characteristics influencing bat survival and reproduction. Variables seek to account for variation of prey capture, reproduction, roosting habitat (e.g., vegetation structure), security and thermal habitat, winter hibernacula, and anthropogenic disturbance. Details on habitat modelling methodologies are provided in Appendix 15-C.



Crown Mountain Coking Coal Project

Figure 15.6-2
Bat Detection Locations

LEGEND

- Acoustic Detector
- Guano Sample
- Live Capture
- Live Capture - Little Brown Myotis
- High Bat Occurrence Area
- Terrestrial Local Study Area
- Project Footprint
- Highway
- Arterial/Collector Road
- Local/Resource Road
- Railway
- Transmission Line
- Watercourse
- Waterbody
- Wetland
- Provincial Park/Protected Area
- British Columbia/Alberta Border

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Kilometres
Scale 1:85,000

N E S W

Map Drawing Information:
Data Provided By NWP Coal Canada Ltd, Dillon Consulting Limited, Keefer Ecological Services Ltd, Province of British Columbia GeoBC Open Data, Government of Alberta Open Data, Natural Resource Canada.
Imagery Provided By Landsat 8 (Aug 2018), and GeoBC Ortho Imagery (Aug 2016).

Map Created By: LMM
Map Checked By: HEB
Map Coordinate System: NAD 1983 UTM Zone 11N

NWP Coal Canada Ltd

Project: 12-6231
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Date: 2022-01-12

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15.6.2.3.2 Results

Habitat Use

The overall estimate of occurrence in fall-winter was approximately 0.22, or at-risk bats are potentially found in approximately 22% of the Terrestrial LSA. Areas assumed to contribute most to suitable at-risk bat habitat were rugged terrain/potential hibernacula mapped in proximity to waterbodies, which are known to be important for hydration during events of spontaneous arousal from the hibernation cycle. The fall-winter model for at-risk bats is two-rank (useable, negligible) due to limited information concerning the parameters affecting bat survivability during hibernation.

The overall estimate of at-risk bat occurrence in spring-summer was approximately 0.19; that is, at-risk bats are potentially found in approximately 19% of the Terrestrial LSA. Areas assumed to contribute most to suitable at-risk bat habitat in spring-summer were old and mature forests in proximity to suitable foraging habitat, with wetlands and riparian areas representing optimal foraging habitat, and early seral stage forests and cutblocks otherwise considered suitable foraging habitat.

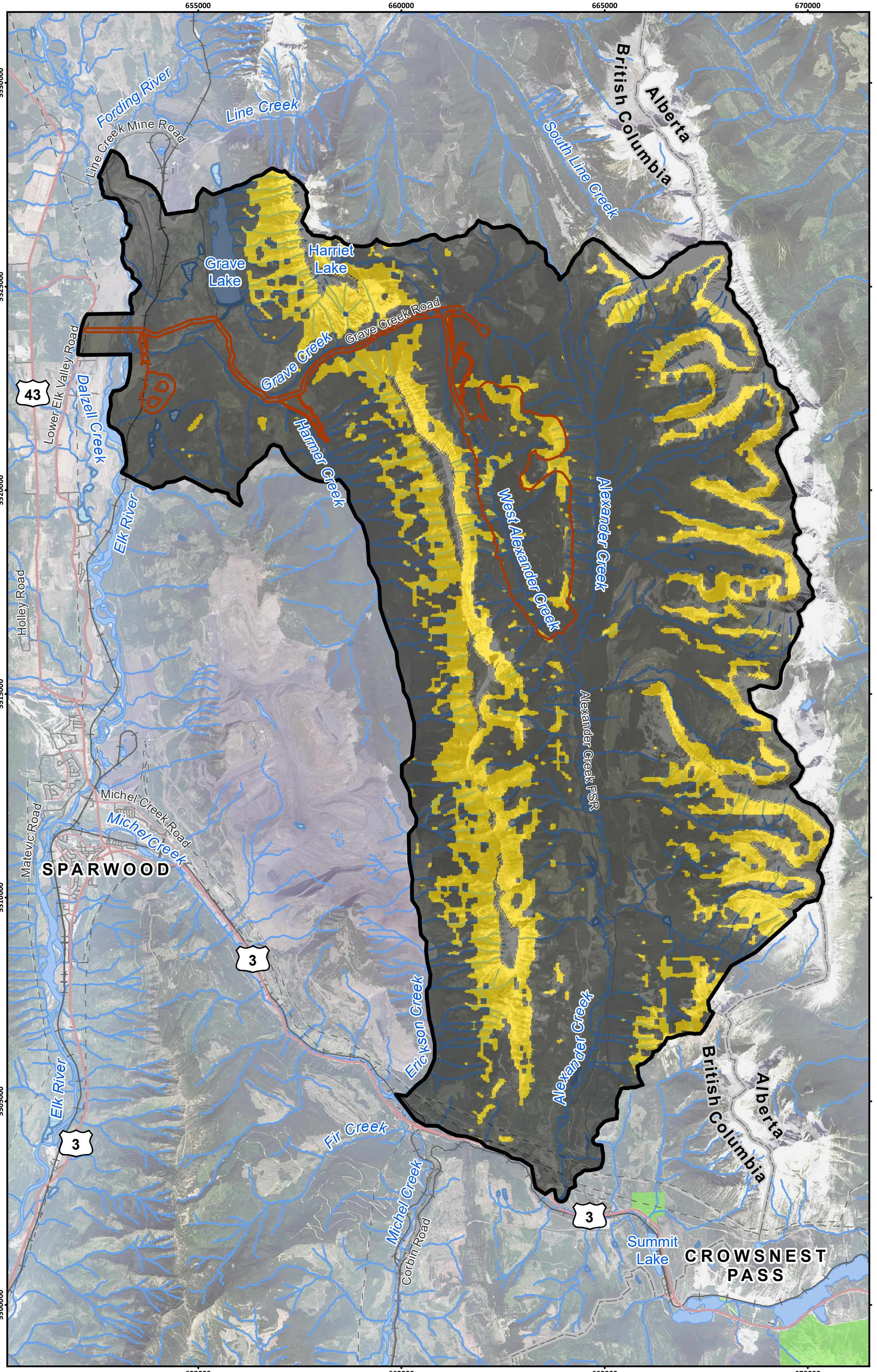
Habitat Suitability

The at-risk bat habitat model indicates that useable habitat for at-risk bats in fall-winter within the Terrestrial LSA are located along Erickson Ridge, Sheep Mountain, and the Continental Divide. The model indicates that useable habitats for at-risk bats in spring/summer within the Terrestrial LSA are located along the lower portions of Erickson Ridge, Grave Creek, and along the Alexander Creek drainage. The availability of at-risk bat habitats within the Terrestrial LSA and RSA is summarized from Appendix 15-C and presented in Table 15.6-2 and Figure 15.6-3.

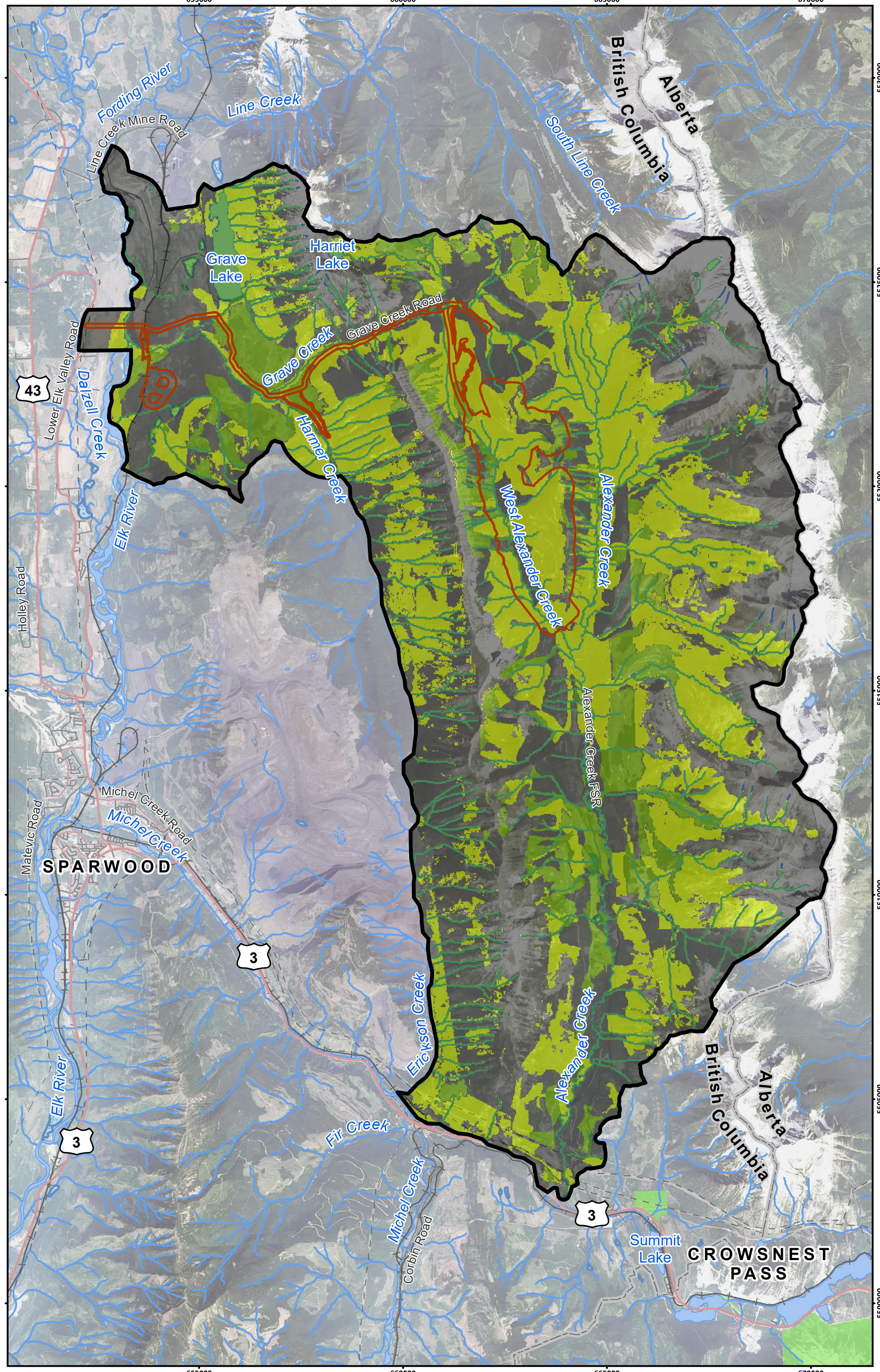
Table 15.6-2: Habitat Suitability for At-Risk Bats in the Terrestrial LSA and the Bird, Bats, and Amphibians RSA

Habitat Quality Rating	Amount of Habitat in the Project Footprint		Amount of Habitat in the Terrestrial LSA		Amount of Habitat in the Terrestrial Birds, Bats, and Amphibians RSA	
	Area (ha)	% of Project Footprint	Area (ha)	% of LSA	Area (ha)	% of Birds, Bats, and Amphibians RSA
Fall-Winter (Hibernacula) Habitat						
Useable (1)	191	15	5,273	22	113,009	9
Negligible (0)	1,092	85	18,948	78	1,150,161	91
Spring-Summer (Foraging and Roosting) Habitat						
High (3)	241	19	4,514	19	223,924	18
Medium (2)	686	53	7,721	32	319,145	25
Low (1)	0	0	17	<1	1,343	<1
Unclassified (0)	356	28	11,969	49	718,758	57

FALL-WINTER



SPRING-SUMMER



Crown Mountain Coking Coal Project

Figure 15.6-3
At-Risk Bat Habitat Suitability in the Terrestrial Local Study Area

LEGEND

Habitat Suitability

- High
- Moderate
- Low
- Unclassified
- Terrestrial Local Study Area
- Project Footprint
- Highway
- Arterial/Collector Road
- Local/Resource Road
- Railway
- Transmission Line
- Watercourse
- Waterbody
- Wetland
- Provincial Park/Protected Area
- British Columbia/Alberta Border

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N E S W

Scale 1:130,000

Map Drawing Information:
Data Provided By NWP Coal Canada Ltd, Dillon Consulting Limited, Keefer Ecological Services Ltd, Province of British Columbia GeoBC Open Data, Government of Alberta Open Data, Natural Resource Canada.
Imagery Provided By Landsat 8 (Aug 2018), and GeoBC OrthoImagery (Aug 2016).

Map Created By: PR
Map Checked By: JM
Map Coordinate System: NAD 1983 UTM Zone 11N

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Project: 12-6231
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During fall-winter, approximately 191 ha of the Project footprint (15%) was predicted as useable habitat for at-risk bats. Useable habitats within the Project footprint during fall-winter are located on high elevation portions of Erickson Ridge and Crown Mountain (Figure 15.6-3). Approximately 5,273 ha of the Terrestrial LSA (22%) was predicted as useable fall-winter habitat for at-risk bats. Areas of useable habitat within the Terrestrial LSA during fall-winter are primarily located along Erickson Ridge, Sheep Mountain, and along ridges of the Continental Divide. Approximately 113,009 ha of the Birds, Bats, and Amphibians RSA (9%) was predicted as useable fall-winter habitat for at-risk bats (Table 15.6-2).

During spring-summer, approximately 241 ha of the Project footprint (19%) was predicted as high suitability living and foraging habitat for at-risk bats. High suitability habitats within the Project footprint during spring-summer are located on lower elevation portions of Erickson Ridge and Crown Mountain (Figure 15.6-3). Approximately 4,514 ha of the Terrestrial LSA (19%) was predicted as high suitability spring-summer habitat. Areas of high suitability habitat for at-risk bats within the Terrestrial LSA during spring-summer are primarily located along lower portions of Erickson Ridge, Grave Creek, and the Alexander Creek drainage (Figure 15.6-3). Approximately 223,924 ha of the Terrestrial Birds, Bats, and Amphibians RSA (18%) was predicted as high suitability living and foraging habitat (Table 15.6-2).

15.6.3 Project Effects Assessment

15.6.3.1 Thresholds for Determining Significance of Residual Effects

The CEAA guidance document Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects (CEAA, 2015b) and the KNC's Recommended Minimum Standards for Proponents in Determining Significance of Effects in Environmental Assessments (EAs) in the Elk Valley (KNC, 2020) provide guidance on significance determination and the role of thresholds beyond which an effect is considered unacceptable. For wildlife species listed under SARA, there are prohibitions against causing harm, injury, or mortality of a species at risk, as well as against destruction of mapped critical habitat (depending on the species and land ownership). This can readily be applied as a threshold that can be used for determining the significance of residual effects. Aside from mapped critical habitat, there are no government or industry regulations or established objectives, environmental standards, or established benchmarks to establish thresholds for the significance of residual effects on at-risk bats resulting from the Project. The desired endpoint for wildlife management is for persistent and self-sustaining wildlife populations. Any effect then that diminishes the ability of a wildlife population to be persistent and self-sustaining was therefore used as a threshold for the determination of significance for a residual effect.

Thus, in consideration of the above, a significant adverse residual environmental effect on the at-risk bat community is one where the Project:

- Causes the non-permitted contravention of any of the prohibitions stated in Sections 32 to 36 of the *Species at Risk Act*, including injury, harassment, or mortality of a bat species at risk;
- Results in the non-permitted loss of critical habitat for bat species at risk; or
- Causes a decline in abundance or change in distribution of bat populations such that the populations will not be sustainable in the Birds, Bats, and Amphibians RSA.

15.6.3.2 Project Effects

Potential effects on at-risk bat habitat availability and distribution and known occurrences and abundance may occur as a result of Project activities associated with mine development. Potential effects on wildlife are discussed with respect to changes at both the individual level (i.e., behaviour, physiological condition, survival) and the population level (i.e., population size, distribution, mortality rate). Since potential effects at the population level are of greater importance than at the individual level, the assessment primarily focuses on the effects to local populations. The assessment focuses only on planned activities within the designed scope of the Project. Effects related to unplanned events (e.g., collisions, spills, equipment malfunctions, accidents) are presented in Chapter 21.

Potential effects to wildlife are interrelated with other assessment disciplines and components that represent pathways to effects on at-risk bat species:

- Atmospheric Environment Assessment (Chapter 6);
- Acoustic Environment Assessment (Chapter 7);
- Soils and Terrain Assessment (Chapter 8);
- Groundwater Assessment (Chapter 9);
- Surface Water Quantity Assessment (Chapter 10);
- Surface Water Quality Assessment (Chapter 11); and
- Landscapes and Ecosystems Assessment (Chapter 13).

The Human and Ecological Health Assessment (Chapter 22) includes an analysis of the effects of potential contaminants of concern on select wildlife species. The results and conclusions of this work will be included in the chemical hazards assessment on at-risk bats.

15.6.3.2.1 Project Interactions

Project activities during the Construction and Pre-Production, Operations, Reclamation and Closure, and Post-Closure phases have the potential to affect at-risk bats. Key Project activities that are expected to interact with at-risk bat VCs, with a potential for adverse effects, are presented in Table 15.6-3. Specific details on Project activities and components are discussed in Chapter 3.

Many Project activities have the potential to interact with at-risk bats. The key interactions resulting in potential significant adverse effect or significant concern (indicated as level III in Table 15.6-3) are primarily those involving habitat loss or alternation and potential for increased mortality. Many of the potential adverse effects that are not key but require mitigation (indicated as level II) are related to noise and other sensory disturbance related to construction and operation and operation of vehicles. Some of the Project activities with no or negligible predicted interactions with at-risk bats are:

- Stockpiling of wood waste in Operations to be used for reclamation;
- Labour (hiring and training);
- Construction waste materials;
- Operation of the explosives factory;
- Fuel storage;
- Sewage treatment;
- Monitoring activities;
- Use of the Branch C Road; and
- The inactive rail line during Post-Closure.

Table 15.6-3: Project-At-Risk Bat Interaction Matrix and Ranking

Project Phase	Project Component	Description of Activities	At-Risk Bats
Construction and Pre-Production	Transportation	Use of Highway 43, Line Creek Mine Road, Valley Road, and Grave Creek Road by highway transport trucks, light duty vehicles, and crew busses to transport personnel, materials, and consumable items	II
	Logging of Merchantable Timber	Merchantable timber will be logged from the infrastructure and pre-production development footprint	III
	Clearing and Grubbing	After the merchantable timber has been removed, the remaining vegetation will be cleared and grubbed from the infrastructure and pre-production development footprint	II
	Stockpiling Wood Waste	Wood waste will be stockpiled on site and used for reclamation as a source of coarse woody debris	I
	Quarry for Construction Materials	Excavation of road bed materials from the North Pit footprint for use on Grave Creek Road	II
	Water Management or Water Management Structures	Water management structures to support initial construction activities will be built prior to soil being salvaged from the run of mine (ROM) and plant site	II
		Interim Sediment Pond will be built prior to the soil removal and stockpiling from the pit access road and initial phase of the North Pit	II
		Grave Creek Reservoir will be constructed to act as a back-up source of process water	II
	Soil Salvage	Soil will be salvaged from the footprint of the infrastructure	II
	Road Upgrading and Construction	Branch C Road will be widened and upgraded to facilitate construction and mine traffic to plant site area	II
		Grave Creek Road will be widened to facilitate the clean coal haul	II
		A new road will be constructed off the Valley Road to access the rail loadout for construction and operation	II
	Linear Infrastructure	Installation of the powerline	II
		Installation of the natural gas line	II
	Overland Conveyor	Clearing, grubbing, and construction of overland conveyor from the plant site to Grave Creek Road	III

Project Phase	Project Component	Description of Activities	At-Risk Bats
	Coal Handling Process Plant Construction	Excavating and pouring of foundation	II
		Transportation of materials and personnel to site	II
		Constructing of the Coal Handling Process Plant (CHPP)	II
		Commissioning of the CHPP	I
	Workshop / Mine Dry Construction	Excavating and pouring of foundations	II
		Transportation of materials to site	II
		Construction of workshop / mine dry	II
		Equipment wash bay and heavy equipment parking	II
		Administration, first aid, and mine dry building	II
		Diesel tank farm	II
		Warehouse	II
		Potable water system	I
		Septic system	I
		Water supply pipelines from Grave Creek and West Alexander Creek	I
		Commissioning of the facilities	I
	Explosives Factory Construction	Construction of the explosives factory	III
	Rail Loadout Construction	Excavation and preparation of the rail bed	II
		Excavation and preparation of foundation stockpiling and coal handling systems	II
		Transportation of materials and personnel to site	II
		Construction of rail loadout	II
		Connection to the CP Fording Sub-line	II
		Commissioning of the rail loadout	I
	Labour	Hiring of personnel for the mine, CHPP operations, administration, and coal haul	I
		Training of personnel	I

Project Phase	Project Component	Description of Activities	At-Risk Bats
	Construction Waste Materials	Collection and transfer to a recycling facility or other approved facility	I
Operations	Transportation	Use of Highway 43, Line Creek Mine Road, Valley Road, and Grave Creek Road by highway transport trucks, light duty vehicles, and crew busses to transport personnel, materials, and consumable items	II
	Explosives Factory	Ammonium nitrate / emulsion storage facilities which have the ability to load explosive agents into delivery trucks	I
		Wash facility to decontaminate the bulk explosive delivery trucks	I
		Storage of explosives (detonators and boosters)	I
	Fuel Storage	Receiving bulk fuel deliveries	I
		On-site storage of fuel	I
		Dispensing fuel	I
		Transferring fuel to on-site delivery trucks	I
	Mine Roads Development	Building roads from material sourced on-site	II
	Mining	Progressive clearing	III
		Removal of unconsolidated material	II
		Loading, hauling, and stockpiling of soil	II
		Drilling and loading of blastholes	II
		Detonating the explosives	II
		Loading, hauling, and dumping of mine rock	II
		Loading, hauling, and stockpiling of coal	II
	Site Water Requirements	Using contact water as the primary process make-up water from Interim Sediment Pond (Year 1 to 5)	I
		Using contact water as the primary process make-up water from the North Pit (Year 5 to 15)	I
		Backup reservoir in Grave Creek as a secondary source of process make-up water	I

Project Phase	Project Component	Description of Activities	At-Risk Bats
	Coal Processing	Run of mine coal sizing	II
		Washing coal	II
		Mechanical and thermal drying of coal	II
		Coal reject disposal (part of loading, hauling, and dumping of mine rock activities)	II
		Conveying clean coal	II
	Sewage Treatment	Sewage will be treated by a septic system constructed at the plant site which will support the administration, mine dry, and CHPP facilities	I
	Main Sediment Pond	Construction of Main Sediment Pond in Year 4	II
		Management of the Main Sediment Pond discharge	I
	Reclamation	Reclaiming available areas as soon as possible to achieve reclamation objectives	II
Reclamation and Closure	Transportation	Use of Highway 43, Line Creek Mine Road, Valley Road, and Grave Creek Road by highway transport trucks, light duty vehicles, and crew busses to transport personnel, materials, and consumable items	II
	Dismantling Infrastructure and Buildings	Dismantling of the CHPP, maintenance facilities, administration, and other facilities	I
		Dismantling, salvaging, collecting, and transferring materials to a recycling facility or other approved facility	I
	Removal of Linear Infrastructure	Removal of the powerline	I
		Removal of the natural gas line	I
	Reclamation	Reclaiming available areas as soon as possible to achieve reclamation objectives	II
	Monitoring	Reclamation monitoring	I
		Geotechnical monitoring	I
		Aquatic effects monitoring	I
	Water Management	Management of the Main Sediment Pond discharge	I

Project Phase	Project Component	Description of Activities	At-Risk Bats
Post-Closure	Water Management	Decommissioning the Main Sediment Pond once water quality objectives have been met	II
	Road Use	Branch C Road will remain as a permanent access road for future commercial and recreational use	I
	Rail Line	The rail line will remain as a permanent feature	I
	Monitoring	Reclamation monitoring	I
		Geotechnical monitoring	I
		Aquatic effects monitoring	I

Notes (after EAO, 2013):
I = No or negligible effect (positive or adverse) is anticipated; not carried forward in the assessment
II = Potential adverse effects requiring additional mitigation or substantive positive effects are expected; carried forward in the assessment
III = Key interaction resulting in potential significant adverse effect or significant concern; carried forward in the assessment

15.6.3.2.2 Overview of Potential Effects

- Habitat loss and degradation;
- Sensory disturbance;
- Disruption to movement; and
- Increased mortality risk.

The health effects of at-risk bat exposure to contaminants of potential concern are described in Chapter 22 and are therefore not repeated here.

The rationale and a description of each potential effect on at-risk bats is provided in Table 15.6-4.

Table 15.6-4: Potential Effects on At-Risk Bats

Potential Effect	Rationale for Selection of Environmental Effect
Habitat Loss and Degradation	Project components and activities may cause habitat loss and degradation for at-risk bats. Habitat loss and degradation includes the loss or reduction in value of foraging, roosting, maternal roosting, and hibernation habitat. Loss and/or degradation of native vegetation can also affect insect population abundance and thereby prey availability for bats. Physical disturbances including ground disturbance and vegetation clearing can cause direct loss of ecosystems and the corresponding resources they provide. A loss of key resources required to fulfill life requisites can result in reduced body condition, survivorship, and reproductive success. Bats may respond to habitat alteration by reducing their use of areas, avoiding habitats for a period of time (i.e., displacement), or abandoning portions of their current range. Habitat selection by bats is influenced by the spatial arrangement of required habitat elements, including day-roosts, night-roosts, hibernacula, foraging areas, and access to water. Habitat loss from clearing contributes to habitat fragmentation that may result in required habitat elements being farther apart on the landscape, causing the reduced occurrence of some bat species (reviewed in B.C. MOE, 2016). Some bat species avoid crossing large open areas; however, the creation of edge habitat can also be beneficial to some bat species by providing increased feeding habitat along forest edges.
Sensory Disturbance	Project components and activities may cause sensory disturbance for at-risk bats. Sensory disturbance includes behavioural responses to Project-related noise, vibration, light, and human presence. Noise may interfere with echolocation, causing a reduction in feeding, depending on the noise frequencies and the bat echolocation frequency level. Noise and vibrations from blasting can affect adjacent bat roosts in summer or winter. Sensory disturbances can lead to disruptions in bat behaviour, causing individuals to lose time and energy normally allocated to feeding. A loss of time towards fulfilling key life requisites can result in reduced body condition and reduced reproductive success. At-risk bats may also respond to sensory disturbances by reducing their use of habitats near the source of disturbance, avoiding habitats for a period (i.e., displacement), or abandoning portions of their current range. Such behavioural responses result in a functional loss of habitat.

Potential Effect	Rationale for Selection of Environmental Effect
Disruption to Movement	Unlike terrestrial wildlife, bats are able fly around infrastructure and obstacles and gaps in suitable habitat. The effect of disruption to movement to at-risk bats was excluded from the effects assessment.
Increased Mortality Risk	Project components and activities have the potential to cause the direct mortality of at-risk bats. The potential for direct mortality is greatest with destruction of occupied roosts, including both tree and rock-roosts. Roosting can also occur in buildings and inactive structures that then become destroyed during decommissioning or other alteration. Direct mortality may also occur from collisions with vehicles. At-risk bats that fly at low levels above ground can be most vulnerable to collisions with vehicles. Indirect mortality could occur through spread of white-nose syndrome, a lethal fungal disease that is spreading rapidly through populations of North America's hibernating bat species. The primary mode of disease transfer seems to be due to bat-to-bat contact, but transfer of fungal conidia (spores) via human clothing or equipment is a possible mechanism of spread (B.C. MOE, 2016). To date, white-nose syndrome is not known to occur in B.C. but has been reported in neighbouring Washington State. Attractants includes the effect of any human activity or material that may attract wildlife and could lead to behavioural changes. Primary bat attractants are lighting and waterbodies, both of which attract bats for feeding. Waterbodies are also used by bats for drinking. Building structures may attract bats for roosting and may lead to direct mortality if incompatible with operation or decommissioning.

15.6.3.2.3 Discussion of Potential Effects

The potential effects (habitat loss and degradation, sensory disturbance, and increased mortality risk) are discussed in the context of each Project phase below.

Habitat Loss and Degradation

The Project footprint overlaps with suitable habitat for at-risk bats. The total Project footprint area is approximately 1,283 ha, though this includes a buffer area intended to account for uncertainty in precise boundaries of disturbance, and not all of the buffer areas will be cleared. The amount of at-risk bat habitat potentially lost depends on the season (see Section 15.6.2.3.2 for a detailed summary of habitat suitability calculations).

Construction and Pre-Production

During Construction and Pre-Production, habitat loss will result from clearing and grubbing the infrastructure and pre-production development footprint, which includes the quarry, Interim Sediment Pond, Grave Creek Reservoir, the CHPP and workshop, initial portions of North Pit and Mine Rock Storage Facility, upgrading of the minesite road and Grave Creek Road, construction of a new road to the explosives factory, the overland conveyor, and the rail loadout.

Habitat degradation may occur in areas not yet cleared, in contingency areas, and areas directly adjacent to the Project footprint through dust deposition, spread of invasive species, and sedimentation from surface water runoff.

Operations

Direct habitat loss will occur during Operations as a result of progressive clearing of the pits, Mine Rock Storage Facility, construction of mine roads, and clearing for the construction of the Main Sediment Pond.

Habitat degradation may occur in areas not yet cleared, in contingency areas, and in areas directly adjacent to the Project footprint through dust deposition, spread of invasive species, and sedimentation from surface water runoff.

Reclamation and Closure

There will be no additional loss or degradation of habitat for at-risk bats during Reclamation and Closure, as all activities with the potential to result in habitat loss or degradation will be completed prior to initiating mine closure. If bats use mine site buildings for roosting, at-risk bat habitat may be lost when buildings are removed.

Post-Closure

There will be no additional loss or degradation of habitat for at-risk bats during Post-Closure, as all activities with the potential to result in habitat loss or degradation will be completed prior to mine closure. If bats use the Main Sediment Pond for feeding, at-risk bat habitat may be lost when the Main Sediment Pond is decommissioned.

Sensory Disturbance

At-risk bats may be affected by Project-related noise and vibration. Sensory disturbance may decrease or eliminate use of suitable habitat by at-risk bats in areas beyond the Project footprint.

The effects of noise and vibration on wildlife receptors is assessed in Chapter 7. Noise and vibration modelling was completed for the worst-case operating scenario. It was determined that operational Year 10 of the Project was the worst-case year for noise and vibration effects from the Project on surrounding sensitive receptors. The effects of Project-related noise in all other years will be less than those arising during operational Year 10. Noise and vibration sources associated with the Project potentially affecting wildlife receptors were split into two primary categories: continuous operations and blasting operations. The area affected by continuous noise was based on the modelled noise levels for:

- Continuous Project-related noise ≥ 55 dBA – the daytime sound level from the Project that is expected to cause disturbances for wildlife; and
- Continuous Project-related noise ≥ 45 dBA – the nighttime sound level from the Project that is expected to cause disturbances for wildlife.

The area affected outside the Project footprint by continuous project-related noise is approximately 242 ha in daytime and 1,118 in nightime.

The area affected by noise from blasting operations was based on modelled peak noise (air overpressure) ≥ 108 dB from blasting. This threshold is the peak noise level at wildlife receptors that is expected to cause disturbed habitat. This distance was estimated to be at 1,500 m from pit blast sites, which affects 1,955 ha outside the Project footprint.

The key sources of ground vibration are rail and blasting operations. Rail-induced ground vibration was not expected to have a significant impact on wildlife (see Chapter 7).

Vibration levels from blasting greater than the threshold level of 10 mm/s will occur at distances of up to 400 m to 500 m from the pits. As such, wildlife could be adversely affected by vibration within the Project site itself; however, wildlife are not anticipated to be present on-site during Operations and no impacts are therefore expected.

Other types of sensory disturbance (light, dust, and human presence) are expected to extend much shorter distances than noise and vibration.

Construction and Pre-Production

Sensory disturbance is expected from the transportation of personnel and materials, land clearing activities, soil salvage, road construction and upgrading, construction of the rail loadout, excavation of the quarry, construction of the CHPP, and construction of water management infrastructure such as the Grave Creek Reservoir and Interim Sediment Pond. Noise may interfere with echolocation, causing a reduction in feeding, depending on the noise frequencies and the bat echolocation frequency level. Noise and vibration from blasting can affect adjacent bat roosts in summer or winter.

Operations

During Operations, noise will be generated from progressive clearing and grubbing, further mine road development, detonating explosives (two to three times per week), loading, hauling, and dumping of mine rock, coal processing, operation of the conveyor, hauling to the rail loadout, operation of the rail loadout, and construction of the Main Sediment Pond. Progressive reclamation will also generate noise.

Reclamation and Closure

During Reclamation and Closure, some sensory disturbance is expected to be generated from the dismantling of infrastructure and buildings and removal of linear infrastructure. Low-level sensory disturbance is also expected to be generated from human activity associated with monitoring and maintenance.

Post-Closure

Sensory disturbance is expected to be minimal during the Post-Closure phase of the Project. Sensory disturbance may arise from noise of light vehicle traffic and human activity associated with monitoring and maintenance activities.

Increased Mortality Risk

There is potential for increased risk of direct mortality to at-risk bats in all phases of the project. Direct mortality may occur through destruction of occupied roosts occurring in trees, rock crevices, or caves (if present). Little brown myotis and northern myotis forage close to the ground (0.5 m and 1 to 3 m, respectively) and may be more vulnerable than eastern red bat (open air foraging at 5 to 10 m) to collisions with vehicles (foraging heights from B.C. MOE, 2016).

Indirect mortality could occur through spread of white-nose syndrome in all phases of the Project. If workers come in contact with caves where bats are hibernating, the fungus causing white-nose syndrome could be spread on clothing or equipment to other bats.

Bats may be attracted to the sediment ponds and Grave Creek Reservoir for feeding. Negative effects of this attraction are unlikely, unless water quality exceeds guideline levels (see Chapter 22). If bats are attracted to and allowed to roost in building or structures, roosts could be destroyed if buildings and structures are modified or removed.

Construction and Pre-Production

The risk of increased mortality during Construction and Pre-Production will be from destruction of occupied roosts and collisions with vehicles.

Operations

The potential for direct mortality described in Construction and Pre-Production will continue in Operations.

There is continued potential for the spread of the fungus that causes white-nose syndrome to other bats if workers come in contact with caves used for bat hibernation.

There is continued potential for destruction of bat roosts if at-risk bats are allowed in buildings or structures.

Reclamation and Closure

Bats roosting in buildings and structures may be destroyed during decommissioning.

Post-Closure

The risk of direct mortality will be minimal during the Post-Closure phase, as vehicle traffic will occur only occasionally during monitoring and maintenance activities.

15.6.3.2.4 Transboundary Effects

Bats are highly mobile and for those species that are migratory, spend a substantial amount of the year outside Canada. Bat populations within the Terrestrial LSA and Birds, Bats, and Amphibians RSA are likely part of larger populations that span across both the B.C./Alberta and the Canada/U.S.A. borders, and on federal lands. While Project-related disturbances to at-risk bat habitat are limited to the Project footprint and do not extend beyond provincial borders, residual adverse effects to at-risk bats have the potential to be considered transboundary effects in Alberta, the U.S.A, or on federal lands.

15.6.3.3 Mitigation Measures

15.6.3.3.1 Mitigation Measures for Habitat Loss and Degradation

At-risk bat habitat loss and degradation will occur primarily through:

- Loss from clearing and grubbing; and

- Degradation through dust deposition, spread of invasive species and sedimentation from surface water.

Measures to mitigate the impact of habitat loss and degradation on at-risk bat VCs include:

- Minimizing disturbance and encroachment into natural vegetation, to the extent feasible, by clearing and grubbing only what is required for Construction and Pre-Production activities and progressive development of pits and Mine Rock Storage Facility;
- Avoidance of mature and old growth with large-diameter trees, and suitable cave hibernacula, where practical alternatives are available;
- No destruction or disruption of occupied bat hibernacula or maternity roosts during site clearing during Construction and Operations of the Project;
- Clearing vegetation only in the year in which the area will be required for construction or operation to minimize the extent of cleared vegetation, to the extent possible;
- Sequencing the development of pits and Mine Rock Storage Facility areas to limit total disturbance during any one period and maximize progressive reclamation opportunities;
- Progressively reclaiming areas, as described in the Ecological Restoration Plan (Chapter 33, Section 33.4.1.3) and Landform Design and Reclamation Plan (Chapter 33, Section 33.4.1.6) as soon as possible to restore habitat for bat species that utilize early successional habitats;
- Implementation of the Erosion and Sediment Control Plan (Chapter 33, Section 33.4.1.4) to reduce the potential for sedimentation of riparian, wetland, and aquatic habitat used by bats; and
- Implementation of the Air Quality and Greenhouse Gas Management Plan (Chapter 33, Section 33.4.1.1) to reduce deposition of dust on vegetation that can affect plant vigour.

Ecological restoration is the primary mitigation for habitat loss and degradation. The reclamation and closure of the Project footprint aims to restore the pre-existing landscapes and uses, including a vegetation mosaic of coniferous forest, open alpine tundra, rock outcrops, shrub and graminoid dominated brushland, talus slopes, wetlands and riparian areas, and habitat capability for key wildlife species (among other goals). Revegetation (reclamation) activities will begin during the Operations phase, soon after stable topography is created within the mine footprint, and will proceed progressively as the area of stable topography grows during the Operations phase. Revegetation is planned to start in Year 6 of Operations with other revegetation taking place in Years 8, 10, 11, and 15 of Operations and continuing into the Reclamation and Closure phase.

As part of the planning, a post-mine terrestrial ecosystem map (TEM) has been developed to envisage the post-mine environment functioning and successional trajectory and guide the selection of appropriate species to revegetate the Project footprint. The post-mine TEM accounts for factors such as elevation, aspect, soil, and plant ecology, and as such, it is the lens for envisioning a realistic post-mine environment. Approximately 790 ha in seven ecosystem types are planned for reclamation within the Project footprint. Remaining areas within the footprint include pit highwalls, water features, and buffer (or contingency) areas. Disturbed portions of the buffer areas (if any) will be assigned appropriate end-use objective according to their elevation, aspect, slope steepness, and proximity to water features (for riparian and wetland ecosystems). Further details of the ecological restoration can be found in the Ecological Restoration Plan (Chapter 33, Section 33.4.1.3). The mitigation measures described above will contribute to avoiding and minimizing the effects of habitat loss and degradation on at-risk bat VCs with moderate effectiveness. These measures will not eliminate all effects and there will be a residual effect of habitat loss and degradation on at-risk bat VCs as a result of the project.

15.6.3.3.2 Mitigation Measures for Sensory Disturbance

Sensory disturbance to at-risk bat VCs may occur from:

- Noise generated from various transportation, construction, and operation activities; and
- Noise and vibration from blasting can disturb roosting and hibernating bats and the physical structure of roost or hibernating sites.

Measures to mitigate the impact of sensory disturbance on at-risk bat VCs include:

- Implementation of the Noise and Vibration Management Plan that includes the following measures:
  - Limit construction activities, especially those with high noise impact, to daytime hours;
  - Appropriately time construction activities to minimize cumulative noise levels;
  - Select equipment for construction activities that is appropriate for the task;
  - Construction equipment at a minimum, is fitted with standard noise-damping devices such as mufflers or enclosures, where possible;
  - Discourage unnecessary idling of construction equipment;
  - Perform regular vehicle maintenance and inspections on all Project equipment, including replacement of old and worn parts;
  - Inform employees of noise impacts and potential mitigation/control measures through appropriate training; and
  - Install and maintain noise mitigation measures, where possible, on and around Project infrastructure;
- For blasting activities in the vicinity of roosting or hibernating sites (if any identified), procedures described in B.C. MOE (2016) will be followed, specifically:
  - Either the sound concussion is less than 150 decibels and that shock wave is less than 15 pounds per square inch (PSI) and the peak particle velocity is less than 15 mm/second; or
  - Maintain a setback of 2 km from occupied significant roost sites (if any are determined). Blasting may occur during periods when bats are not occupying a roost (if any are identified); however, as a result, the roost habitat is not degraded.

The mitigation measures described above will contribute to minimizing the effects of sensory disturbance on at-risk bat VCs with high effectiveness. These measures will not eliminate all effects and there will be a residual effect of sensory disturbance on at-risk bat VCs as a result of the Project.

15.6.3.3.3 Mitigation Measures for Increased Mortality Risk

Increased mortality risk on at-risk bats may occur through:

- Destruction of occupied roosts and hibernation sites occurring in trees, rock crevices, or caves (if present);
- Collisions with vehicles; and
- White-nose syndrome, if the fungus that causes white-nosed syndrome is spread on clothing or equipment.

Measures to mitigate the impact of increased mortality risk on at-risk bats include:

- Vegetation clearing activities will be avoided during the most sensitive period for bats (May 30 to September 1 in the Kootenay Region);
- Pre-clearing bat roost and hibernaculum surveys will be conducted in areas considered to have high potential for roosting or hibernation;
- If an active roost site is identified, the tree will not be felled and a suitable buffer zone will be maintained during the maternal roosting period, or FLNRORD (or the appropriate governing agency) will be contacted for guidance;
- If a cave-based bat hibernaculum is found during pre-clearing surveys, FLNRORD or the applicable provincial government agency will be notified and mitigation enacted, as directed;
- Decontamination protocols to minimize the introduction and transmission of white-nose syndrome should be followed in all cases where bats are present or likely present (e.g., caves); signs of white-nose syndrome symptoms on bats should be immediately reported to ENV and the B.C. Wildlife Health Program;
- Buildings will be designed to exclude bat use and will be regularly inspected for openings that may allow for bat entry; if bats use is suspected, then a survey will be conducted to determine presence and a strategy developed to exclude bats with the least impact; and
- Observe speed limits to minimize the potential for collisions with bats.

The mitigation measures described above will contribute to minimizing the effects of increased mortality risk on at-risk bat VCs with high effectiveness. These measures will not eliminate all effects and there will be a residual effect of increased mortality risk on at-risk bat VCs as a result of the Project.

15.6.3.3.4 Summary of Mitigation Measures

A summary of the key mitigation approaches and their effectiveness to mitigate potential effects is provided in Table 15.6-5. The potential for residual effects were assessed in consideration of the expected effectiveness of the mitigation measures to avoid, minimize, restore, or compensate for potential effects and the at-risk bat measurement indicators defined in the AIR (habitat availability and distribution and known occurrence and abundance).

Where mitigation measures do not or may not mitigate all effects or if there is a low level of confidence in their effectiveness, the effect was carried forward for further analysis of residual effects. Mitigation measures that are expected to completely mitigate potential effects with a high level of confidence based on their proven effectiveness elsewhere were classified as having no expected residual effects. This includes increased mortality risk.

No other technically and economically feasible mitigation measures were considered for the at-risk bat VCs, and NWP is not aware of potential future technology innovations that could help further mitigate effects.

Table 15.6-5: Summary of Proposed Mitigation Measures Related to At-Risk Bats

Valued Component	Potential Effect	Mitigation Measures	Rationale	Applicable Project Phases	Effectiveness	Residual Effect
At-Risk Bats	Habitat Loss and Degradation	• Avoidance of known and high potential hibernacula • Project design • Progressive reclamation	• These measures contribute to avoidance, minimization, and restoration of habitat loss and degradation. • Not all effects of habitat loss and degradation are expected to be mitigated.	• Construction and Pre-Production • Operations • Reclamation and Closure	Moderate	Yes
	Sensory Disturbance	• Minimize habitat and sensory disturbance • Manage vehicle traffic and site access	• These measures contribute to avoidance and minimization of sensory disturbance. • Not all effects of sensory disturbance are expected to be mitigated.	• Construction and Pre-Production • Operations • Reclamation and Closure	High	Yes
	Increased Mortality Risk	• Clearing outside of the maternal roosting period • Pre-disturbance bat surveys • Protection of roosts • Measures to minimize potential spread of white-nose syndrome	• These measures contribute to avoidance and minimization of indirect mortality. • The effects of direct mortality are expected to be mitigated for at-risk bats.	• Construction and Pre-Production • Operations • Reclamation and Closure • Post-Closure	High	No

15.6.3.4 Characterization of Residual Effects, Significance, Likelihood, and Confidence

15.6.3.4.1 Methods

Habitat loss and degradation was assessed by calculating the loss of high-quality habitat within the Project footprint. Due to the limited information available for northern myotis and eastern red bat, and because of the overlapping habitat characteristics of the three at-risk bats, the habitat model developed for the little brown myotis was also adopted to represent potential habitat for northern myotis and eastern red bat (see Section 15.6.2.3.2), as a conservative approach. The fall-winter habitat modelling used two classesuseable and non-useable. Useable habitat was considered high-quality habitat for the purpose of the assessment. Spring-summer habitat was modelled using four classes: high, medium, low, and unclassified. High habitat was considered high-quality habitat for the purpose of the assessment.

Residual effects were characterized using the criteria described in Chapter 5, Section 5.3.4.5. The following limits were used for the magnitude of a residual effect on at-risk bats:

- Negligible: No detectable changes from baseline conditions;
- Low: 0-5% change;
- Moderate: 6-15% change; and
- High: >15% change.

The residual effects of contaminants of potential concern on at-risk bats are described in Chapter 22 and are therefore not repeated here.

15.6.3.4.2 Characterization of Residual Effects

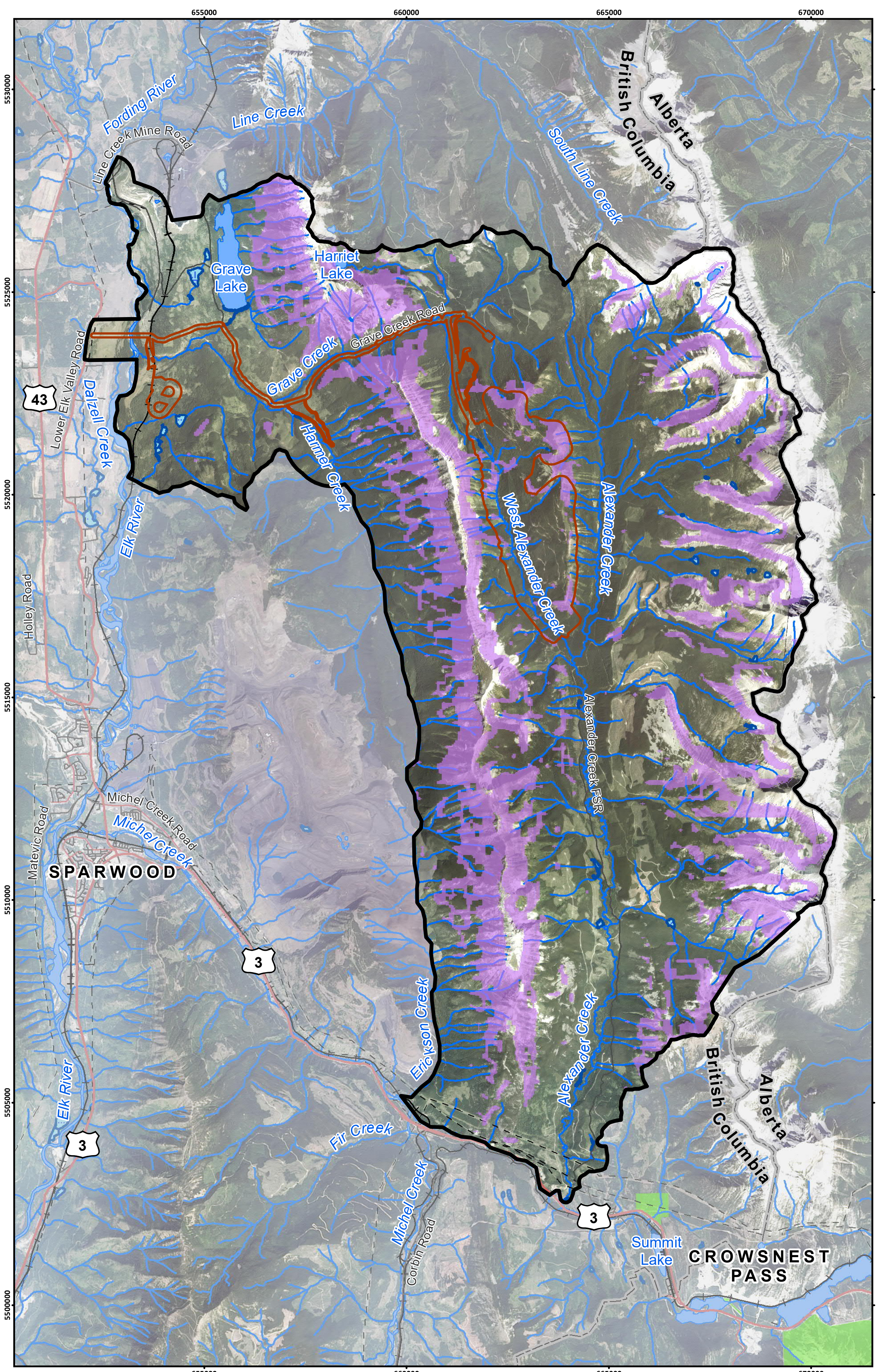
Habitat Loss and Degradation

The Project footprint overlaps with high-quality at-risk bat habitat (Figure 15.6-4 and summarized in Table 15.6-6). The Project will result in a predicted loss of 191 ha of high-quality fall-winter at-risk bat habitat, representing 3.6% of the total amount of high-quality fall-winter at-risk bat habitat available in the Terrestrial LSA (5,273 ha). Nearly all loss will be at the mine site footprint and most at high elevations on Crown Mountain. Some areas predicted to be lost are within the buffer zone, and the area lost may be less. On a proportional basis, the availability of high-quality at-risk bat habitat in fall-winter is lower within the Project footprint compared to the Terrestrial LSA as whole (15% for the Project footprint and 22% for the Terrestrial LSA).

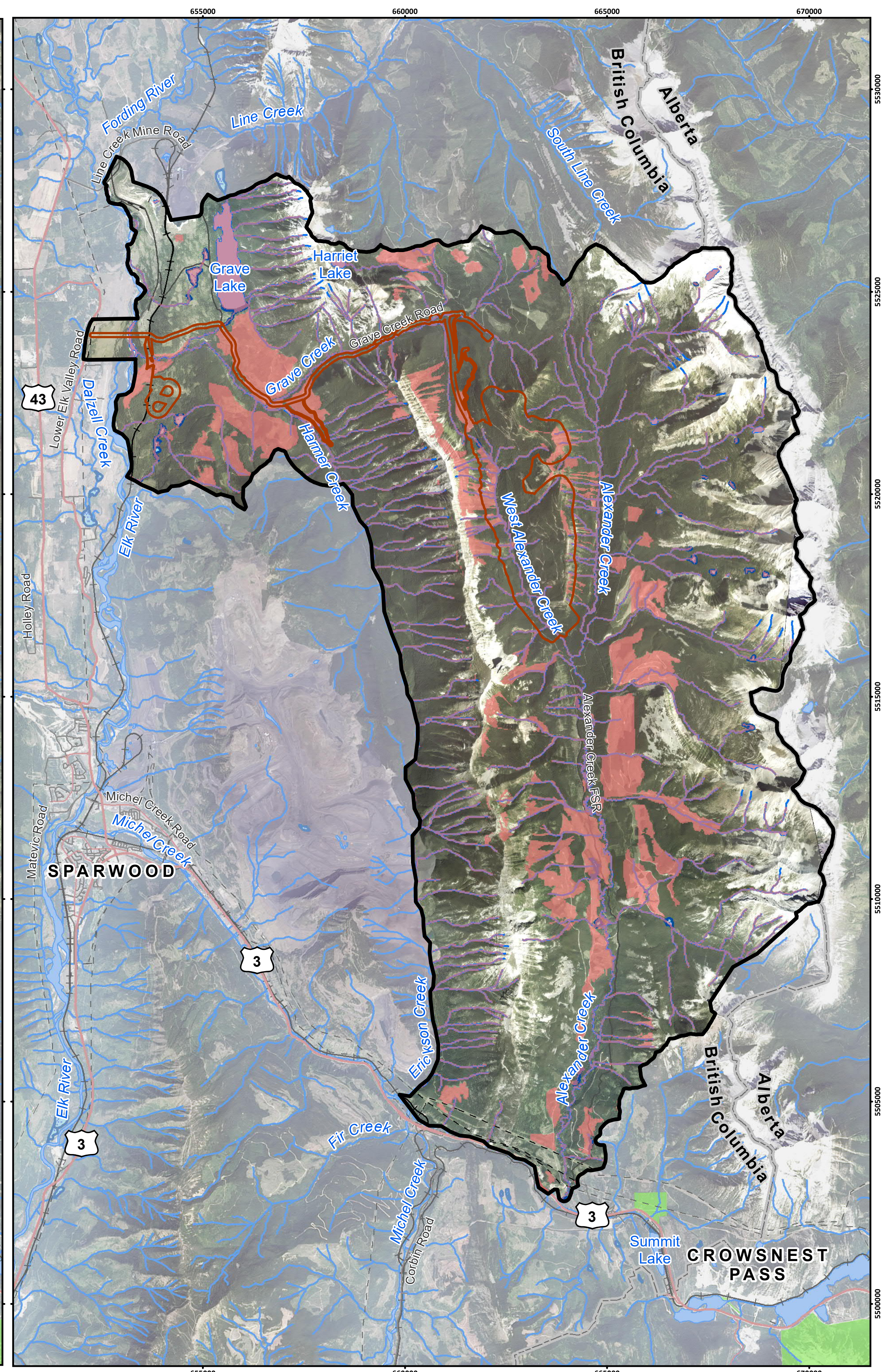
Table 15.6-6: Change in High-Quality At-Risk Bat Habitat in the Project Footprint and Relative to the Terrestrial LSA

Season	Area (ha) of High-Quality Habitat in Project Footprint	% of Project Footprint	Area (ha) of High-Quality Habitat in LSA	% of LSA	Change as Proportion of Terrestrial LSA
Fall/Winter (Hibernacula)	191	15%	5,273	22%	-3.6%
Spring/Summer (Foraging and Roosting)	241	19%	4,514	19%	-5.3%

FALL-WINTER



SPRING-SUMMER



Crown Mountain Coking Coal Project

Figure 15.6-4
High-Quality At-Risk Bat Habitat in the Terrestrial Local Study Area

LEGEND

- High-Quality Fall-Winter Bat Habitat
- High-Quality Spring-Summer Bat Habitat
- Terrestrial Local Study Area
- Project Footprint
- Highway
- Arterial/Collector Road
- Local/Resource Road
- Railway
- Transmission Line
- Watercourse
- Waterbody
- Wetland
- Provincial Park/Protected Area
- British Columbia/Alberta Border

0 2.5 5
Kilometres

N W E S

Scale 1:130,000

Map Drawing Information:
Data Provided By NWP Coal Canada Ltd, Dillon Consulting Limited, Keefer Ecological Services Ltd, Province of British Columbia GeoBC Open Data, Government of Alberta Open Data, Natural Resource Canada.
Imagery Provided By Landsat 8 (Aug 2018), and GeoBC OrthoImagery (Aug 2016).

Map Created By: PR
Map Checked By: JM
Map Coordinate System: NAD 1983 UTM Zone 11N

NWP Coal Canada Ltd

Project: 12-6231
Status: FINAL
Date: 2022-01-20

For spring-summer, the Project will result in a predicted loss of 241 ha of high-quality habitat, representing 5.3% of the total amount of high-quality spring-summer at-risk bat habitat available in the Terrestrial LSA (4,514 ha). Loss will be along Grave Creek Road and the utility corridor, the road to the rail loadout, along the conveyor, and in the mine site footprint. Some areas predicted to be lost are within the buffer zone and the area lost may be less. On a proportional basis, the availability of high-quality at-risk habitat in spring-summer is similar within the Project footprint compared to the Terrestrial LSA as whole (19% for both).

Clearing will begin in Construction and Pre-Production within initial portions of the 1,283 ha Project footprint prepared for the mine site facilities, a portion of the North Pit, the Interim Sediment Pond, roads, the conveyor, the powerline, and the rail loadout. During Operations, progressive clearing of the pits, Mine Rock Storafe Facility, and Main Sediment Pond will continue through to Year 15. Habitat loss will have a continuous adverse effect until progressive reclamation begins in Year 10 of Operations. With progressive reclamation between Years 10 and 15 and continued reclamation in the Reclamation and Closure phase, the effect of habitat loss will begin to decline, though high-quality habitat will not be restored for many decades (for roosting habitat) after Post-Closure.

No bat roosts were identified during baseline surveys within or directly adjacent to the Project footprint; however, this does not mean that one or more might occur. Pre-disturbance surveys in the Project footprint will allow for avoidance of significant bat roosts or if necessary, removal during a least risk period.

Bats drink from open water, preferably still. The Project will involve no loss of open water. Open water will temporarily be created with construction of the Grave Creek Reservoir and the sediment ponds.

Clearing of forested areas will create new edge habitat that at-risk bats may use for feeding. The benefits of new areas for feeding is unknown and not considered further.

Habitat selection by bats is influenced by the spatial arrangement of required habitat elements, including day-roosts, night-roosts, hibernacula, foraging areas, and access to water. Habitat loss from clearing contributes to habitat fragmentation that may result in required habitat elements being farther apart on the landscape, causing the reduced occurrence of some bat species (reviewed in B.C. MOE, 2016). Some bat species avoid crossing large open areas, as well as roads (Fensome and Mathews, 2016). It is difficult to estimate the effect of habitat fragmentation resulting from the Project because of the existing high levels of fragmentation from road development and forest harvesting that already occur. The difficulty is further compounded because bat movements can be over large distances, making predictions and interpretations complex. For example, little brown myotis, classified as a mid-range flyer, may have summer movements of 1 to 10 km between day-roosts and foraging areas (B.C. MOE, 2016).

Post mine reclamation will restore a mosaic of coniferous forest, open alpine tundra, rock outcrops, shrub and graminoid dominated brushland, talus slopes, wetlands, and riparian areas (described in Section 15.6.3.3.1 and in the Ecological Restoration Plan, Chapter 33, Section 33.4.1.3). Most of the restored ecosystems (all aside from sparsely vegetated talus) will provide habitat for at-risk bats through food availability or roosting sites, over time. Reclamation will begin in Year 10 of Operations for limited areas and then accelerating at the end of Operations. Within five years of closure, graminoids, forbs, and some shrubs will have become established, though the quality will be variable and may be limited in many areas. Forest will begin to become established at 50 years Post-Closure onward, especially at low elevations. The Project footprint is ultimately expected to be a landscape similar in structure and composition to the pre-Project landscape.

Habitat degradation of areas outside the Project footprint habitat can occur from potential introduction and spread of invasive species, changes in vegetation vigour from dust deposition, and surface water runoff from the Project footprint that can contain suspended solids and affect vegetation. Mitigation for each of these effects was described in Chapter 13 and found to have no residual effects to each of the ecosystem VCs.

The Project footprint includes a buffer area intended to account for uncertainty in precise boundaries of disturbance. Not all of the buffer area will be disturbed, and the calculations of habitat loss are therefore conservative and may be overestimated.

The residual effect to at-risk bats from direct habitat loss and degradation is characterized as follows:

- Duration: *Long-term to permanent*, depending on the habitat type. Feeding habitat will be restored before the end of Post-Closure. Roosting habitat in trees will not be restored before the end of Post-Closure.
- Magnitude: *Moderate*, up to 5.3% loss of high-quality spring-summer habitat in the Terrestrial LSA, and less for fall-winter habitat.
- Geographic Extent: *Discrete*, as the effect of habitat loss will be within the Project footprint only.
- Frequency: *Continuous*, the effect of habitat loss is expected to be continuous until lost habitat is reclaimed.
- Reversibility: *Irreversible*, since each of the at-risk bat species are dependent on forest cover and forest will not be restored prior to the end of reclamation.
- Context: *Low,* as bats have slow reproductive rates, long lifespans, and habits of coloniality that make bat populations vulnerable to extirpation (B.C. MOE, 2016).

Sensory Disturbance

The effects of sensory disturbance to at-risk bats included effects of peak noise from blasting, vibration from blasting, and continuous noise levels. The effects of vibration from blasting were determined to have no residual effect after mitigation.

Even after mitigation, continuous noise will extend beyond the Project footprint and may affect at-risk bats. Noise sources from well sites, compressor stations, traffic, wind/vegetation, and broadband noise have been documented to alter bat foraging and movement and echolocation behaviours (review in Player and Keim, 2015). However, the effect of noise depends on the overlap in frequencies of noise with the frequencies at which bats echolocate (Bunkley et al. 2015). The three at-risk bat species are considered high-frequency bats (>35 kHz) and the overlaps in frequency with noise generated by the Project is likely very small.

The residual effect to at-risk bats from sensory disturbance is characterized as follows:

- Duration: *Long-term*, as noise generated by the Project will be substantially reduced after Operations and cease at Closure.

- Magnitude: *Low*, as the overlap in frequency between noise generated by the Project and the echolocation frequency of the at-risk bat species may be small.
- Geographic Extent: *Local*, as the effect of noise will extend beyond the Project footprint.
- Frequency: *Continuous*, as noise is continuously generated until the end of Operations.
- Reversibility: *Reversible long-term*, since the effect of noise will cease when Project noise stops.
- Context: *Low,* as bats have slow reproductive rates, long lifespans, and habits of coloniality that make bat populations vulnerable to extirpation (B.C. MOE, 2016).

15.6.3.4.3 Determination of Significance

The stability of a bat population depends on the continued presence of required roost types (e.g., summer, winter, day, night, maternity, and swarming), adequate and diverse foraging habitats, and connectivity between these habitats. The Project is expected to result in permanent loss of roosting habitat. Some foraging habitat will be restored after Reclamation and Closure. The amount of high-quality habitat is small relative to availability outside the Project footprint and in the Terrestrial LSA. Connectivity may be lost in the minesite footprint due to loss of blocks of forest cover, though most of the high-quality habitat loss will be along access roads, the utility corridor, and the overland conveyor where the Project footprint is narrow and impacts to connectivity will be less. Surveys found several high bat detection areas located within or directly adjacent to the Project footprint. The risk of sensory disturbance is low, as the overlap in frequency between noise generated by the Project and the echolocation frequency of the at-risk bat species may be small.

Based on the characterization of the residual effects, the Project would not limit the ability of at-risk bats to persist and maintain self-sustaining populations in the Terrestrial LSA. The residual effects of habitat loss and degradation and sensory disturbance on at-risk bats are considered not significant.

15.6.3.4.4 Likelihood and Confidence

Effects from Project activities that are determined to be not significant do not require a characterization of likelihood.

There is a moderate understanding of at-risk bat ecology, their habitat availability and distribution, their response to noise, known occurrences, and abundance in the Terrestrial LSA. The confidence in the determination of residual effects to at-risk bats is moderate.

15.6.3.5 Summary of Residual Effects Assessment

Residual effects and the selected mitigation measures, characterization criteria, significance determination, likelihood, and confidence are summarized in Table 15.6-7. There are no significant residual effects to at-risk bats anticipated as a result of the Project.

15.6.4 Cumulative Effects Assessment

Cumulative environmental effects are the result of Project residual environmental effects interacting with the effects of other past, present, and reasonably foreseeable future projects or activities to produce a combined/overlapping effect. The objective of the cumulative effects assessment is to consider overlapping effects for all residual adverse effects, not only those predicted to be significant (EAO, 2013). The assessment of cumulative effects on the at-risk bat VC requires that:

- The Project results in a residual adverse environmental effect on the at-risk bat VC;
- A residual Project effect interacts cumulatively with effects from other projects or activities (i.e., an effect of the Project overlaps spatially and temporally with those of other projects or activities that have been or will be carried out);
- The other projects or activities have been or will be carried out and are not hypothetical; and
- The cumulative effect is likely to occur.

Further information regarding the cumulative effects assessment methodology is provided in Chapter 5, Section 5.3.5.4.

An assessment of cumulative effects is required for the at-risk bat VC due to the possibility that potential Project residual effects on at-risk bats may remain after implementation of proposed mitigation measures. Habitat loss and degradation and sensory disturbance were found to have residual (but not significant) Project effects for at-risk bats.

15.6.4.1 Assessment Boundaries

15.6.4.1.1 Spatial Boundaries

The assessment of cumulative effects for at-risk bat VCs was conducted for the Birds, Bats, and Amphibians RSA, as defined in Section 15.2.3.1. The Birds, Bats, and Amphibians RSA is approximately 12,634 km^2. It includes all operating and proposed mines within the Elk Valley and several developed areas including the municipal boundaries of Sparwood, Elkford, Fernie, and Crowsnest Pass.

15.6.4.1.2 Temporal Boundaries

The temporal boundaries for the Project include periods of Construction and Pre-Production, Operations, Reclamation and Closure, and Post-Closure, as identified in Section 15.2.3.2.

Temporal cases used in the assessment of cumulative effects includes the following:

1. Base Case – The current status of the VC prior to the start of the Project, including all appropriate past and present projects or activities – generally represented by existing conditions;
2. Project Case – Status of the VC with the Project in place, over and above the Base Case – generally represented by the Project effects assessment; and
3. Future Case – The status of the VC as a result of the Project Case in combination with all reasonably foreseeable future projects and/or activities that could be carried out.

The comparison of the Project Case with the Future Case allows the Project contribution to cumulative effects of all past, present, and reasonably foreseeable future projects and/or activities to be determined.

15.6.4.1.3 Administrative Boundaries

There are no administrative boundaries that are relevant to the cumulative effects assessment beyond those identified in Section 15.2.3.3.

Table 15.6-7: Summary of Residual Effects on At-Risk Bat VCs

Valued Component	Residual Effect	Project Phases	Mitigation Measures	Summary of Residual Effects Characterization	Significance (Significant, Not Significant)	Likelihood (High, Moderate, Low)	Confidence (High, Moderate, Low)
At-Risk Bats	Habitat Loss and Degradation	• Construction and Pre-Production • Operations	• Avoidance of known and high potential hibernacula • Project design • Progressive reclamation	Duration: Long-term to permanent Magnitude: Moderate Geographic Extent: Discrete Frequency: Continuous Reversibility: Irreversible Context: Low	Not Significant	Not Applicable	Moderate
At-Risk Bats	Sensory Disturbance	• Construction and Pre-Production • Operations • Reclamation and Closure	• Minimize habitat and sensory disturbance • Manage vehicle traffic and site access	Duration: Long-term Magnitude: Low Geographic Extent: Local Frequency: Continuous Reversibility: Reversible long-term Context: Low			

15.6.4.1.4 Technical Boundaries

In addition to those presented in Section 15.2.3.4, technical boundaries or constraints imposed on the assessment due to limitations in the ability to predict the cumulative effects of the Project in combination with those of other past, present, or reasonably foreseeable future projects or activities include the following:

- Information on species ranges and population numbers in the region is variable and, in some cases, limited;
- Habitat availability (including habitat suitability, resource selection, and habitat use) was assessed from occupancy and habitat modelling. The models have inherent uncertainty and are an imperfect representation;
- There is limited knowledge of the precise scope and extent of potential effects of past, present, and reasonably foreseeable future projects, aside from the Project. The geographic extents of footprints for these projects are from publicly-available sources and their accuracy cannot be guaranteed; and
- There is limited knowledge of species and individual responses to disturbance and the relationship to potential population-level effects is not well understood.

15.6.4.2 Identifying Past, Present, and Reasonably Foreseeable Projects and/or Activities

Descriptions of the past, present, and reasonably foreseeable projects and/or activities for consideration in the cumulative effects assessment are provided in Chapter 5, Section 5.3.5.3.

Several past, present, and reasonably foreseeable future projects or activities are expected to interact with the at-risk bat VCs, which may result in a potential for adverse cumulative effects (Table 15.6-8). Maps showing the location of the past, present, and reasonably foreseeable future projects or activities are presented in Figure 5.3-4 to Figure 5.3-6 (Chapter 5).

As noted in Chapter 5, Section 5.3.5.3, the following projects were considered as past, present, or reasonably foreseeable future projects or activities in the cumulative effects assessment but were not included:

- Coal Mountain Phase 2, as the environmental assessment was placed on hold by Teck Coal Limited in 2016;
- Mount Brussilof (Baymag Mine) by Baymag, due to no temporal overlap;
- Barnes Lake Phosphate Exploration Project by Fertoz International Inc., given that the project is in exploration phase and no project has been proposed; and
- Cabin Ridge Coal by Warburton Group is in exploration and no project has been proposed.

15.6.4.3 Mitigation for Cumulative Effects

Cumulative effects can be reduced through minimizing local Project-related effects using the mitigation measures described for the Project (Section 15.6.3.3). It is assumed that other projects in the region will also adopt similar measures. Addressing cumulative effects often requires regional stakeholder involvement and government-led initiatives to implement effective management plans and monitoring programs. NWP will participate in regional initiatives, where relevant and appropriate, and will adopt new management practices and measures to meet regional planning objectives, where possible.

Table 15.6-8: Project-At-Risk Bat VC Interactions Matrix for Potential Cumulative Effects

Past, Present, or Reasonably Foreseeable Future Projects or Activities	Ranking of Potential Cumulative Effect	Justification / Rationale
	At-Risk Bats	
Past or Present Projects and/or Activities that Have Been Carried Out		
Natural Resource Extraction – Mining (past)	I	Has occurred within the range of at-risk bat VCs and their habitat.
Coal Mountain Operations	III	Occurs within the range of at-risk bat VCs and their habitat.
Elkview Operations	III	Occurs within the range of at-risk bat VCs and their habitat.
Line Creek Operations	III	Occurs within the range of at-risk bat VCs and their habitat.
Fording River Operations	III	Occurs within the range of at-risk bat VCs and their habitat.
Greenhills Operations	III	Occurs within the range of at-risk bat VCs and their habitat.
Kootenay West Mine	III	Occurs within the range of at-risk bat VCs and their habitat.
Elkhorn Quarry West (Windermere Mining Operations)	III	Occurs within the range of at-risk bat VCs and their habitat.
Marten Phosphate Project	III	Occurs within the range of at-risk bat VCs and their habitat.
Energy - Elko Dam	III	Occurs within the range of at-risk bat VCs and their habitat.
Koocanusa Reservoir	III	Occurs within the range of at-risk bat VCs and their habitat.
Forestry	III	Occurs within the range of at-risk bat VCs and their habitat.
Energy - Pipelines	II	Occurs within the range of at-risk bat VCs and their habitat.
Energy - Electrical Transmission	II	Occurs within the range of at-risk bat VCs and their habitat.
Transportation	II	Occurs within the range of at-risk bat VCs and their habitat.
Recreation and Tourism	I	Occurs within the range of at-risk bat VCs and their habitat, though adverse effects are expected to be minimal or absent.
Commercial, Residential, and Industrial Use	II	Occurs within the range of at-risk bat VCs and their habitat.
Parks and Protected Areas	I	Occurs within the range of at-risk bat VCs and their habitat, though adverse effects are expected to be minimal or absent.
Agriculture	I	Occurs within the range of at-risk bat VCs and their habitat. Not all effects are adverse.
Natural Processes or Events	I	Magnitude of effect on at-risk bat VCs likely very small.

Past, Present, or Reasonably Foreseeable Future Projects or Activities	Ranking of Potential Cumulative Effect	Justification / Rationale
	At-Risk Bats	
Reasonably Foreseeable Future Projects and/or Activities That Will Be Carried Out		
Michel Coal Project	III	Occurs within the range of at-risk bat VCs and their habitat.
Grassy Mountain Coal Project	III	Occurs within the range of at-risk bat VCs and their habitat.
Tent Mountain Mine	III	Occurs within the range of at-risk bat VCs and their habitat.
Fording River Extension Project	III	Occurs within the range of at-risk bat VCs and their habitat.
Bingay Main Project	III	Occurs within the range of at-risk bat VCs and their habitat.
Elan Hard Coking Coal Project	III	Occurs within the range of at-risk bat VCs and their habitat.
Climate Change	III	May affect habitat availability of at-risk bat VCs
Natural Processes or Events	III	Magnitude of effect on at-risk bat VCs likely very small.

Notes (after EAO, 2013):
I – Residual Project effects do not act cumulatively with those of other past, present, or reasonably foreseeable future projects and/or activities. Not carried forward in the assessment.
II – Residual Project effects act cumulatively with those of other past, present, or reasonably foreseeable future projects and/or activities, but are unlikely to result in significant cumulative effects; or residual Project effects act cumulatively with existing significant cumulative effects but the Project will not measurably contribute to these cumulative effects on the VC. Carried forward in the assessment.
III – Residual Project effects act cumulatively with those of other past, present, or reasonably foreseeable future projects and/or activities, and may result in significant cumulative effects; or residual Project effects act cumulatively with existing significant cumulative effects and the Project may measurably contribute to adverse changes in the state of the VC. Carried forward in the assessment.

15.6.4.4 Potential Residual Cumulative Effects

15.6.4.4.1 Assessment Methods

The assessment of potential cumulative effects on at-risk bats was characterized using a combination of quantitative methods and qualitative discussions. Quantitative methods were used to measure habitat loss and degradation. Qualitative discussions are based on scientific literature, baseline studies, habitat models, and professional judgment and were used to characterize sensory disturbance.

Habitat loss and degradation was measured by calculating the loss of high-quality habitat within the Birds, Bats, and Amphibians RSA for the Base Case, the Project Case, and the Future Case. High-quality at-risk bat habitat was defined as areas with high habitat suitability.

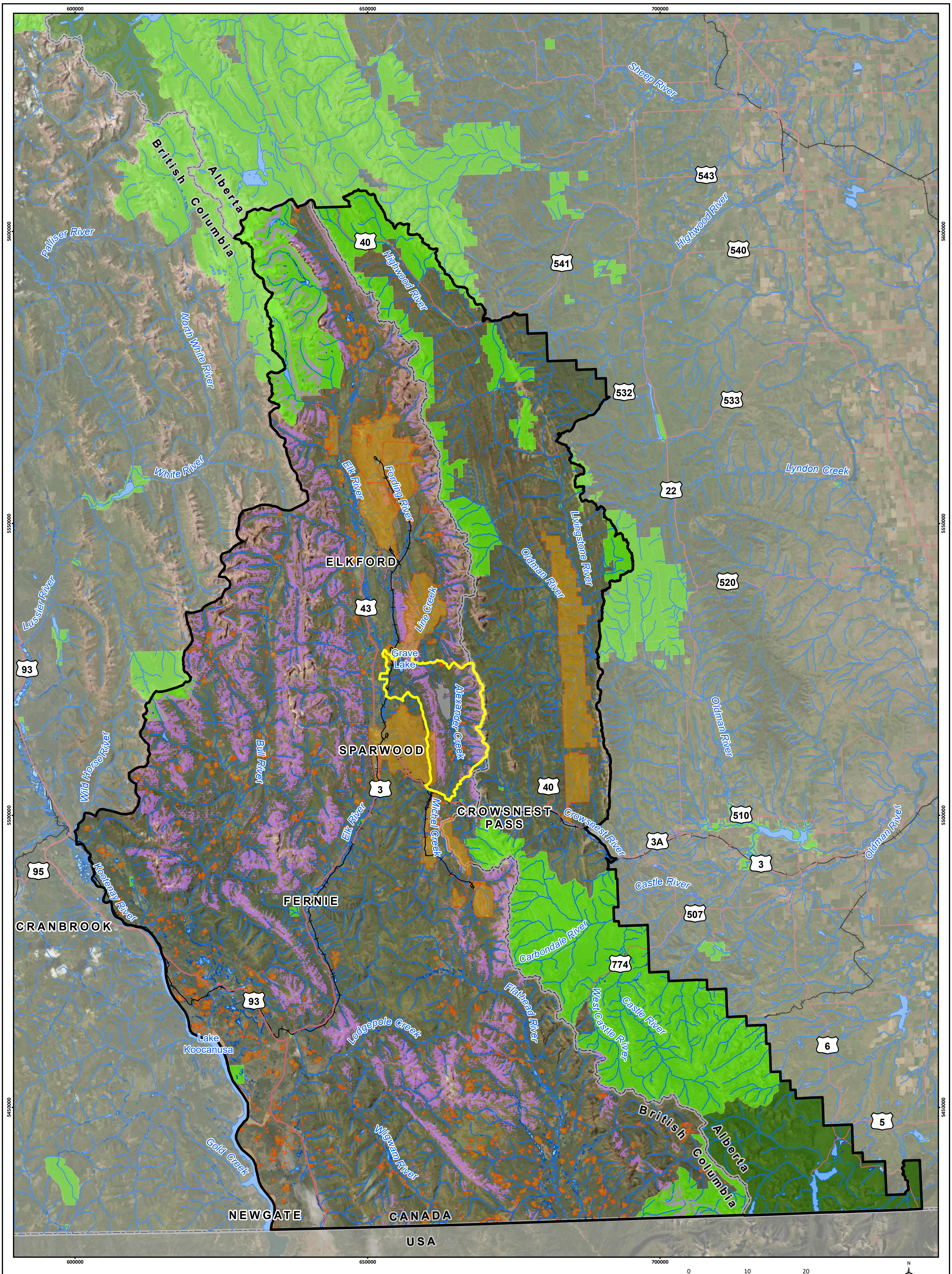
The habitat suitability mapping used for the Project Case and Future Case is the same as was used for the Base Case. Ecosystems change over time through natural successional processes (e.g., forest regrowth) and natural disturbance regimes (e.g., fire). Habitat suitability for any given wildlife species will therefore also change over time. For the purposes of the assessment of cumulative effects, the assumption is that while ecosystems are dynamic, the general amount and distribution of ecosystems (and therefore suitable habitat for any given wildlife species) in the Bird, Bats, and Amphibians RSA is approximately the same for the Base Case, Project, Case, and Future Case, aside from habitat losses from the reasonably foreseeable future projects and activities that are included in the Future Case. Reasonably foreseeable future projects and activities were assumed to result in complete removal of suitable wildlife habitat. This is a conservative approach as some activities will not result in complete loss of habitat (e.g., cutblocks provide food resources for some species) and some physical disturbance footprints are restored over time (e.g., mine reclamation).

For sensory disturbance, a quantitative approach was used for Project effects. A quantitative approach could not be used for the cumulative effects of sensory disturbance because of the difficulty in assigning zones of influence or avoidance to all reasonably foreseeable future projects or activities when design details are not available. A qualitative approach was therefore used.

15.6.4.4.2 Characterization of Residual Cumulative Effects

Habitat Loss and Degradation

Most present and reasonably foreseeable future projects and activities occur within the range of at-risk bats and in potentially suitable habitat and thus involve some level of habitat loss or alteration of at-risk bat habitat (Figure 15.6-5 and Figure 15.6-6). The Base Case incorporates the cumulative loss or alteration of at-risk bat habitat as a result of past and present projects and was the basis for the assessment of Project effects. For the Future Case that includes both the Project and all reasonably foreseeable future projects and activities, approximately 2.0% of high-quality fall-winter at-risk bat habitat and 9.4% of high-quality spring-summer at-risk bat habitat are predicted to be lost within the Birds, Bats, and Amphibians RSA (Table 15.6-9). The Project is predicted to contribute 0.17% of that fall-winter habitat loss and 0.11% of that spring-summer habitat loss.



Crown Mountain Coking Coal Project

Figure 15.6-5
High-Quality At-Risk Bat Fall-Winter Habitat and Reasonably Foreseeable Future Projects and Activities in the Birds, Bats, and Amphibians Regional Study Area

LEGEND

- High-Quality At-Risk Bat Fall-Winter Habitat
- Reasonably Foreseeable Future Projects and Activities
- Birds/Bats/Amphibians Regional Study Area
- Terrestrial Local Study Area
- Crown Mountain Coking Coal Project
- Highway
- Railway
- Watercourse
- Waterbody
- Wetland
- Provincial Park/Protected Area
- National Park
- British Columbia/ Alberta Border

Scale 1:600,000

Map Drawing Information:
Data Provided By NWP Coal Canada Ltd, Dillon Consulting Limited, Keefer Ecological Services Ltd, Province of British Columbia GeoBC Open Data, Government of Alberta Open Data, Natural Resource Canada.
Imagery Provided By ESRI.

Map Created By: LMM
Map Checked By: HEB
Map Coordinate System: NAD 1983 UTM Zone 11N

NWP Coal Canada Ltd

Project: 12-6231

Status: FINAL

Date: 2022-01-21

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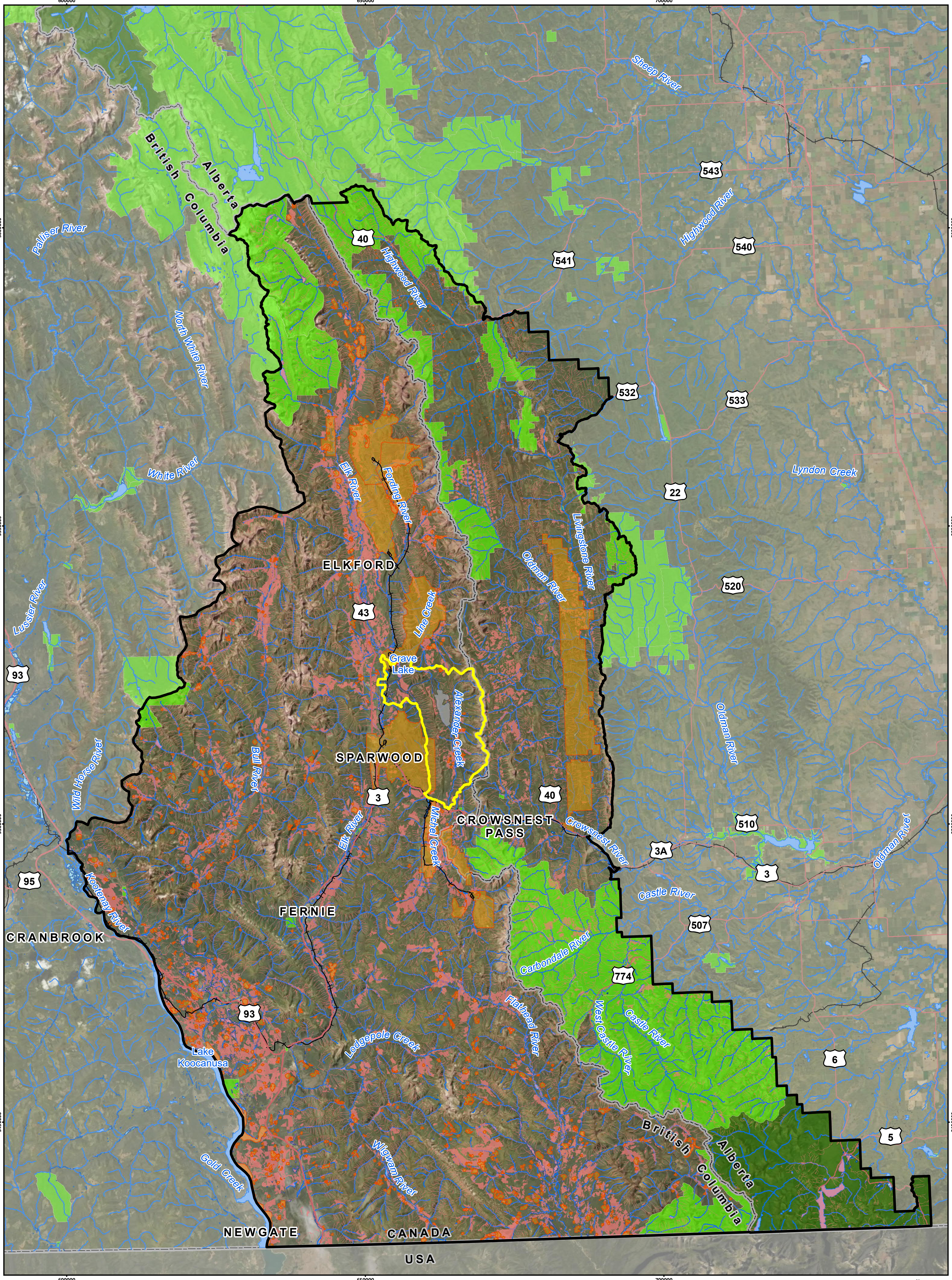

Crown Mountain Coking Coal Project

Figure 15.6-6
High-Quality At-Risk Bat Spring-Summer Habitat and Reasonably Foreseeable Future Projects and Activities in the Birds, Bats, and Amphibians Regional Study Area

LEGEND

- High-Quality At-Risk Bat Spring-Summer Habitat
- Reasonably Foreseeable Future Projects and Activities
- Birds/Bats/Amphibians Regional Study Area
- Terrestrial Local Study Area
- Crown Mountain Coking Coal Project
- Highway
- Railway
- Watercourse
- Waterbody
- Wetland
- Provincial Park/Protected Area
- National Park
- British Columbia/ Alberta Border

0 10 20
Kilometres

Scale 1:600,000

Map Drawing Information:
Data Provided By NWP Coal Canada Ltd, Dillon Consulting Limited, Keefer Ecological Services Ltd, Province of British Columbia GeoBC Open Data, Government of Alberta Open Data, Natural Resource Canada.
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Table 15.6-9: Change in High-Quality At-Risk Bat Habitat for the Base Case, the Project Case, and the Future Case in the Birds, Bats, and Amphibians RSA

VC	Season	Amount (ha) of High-Quality Habitat (Change from Base Case in Brackets)			Change as Proportion of Birds, Bats, and Amphibians RSA	
		Base Case	Project Case	Future Case	Base Case to Project Case	Base Case to Future Case
At-Risk Bats	Fall/Winter (Hibernacula)	113,009	112,818 (-191)	110,750 (-2,259)	-0.17%	-2.0%
	Spring/Summer (Foraging and Roosting)	223,924	223,683 (-241)	202,930 (-20,994)	-0.11%	-9.4%

The residual cumulative effect to at-risk bats from habitat loss and degradation arising from the effects of the Project in combination with those of all other past, present, and reasonably foreseeable future projects and activities is characterized as follows:

- Duration: *Long-term to permanent*, depending on the habitat type. Feeding habitat will be restored before the end of Post-Closure. Roosting habitat in trees will not be restored before the end of Post-Closure.
- Magnitude: *Low to Moderate*, there will be up to an overall 2.0% of high-quality at-risk bat habitat lost in the fall and winter and up to 9.4% of high-quality at-risk bat habitat lost in the spring and summer in the Birds, Bats, and Amphibians RSA due to the development of the Project and all reasonably foreseeable future projects and activities. The Project contribution to these losses is expected to be a 0.17% loss of high-quality at-risk bat habitat in fall-winter and 0.11% loss of high-quality at-risk bat habitat in spring-summer in the Birds, Bats and Amphibians RSA.
- Geographic Extent: *Regional*, as the effect of habitat loss of the Future Case will be in the Birds, Bats, and Amphibians RSA.
- Frequency: *Continuous*, the effect of habitat loss and degradation is expected to be continuous until lost habitat is restored.
- Reversibility: *Irreversible*, since each of the at-risk bat species are dependent on forest cover and forest will not be restored prior to the end of reclamation.
- Context: *Low,* as bats have slow reproductive rates, long lifespans, and habits of coloniality that make bat populations vulnerable to extirpation (B.C. MOE, 2016).

Sensory Disturbance

The effects of sensory disturbance to at-risk bats included effects of peak noise from blasting, vibration from blasting, and continuous noise levels. The effects vibration from blasting were determined to have no residual effect after mitigation. The three at-risk bat species are considered high-frequency bats (>35 kilohertz [kHz]) and the overlaps in frequency with noise generated by anthropogenic noise in the Birds, Bat, and Amphibians RSA is expected to be very small (as originally discussed for Project-level effects in Section 15.6.3.4.2). The residual cumulative effect to at-risk bats from sensory disturbance arising from the effects of the Project in combination with those of all other past, present, and reasonably foreseeable future projects and activities is characterized as follows:

- Duration: *Long-term*, as sensory disturbance will continue through to the end of the Operations phases of both the Crown Mountain Coking Coal Project and those of other reasonably foreseeable future projects and activities.

- Magnitude: *Nil*, as the overlap in frequency between sensory disturbances generated by the Project (particularly noise) and the echolocation frequency of the at-risk bats is very small or absent.
- Geographic Extent: *Regional*, as the effect of sensory disturbances will extend beyond the Project footprint and within the Birds, Bats, and Amphibians RSA.
- Frequency: *Continuous,* though at varying levels till the end of Operations phases of the Crown Mountain Coking Coal Project and those of other reasonably foreseeable future projects and activities.
- Reversibility: *Reversible long-term*, the effect of sensory disturbance will decline substantially at the end of the Operations phase of the Crown Mountain Coking Coal Project and those of other reasonably foreseeable future projects and activities.
- Context: *Low,* as bats have slow reproductive rates, long lifespans, and habits of coloniality that make bat populations vulnerable to extirpation (B.C. MOE, 2016).

15.6.4.4.3 Determination of Significance

Historical at-risk bat abundance data for the Birds, Bats, and Amphibians RSA are not available, and little is known about the populations of the three at-risk bat VCs. There will be incremental loss of at-risk bat habitat arising from the effects of the Project in combination with those of all other past, present, and reasonably foreseeable future projects and activities. However, the primary serious threat to the two SARA-listed at-risk bat species (little brown myotis and northern myotis) is white-nose syndrome (COSEWIC, 2013a). In the Project-level effects assessment, the risk of increased mortality from white-nose syndrome was predicted to be fully mitigated with no residual effects. While the effect of incremental habitat loss cannot be discounted, its influence on at-risk bat abundance and distribution is expected to be low. Based on the characterization of the residual cumulative effects, the Project in combination with reasonably foreseeable future projects and activities would not limit the ability of at-risk bats to persist and maintain self-sustaining populations in the Birds, Bats, and Amphibians RSA, including within Alberta and on federal lands located within the RSA. The residual cumulative effects of habitat loss and degradation and sensory disturbance on at-risk bats arising from the Project in combination with other past, present, and reasonably foreseeable future projects and activities during all phases are therefore considered not significant.

15.6.4.4.4 Likelihood and Confidence

Effects from Project activities that are determined to be not significant do not require a characterization of likelihood.

The confidence in the determination of the significance of residual cumulative effects to at-risk bats arising from the Project in combination with other past, present, and reasonably foreseeable future projects and activities is high.

15.6.4.4.5 Summary of Cumulative Effects

Residual cumulative effects and the selected mitigation measures, characterization criteria, significance determination, likelihood, and confidence for at-risk bats are summarized in Table 15.6-10.

Table 15.6-10: Summary of Cumulative Effects on At-Risk Bats

Residual Cumulative Effect	Mitigation Measures	Summary of Cumulative Residual Effects Characterization	Significance (Significant, Not Significant)	Confidence (High, Moderate, Low)
Habitat Loss and Degradation	• Minimizing local Project-related effects. • Participate in regional initiatives, where relevant and appropriate, and adoption of new management practices and measures to meet regional planning objectives, where possible.	Duration: Long-term to permanent Magnitude: Low to moderate Geographic Extent: Regional Frequency: Continuous Reversibility: Irreversible Context: Low	Not Significant	High
Sensory Disturbance	• Minimizing local Project-related effects. • Participate in regional initiatives, where relevant and appropriate, and adoption of new management practices and measures to meet regional planning objectives, where possible.	Duration: Long-term Magnitude: Nil Geographic Extent: Regional Frequency: Continuous Reversibility: Reversible long-term Context: Low		

15.6.5 Follow-up Strategy

A follow-up program is used to verify environmental effects predictions or to verify the effectiveness of mitigation measures where there is uncertainty (i.e., low to moderate confidence). Where environmental effects exceed that predicted under the effects assessment, or mitigation measures prove to be ineffective, alternative strategies are developed to adaptively manage the Project's effects on wildlife VCs.

Wildlife monitoring outlined in the Wildlife Management and Monitoring Plan (Chapter 33, Section 33.4.1.13) to support the verification of mitigation measures and effects predictions relating to at-risk bat VCs will include:

- Pre-clearing bat roost and hibernaculum surveys will be conducted in areas considered to have high potential for roosting or hibernation;
- Monitoring of footprint and habitat losses/gains to track and compare the planned footprint with the actual footprint and to track ecological restoration;
- Recording and monitoring of use of Project infrastructure by bats; and
- Monitoring of species occurrence at the local level by Project personnel documenting incidental observations of wildlife (i.e., wildlife sighting and incidents).

15.6.6 Summary and Conclusions

At-risk bats such as the little brown myotis and northern myotis, and the eastern red bat (not listed as at-risk but detections within B.C. are rare and are becoming of increasing interest) have the potential to occur within the Terrestrial LSA and were therefore considered together as a VC. All three bat VCs were detected in the Terrestrial LSA during baseline surveys. The potential effects of the Project on at-risk bats were determined to be habitat loss and degradation, sensory disturbance, and increased mortality risk. Various mitigation measures will avoid or minimize potential effects to at-risk bats, though potential residual effects may remain. These residual effects were determined to be not significant. There will be incremental loss of at-risk bat habitat arising from the effects of the Project in combination with those of all other past, present, and reasonably foreseeable future projects and activities. However, the primary serious threat to the two at-risk bat species (little brown myotis and northern myotis) is white-nose syndrome. In the Project-level effects assessment, the risk of increased mortality from white-nose syndrome was predicted to be fully mitigated with no residual effects. While the effect of incremental habitat loss cannot be discounted, its influence on at-risk bat abundance and distribution is expected to be low.

The residual cumulative effects of the Project in combination with reasonably foreseeable future projects and activities were determined to be not significant. Follow-up monitoring is to include pre-clearing bat roost and hibernaculum surveys and footprint and facility monitoring.

15.7 Bird Community

15.7.1 Introduction

The bird community effects assessment includes landbirds, raptors, and waterbirds. Landbirds include all birds that use terrestrial habitats, including key families such as passerines, woodpeckers, and nighthawks[20]. Raptors include all birds of prey such as owls, vultures, eagles, hawks, and falcons. Waterbirds include wetland and riverine birds; birds that require water or wetland habitat to complete their life cycles.

The AIR (EAO, 2018) identified migratory birds and Northern Goshawk as VCs. Migratory Birds are those bird species defined under the *Migratory Birds Convention Act* (MBCA, 1994) and, as per the AIR, as represented by Olive-sided Flycatcher, Barn Swallow, and woodpeckers. The EIS Guidelines (CEAA, 2015a) require consideration of migratory birds (as defined under MBCA, 1994) and species at risk (species listed under the *Species at Risk Act* [SARA; 2002]). In the EIS Guidelines (CEAA, 2015a), consideration of impacts to migratory birds refers to all species of migratory birds, and not a subset of representative species, as used in the AIR (EAO, 2018).

The AIR (EAO, 2018) identified waterbirds within the RSA (represented by Harlequin Duck, Mallard, Red-winged Blackbird, and Spotted Sandpiper) as a VC under aquatic health. Aquatic health is assessed as part of the Human and Ecological Health Assessment (Chapter 22). The aquatic health components included in the human and ecological health assessment are waterbirds, benthic invertebrates, fish species and amphibians. The assessment of residual project effects and cumulative effects to the aquatic health components was conducted for all aquatic health components combined. Since waterbirds are a specific VC under aquatic health, it is important for conformity to the AIR that an effects assessment specifically for waterbird health be included. Project and cumulative effects to waterbird health are therefore included under the bird community VCs. Information and baseline data on waterbirds is also included under the bird community partly because waterbirds are also classified as Migratory Birds under the MBCA (1994).

Based on the requirements of the AIR (EAO, 2018) and EIS Guidelines (CEAA, 2015a), potential effects on birds are evaluated for:

- Migratory Birds
  - As represented by Olive-sided Flycatcher, Barn Swallow, and woodpeckers;
  - Migratory bird guilds;
- Northern Goshawk;
- Bird species at risk; and
- Waterbird health.

15.7.1.1 Regulatory and Policy Considerations

Birds and their habitat are protected under several pieces of federal and provincial legislation. The primary pieces of legislation include the federal MBCA (1994), the federal SARA (2002), and the provincial *Wildlife Act* (1996) and *Forest and Range Practices Act* (2002). Applicable federal and provincial legislation and guidance documents relevant to birds are summarized in Table 15.7-1.

Canada, Mexico, and the U.S.A. formed the North American Bird Conservation Initiative (NABCI) in 1999 in response to population declines of many bird species (ECCC, 2017). The NABCI developed a set of ecoregions appropriate to birds throughout North America for integrated conservation purposes. These Bird Conservation Regions (BCRs) are the primary units within which conservation planning is undertaken

[20] Landbirds is a term typically used to refer to all terrestrial birds (i.e., non-waterbirds) including raptors. In this document, raptors are included as a separate category from landbirds to allow for convenient reference to the raptor species group.

and there are 12 BCRs in Canada (ECCC, 2017). Canada has developed bird conservation strategies for each BCR and BCR sub-region that provide a clear set of conservation objectives for species of conservation concern. The BCR Strategies present ECCC's migratory bird conservation priorities and provide an overview of the conservation needs of bird populations to practitioners who may undertake activities that promote bird conservation in Canada and internationally.

Table 15.7-1: Federal and Provincial Legislation and Guidance Documents Relevant to Birds

Legislation/Guideline Name	Year	Description
Federal Legislation		
Migratory Birds Convention Act	1994	Prohibitions under the MBCA (1994) provide legislative protection to migratory birds listed under its Schedule 1 and their nests.
Species at Risk Act	2002	SARA protects wildlife species listed as extirpated, endangered, or threatened from being killed, harmed, harassed, or captured; and the residences of these at-risk wildlife species on federal land and within federally designated Critical Habitat.
Federal Guidelines		
Bird Conservation Strategy for Bird Conservation Region 10 Pacific and Yukon Region: Northern Rockies	2013	The primary aims of this BCR Strategy is to present ECCC's priorities with respect to migratory bird conservation in this region, and to provide a comprehensive overview of the conservation needs of bird populations to practitioners who may then undertake activities that promote bird conservation in Canada and internationally.
Recovery Strategy for the Olive-sided Flycatcher (Contopus cooperi) in Canada	2016	The short-term population objective for Olive-sided Flycatcher in Canada is to halt the national decline by 2025, while ensuring the population does not decrease more than 10% over this time. The long-term (after 2025) population objective is to ensure a positive 10-year population trend. The distribution objective is to maintain the current extent of occurrence in Canada. Broad strategies and approaches to achieve these objectives are outlined in this recovery strategy.
Recovery Strategy for the Common Nighthawk (Chordeiles minor) in Canada	2016	The short-term population objective for the Common Nighthawk in Canada is to halt the national decline by 2025, while ensuring the population does not decrease more than 10% over this time. The long-term (after 2025) population objective is to ensure a positive 10-year population trend. The distribution objective is to maintain the current extent of occurrence in Canada. Broad strategies to be taken to address the threats to the survival and recovery of Common Nighthawk are presented.
Management Plan for the Lewis's Woodpecker (Melanerpes lewis) in Canada	2014	The main threats to populations of Lewis's Woodpecker in Canada are breeding habitat loss (due to urban and agricultural development, removal of snags, firewood cutting, and pine beetle outbreaks), interspecific competition from European Starlings, and fire suppression (which results in forest in-growth and deterioration of habitat conditions). The objective of this management plan is to increase the breeding population of Lewis's

Legislation/Guideline Name	Year	Description
		woodpeckers in the six geographic regions across their current range in Canada to approximately 600 pairs by 2040.
Proposed Recovery Strategy for the Lewis's Woodpecker (Melanerpes lewis) in Canada	2016	The population and distribution objective is to maintain or increase the regional populations and the distribution of Lewis's Woodpeckers within Canada.
Amended Recovery Strategy for the Williamson's Sapsucker (Sphyrapicus thyroideus) in Canada	2016	The population and distribution objective for Williamson's Sapsucker is to ensure the persistence of the populations in Canada within each of the identified Areas of Occupancy (AO) including: Western, Okanagan-Boundary, and East Kootenay by maintaining them at or above: 1) the current abundance; 2) the current distribution and AO, allowing for natural fluctuations in both cases.
Provincial Legislation		
Forest and Range Practices Act	2002	Outlines how resource-based activities can be conducted on Crown land in B.C., while ensuring protection of plants, animals, and ecosystems. Broad habitat and species protection measures provide direction for the protection of birds during activities such as clearing and road-building by forest and range licensees. Under the Act, habitats such as riparian areas and wetlands require special management and mitigation measures.
Wildlife Act	1996	The *Wildlife Act* protects all native and some non-native wildlife species found in B.C. from direct harm or harassment, except as allowed by regulation (e.g., hunting or trapping). The *Wildlife Act* provides legislative protection to all native birds and their occupied nests.
Provincial Guidelines		
Develop with Care 2014 Environmental Guidelines for Urban and Rural Development	2014	A comprehensive guide for preserving environmental values during land development practices. The document lists the program priorities of the Ministry of Forests, Lands and Natural Resource Operations, the B.C. Ministry of Environment, and other agencies, and promotes methods for retaining and creating environmental function and resilience.
Elk Valley Water Quality Plan	2015	Regionally-specific benchmark tissue concentrations for selenium were developed for bird egg tissues in the Elk Valley Water Quality Plan (EVWQP; Teck Coal Limited, 2015c). The benchmark concentrations are those resulting in a critical effect size for bird reproduction of ~10% (12 milligrams per kilograms dry weight [mg/kg dw]) and ~20% (16 mg/kg dw), quantified according to dose-response curves representing the following: • Negligible potential for population-level effects if <10%; • A possibility of population-level effects if between 10% and 20%; and • A potential for measureable and ecologically meaningful population-level if >20%.

Legislation/Guideline Name	Year	Description
British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture	2019	The B.C. tissue guideline for selenium in bird egg tissue is 6 milligrams per kilogram dry weight (mg/kg dw). The guideline was based on a weight of evidence with selenium as the most direct or sensitive measure (derivation from 10% Effect Concentration [EC10] for a Mallard egg with an uncertainty factor of 2 applied).
Recovery Plan for the Williamson's Sapsucker (Sphyrapicus thyrodieus) on Crown Lands in British Columbia	2012	The scope of this provincial recovery plan applies to provincial Crown land in the Williamson's Sapsucker area of occupancy in B.C. The population and distribution goal (recovery goal) for Williamson's Sapsucker is to ensure the persistence of its populations in Canada (East Kootenay, Okanagan-Boundary, and Western) by maintaining them at or above (1) the current abundance; and (2) the current distribution and area of occupancy, allowing for natural fluctuations in both cases.

The Project is located in the Canadian portion of BCR 10 Pacific and Yukon Region: Northern Rockies, which covers about 44 million ha ranging from the Columbia and Rocky Mountains from the Canada-U.S.A. border in the south to the southern edge of the boreal forest in the north and extends westward across the central plateau to the Coast Mountains. Environment Canada (2013) identified 230 migratory bird species in BCR 10, 77 of which are identified as species of conservation concern or priority bird species. The most severe threats to migratory bird species in BCR 10 include loss of habitat due to forestry, habitat alterations due to the mountain pine outbreak, and forest fire suppression (Environment Canada, 2013).

15.7.1.2 Species of Conservation Concern

Species of conservation concern are species with rare or declining populations or habitats that are provincially Blue- or Red-listed, federally-listed under SARA (2002) and/or COSEWIC, or globally-listed by NatureServe. Species were identified using the British Columbia Conservation Data Centre's (B.C. CDC) Species and Ecosystems Explorer (B.C. CDC, 2019a). The B.C. CDC Species and Ecosystems Explorer identified 25 bird species of conservation concern that can be found with the East Kootenay region and have the potential to occur near the Project, based on documented historical observations of these species (Table 15.7-2).

Table 15.7-2: Bird Species of Conservation Concern Likely to Occur within the East Kootenay Region (B.C. CDC, 2019a)

Common Name	Scientific Name	B.C. Conservation List[1]	B.C. Status Rank[2]	COSEWIC Status[3]	SARA Status[4]	Global Status[5]
Landbirds						
Bank Swallow*	*Riparia riparia*	Yellow	S4B	T	1-T	G5
Barn Swallow*	*Hirundo rustica*	Blue	S3S4B	T	1-T	G5
Black Swift*	*Cypseloides niger*	Blue	S2S3B	E	1-E	G4
Bobolink*	*Dolichonyx oryzivorus*	Blue	S3B	T	1-T	G5

Common Name	Scientific Name	B.C. Conservation List[1]	B.C. Status Rank[2]	COSEWIC Status[3]	SARA Status[4]	Global Status[5]
Common Nighthawk*	*Chordeiles minor*	Yellow	S4B	SC	1-T	G5
Evening Grosbeak*	*Coccothraustes vespertinus*	Yellow	S5	SC	1-SC	G5
Lewis's Woodpecker*	*Melanerpes lewis*	Blue	S2S3B	T	1-T	G4
Long-billed Curlew*	*Numenius americanus*	Blue	S3B	SC	1-SC	G5
Olive-sided Flycatcher*	*Contopus cooperi*	Blue	S3S4B	SC	1-T	G4
Williamson's Sapsucker*	*Sphyrapicus ruber*	Blue	S3B	E	1-E	G5
Raptors						
Flammulated Owl	*Psiloscops flammeolus*	Blue	S3B	SC	1-SC	G2
Northern Goshawk (*atricapillus* ssp.)	*Accipiter gentilis atricapillus*	Blue	S3S4	NAR		G5T5
Peregrine Falcon	*Falco peregrinus*	No Status	S3	SC	1-SC	G4
Peregrine Falcon (*anatum* spp.)	*Falco peregrinus anatum*	Red	S2?	NAR	1-SC	G4T4
Short-eared Owl	*Asio flammeus*	Blue	S3B, S2N	SC	1-SC	G5
Swainson's Hawk	*Buteo swainsoni*	Red	S2B			G5
Western Screech Owl	*Megascops kennicottii*	No Status	S4	T	1-T	G4G5
Western Screech Owl (*macfarlanei spp.)*	*Megascops kennicottii macfarlanei*	Blue	S3	T	1-T	G4G5T4
Waterbirds						
American Avocet*	*Recurvirostra americana*	Blue	S2S3B			G5
American Bittern*	*Botaurus lentiginosus*	Blue	S3B			G5
Eared Grebe*	*Podiceps nigricollis*	Blue	S3B			G5
Great Blue Heron (*heriodias* spp.)*	*Ardea herodias*	Blue	S3?			G5T5
Horned Grebe*	*Podiceps auritus*	Yellow	S4B, SNRN	SC	1-SC	G5
Rusty Blackbird	*Euphagus carolinus*	Blue	S3S4B	SC	1-SC	G4
Sandhilll Crane*	*Antigone canadensis*	Yellow	S4B	NAR		G5

Notes:
* Listed under the MBCA (1994).
[1] Yellow: at the least risk of being lost. Blue: special concern. Red: at risk of being lost (extirpated, endangered, or threatened; B.C. CDC, 2019a).
[2] S= Subnational rank assigned by B.C. CDC. B= Breeding Population. 2 = Imperiled. 3= Special Concern, vulnerable to extirpation or extinction. 4= Apparently Secure. SNRN=species not ranked. ?= inexact or uncertain rank (B.C. CDC, 2019a).
[3] Based on COSEWIC Status Reports. SC=Special Concern. T=Threatened. E=Endangered. NAR=Not at Risk (COSEWIC, n.d.).
[4] 1= Listed on Schedule 1 of SARA (2002). SC=Special Concern. T=Threatened. E=Endangered. NAR=Not at Risk.
[5] NatureServe Global (G) Conservation Status Rank. G2=Imperiled. G4=Secure. G5=Secure. G#G#: Range rank, uncertainty about the exact status. T: Infraspecific Taxon (subspecies or varieties). (NatureServe, n.d.).

15.7.1.3 Migratory Birds

Most bird species in Canada are migratory, moving variable distances between overwintering grounds in the south to nutrient rich breeding grounds in the north in the spring, and back to the south in the fall. An ecological definition for migratory birds includes those birds that move seasonally for the purpose of moving to a new location where conditions are alternately favourable; that is, on a greater scale and longer distances than movements of typical daily activity (Dingle and Drake, 2007). Migratory birds are ecologically and economically valuable as they: help regulate pest insect and rodent populations affecting agriculture and forestry; act as pollinators in both seed dispersion and flower pollination; contribute to socio-economic activities (i.e., hunting and birdwatching); and contribute to the overall health and biodiversity of aquatic and terrestrial ecosystems (United Nations Environment Programme, 2012).

Migratory bird pathways in North America are split into four major management areas: the Pacific Flyway, Central Flyway, Mississippi Flyway, and Atlantic Flyway (Ducks Unlimited, 2019). The Pacific Flyway stretches 6,500 km from north to south and over 1,600 km from east to west, spanning from the Arctic to the west coast of Mexico and from the Rocky Mountains to the Pacific Ocean (Ducks Unlimited, 2019). The Terrestrial LSA is located at the eastern edge of the Pacific Flyway and it is anticipated that migratory birds within the Terrestrial LSA overwinter in the U.S.A., Mexico, or South America. The following subsections provide an overview of the habitat requirements, life history traits, and threats for the three representative migratory bird species identified in the AIR.

15.7.1.3.1 Barn Swallow

The Barn Swallow is provincially Blue-listed and listed as Threatened under SARA (2002). This species typically nests on artificial structures areas associated with human and rural settings such as barns, garages, houses, bridges, and culverts in colonies of approximately 10 pairs (COSEWIC, 2011). Prior to European settlement, Barn Swallows used natural features such as caves, holes, crevices, ledges and Indigenous peoples structures (Speich, et al., 1986; COSEWIC, 2011). Barn Swallows in B.C. have been recorded at elevations ranging from near sea level to at least 2,400 m asl (COSEWIC, 2011). Nesting habitats are typically close to foraging sites with open habitat such as fields, pastures, lake and river shorelines, right-of-ways, islands, and wetlands that support abundant aerial insect populations (COSEWIC, 2011). In B.C., the species raises two broods of approximately three to five chicks per year (Campbell et al., 1997). The main threats to Barn Swallow include habitat loss and degradation due to the replacement of older wood buildings with metal buildings; changes in insect prey; loss of nesting sites to invasive species such as House Sparrow (*Passer domesticus*); parasitism; and human persecution (COSEWIC, 2011).

15.7.1.3.2 Olive-sided Flycatcher

The Olive-sided Flycatcher is provincially Blue-listed and listed as Threatened under SARA (2002). This species occupies the edges of open to semi-open mature coniferous or mixed forests containing tall trees or snags for perching and live residual trees for nesting; these areas are often situated near open areas, burn sites, edges of wetlands, or human created openings that support abundant aerial insect populations (Environment Canada, 2016a; Altman and Sallabanks, 2020). Although the species is generally found at elevations ranging between 1,000 and 2,000 m asl, it has been recorded from 400 to 3,400 m asl (Altman and Sallabanks, 2020). Olive-sided Flycatchers are socially monogamous and raise a single brood of approximately three chicks per year. The main threats to Olive-sided Flycatchers include habitat loss through commercial forestry, fire suppression, anthropogenic disturbances, insect declines, and pesticide use (Environment Canada, 2016a).

15.7.1.3.3 Woodpeckers

Woodpeckers are forest bird species and year-round residents of B.C. and possess a unique set of characteristics used for climbing, drilling, drumming, and foraging on trees (RISC, 1999a). Woodpeckers excavate cavities in dead and live trees in order to perform courtship rituals, nest, roost, and forage (RISC, 1999a). This behaviour is a valuable ecosystem service that provides cavities to other species, including birds, insects, and small mammals (Martin et al., 2004). Woodpeckers are listed under the MBCA (1994); however, they are not known to migrate very far and most are considered to be resident species (RISC, 1999a).

Twelve woodpecker species breed in B.C., nine of which are known to be distributed in the Kootenay Region: American Three-toed Woodpecker (*Picoides dorsalis*); Black-backed Woodpecker (*Picoides arcticus*); Downy Woodpecker (*Dryobates pubescens*); Hairy Woodpecker (*Dryobates villosus*); Lewis's Woodpecker (*Melanerpes lewis*); Northern Flicker (*Colaptes auratus*); Pileated Woodpecker (*Dryocopus pileatus*); Red-naped Sapsucker (*Sphyrapicus nuchalis*); and Williamson's Sapsucker (*Sphyrapicus thyroideus*; RISC, 1999a).

15.7.1.4 Raptors

Raptors are birds of prey and include hawks, eagles, falcons, and owls. Raptors are widespread in B.C. and occupy nearly all terrestrial habitats (FLNRO, 2013). Fourteen raptor species have the potential to occur in the East Kootenay region, and Osprey (*Pandion haliaetus*) are particularly known to be common in this region due to the abundance of fish-bearing waterbodies and watercourses (FLNRO, 2013).

Prey abundance is considered to be one of the most important factors influencing raptor dispersal (Widen, 1994). Raptors are generally long-lived birds that feed at high trophic levels; as such, they are considered good ecological indicators for environmental pollution and habitat degradation and destruction (Ministry of Sustainable Resource Management, 2001). In addition to the need for adequate prey, raptors also require habitat suitable for hunting. Many raptors hunt using perches on large, often dead trees or conspicuous upright structures that provide clear views of their prey (either in the ground or air space), and it has been shown that raptors significantly favour habitats with perches (Widen, 1994). The following subsection provides an overview of the habitat requirements, life history traits, and threats for Northern Goshawk, the raptor VC selected for the environmental assessment of this Project.

15.7.1.4.1 Northern Goshawk

The Northern Goshawk is a bird of prey that inhabits forested landscapes across North America, Europe, and Russia (Brown and Amadon, 1989). There are two subspecies of Northern Goshawk in B.C.: the smaller coastal subspecies *Accipiter gentilis laingi*, and the larger *atricapillus* subspecies found throughout the rest of the province including in the East Kootenay region. The *atricapillus* subspecies is provincially Blue-listed but is not SARA-listed and is considered as Not at Risk by COSEWIC (B.C. CDC, n.d.c). Northern Goshawk belong to the family Accipitridae, which is not listed under the MBCA (1994).

Northern Goshawks require extensive areas (>60%) of old growth and mature forests for hunting and nesting at elevations between 250 to 2,100 m asl (B.C. CDC, 1999; Mahon and Doyle, 2003). Suitable habitat features generally include trees with: large and extra-large diameters; complex canopy structure; and stand structure that supports sub-canopy flyways and closed canopies (Stuart-Smith et al., 2012). Though these conditions are typical of mature and old growth forests, they may exist in forests of various structural stages, depending on stand composition, site history, local productivity, and stand height (Penteriani, 2002; Squires and Kennedy, 2006). Stick nests up to 1.5 m across and 1 m deep are built along tree trunks or on top of broken snags and are generally located at least 100 m from stand edges, where forests lie adjacent to non-forest, shrub-dominated, or herbaceous habitats (Stuart-Smith et al., 2012). This species' diet consists of small mammals (e.g., squirrels, snowshoe hares) and birds (e.g., grouse, jays, thrushes, woodpeckers).

The primary threat facing Northern Goshawks is habitat loss associated with industrial activities, including forest fragmentation; creation of even-aged and monotypic stands; increases in the area of younger age classes; and loss of tree species diversity (Widen, 1997; Cooper and Stevens, 2000; Peck, 2000; Kennedy, 2003; Andersen et al., 2005; Stuart-Smith et al., 2012). Other threats include industrial noise leading to nest abandonment; competition with other raptors (e.g., Barred Owl [*Strix varia*]); culling by poultry farmers; biting/blood sucking insects (Blackflies [*Simuliidae*] and blowflies [*Protocalliphora*]); and predation of juveniles by canids such as coyotes and wolves (*Canis* spp.), foxes (*Vulpes* spp.), and owls (Reynolds et al., 1992; Squires and Reynolds, 1997; Stuart-Smith et al., 2012).

15.7.1.5 Waterbirds

For the purposes of the Application/EIS, waterbirds include water-dependent birds that spend most or part of their lifecycle near waterbodies. Waterbird habitat within the Project region includes both lentic (still) waterbodies such as lakes, ponds, and wetlands, and lotic (moving) waterbodies such as rivers, streams, and creeks. Most waterbird families are considered migratory game birds or migratory non-game birds and are included in Article I of the MBCA (1994); notable exceptions include Red-winged Blackbird and the Kingfisher (Alcedinidae) family.

Waterbirds can reflect the productivity of aquatic ecosystems, as they spend much of their time in the water while foraging on aquatic food resources such as aquatic vegetation, benthic invertebrates, zooplankton, fish, and amphibians. If an aquatic ecosystem inhabited by waterbirds contains distributed contaminants (e.g., selenium, mercury), there is potential for waterbirds to bioaccumulate contaminants in their tissues and pass them on to their young, or to transfer contaminants to higher trophic levels through biomagnification (Ohlendorf et al., 1989; Williams et al., 1989). The following subsections provide an overview of the habitat requirements, life history traits, and threats for each representative waterbird species selected for the aquatic health assessment.

15.7.1.5.1 American Dipper

The American Dipper is the only truly aquatic passerine in North America. The species is Yellow-listed in B.C. and is not listed federally under SARA nor by COSEWIC. In B.C., American Dipper occur throughout the entire province but are more common in southern B.C. (Campbell et al., 1997; Martell, 2015a). The species breeds at elevations between 300 and 2,140 m asl (Campbell et al., 1997). While American Dippers are widely distributed, they do not exhibit long migratory patterns and instead exhibit two primary life history types: local residents, and altitudinal migrants. Local residents remain within the same territory year-round, while altitudinal migrants share the winter grounds with the resident population and move to high elevation breeding habitats in the spring (Morrissey et al., 2004; Gillis et al., 2008).

American Dippers depend on fast-flowing, mountain waterways that have riffles, cascades, and waterfalls for food and nesting habitat (Gillis et al., 2008). Pollution-free, small to medium sized streams (usually less than 15 m in width and 2 m in depth) are favoured (Kingery and Willson, 2020). The most important environmental criteria for breeding habitat is nest site suitability and food availability (Kingery and Willson, 2020). Nesting habitat includes cliff ledges, boulders, overhanging logs, undercut banks with exposed tree roots, and bridges (Morrissey, 2004). A clutch size of three to six eggs is laid between mid-March and mid-April (Fenneman, 2019; Kingery and Willson, 2020), and both the male and female adults tend to the altricial young (B.C. CDC, 1994d). American Dippers have an exclusively aquatic diet comprised of benthic macroinvertebrates, small fish, fish eggs, and tadpoles (Morrissey and Olenick, 2004; Morrissey et al., 2005). Foraging behaviour includes walking, swimming, or diving in streams to capture prey (B.C. CDC, 1994d).

American Dippers are threatened by deforestation, bank erosion, silting, acidification, agricultural runoff, and industrial pollution (Kingery and Willson, 2020). Populations are susceptible to effects from mining operations including habitat degradation, changes in water flow patterns that affect food sources, and direct negative toxicological effects on reproduction or survival from heavy metal accumulation (Henny et al., 2005). American Dippers have been used to assess the influence of mining operations on avifauna of small streams through bioaccumulation and the corresponding toxicological effects of mercury and selenium (Harding et al., 2005; Henny et al., 2005; Morrissey et al., 2005; Wayland and Crosley, 2006).

15.7.1.5.2 Mallard

The Mallard is Yellow-listed in B.C. and is not listed federally under SARA nor by COSEWIC. Within B.C., Mallards breed throughout the province and overwinter along the coast (B.C. CDC, 1994a; RISC, 1999e). Mallards utilize ponds, lakes, marshes, and flooded field habitats (B.C. CDC, 1994a). Nesting usually occurs on the ground in concealing vegetation within 0.8 km of water, but occasionally Mallards will nest in trees or other atypical areas (B.C. CDC, 1994a). The average clutch size is eight to ten chicks laid in late April to late May (B.C. CDC, 1994a; RISC, 1999e). Mallards dabble to feed and consume seeds/rootlets/tubers of aquatic plants, seeds of swamp and river bottom trees, acorns, cultivated grains, insects, molluscs, amphibians, and fish eggs/small fish; juveniles mainly consume invertebrates and adults primarily consume vegetation (B.C. CDC, 1994a). Mink, great horned owls, weasels, and red fox are observed to prey on Mallards (Talent et al., 1983; Pearse and Ratti, 2004).

15.7.1.5.3 Harlequin Duck

The Harlequin Duck is split into two populations in Canada under SARA (2002); eastern and western populations. The eastern Canadian population, which breeds in Newfoundland, Labrador, New Brunswick, Quebec, and Nunavut, is listed under *SARA* as Special Concern (COSEWIC, 2013b). The western Canadian population that breeds in B.C. and Alberta is not listed as a species at risk under SARA (Environment Canada, 2007b; COSEWIC, 2013b) and is Yellow-listed in B.C. The discussion that follows is focused on the western Canadian population.

Harlequin Ducks overwinter in coastal marine waters and migrate into steep mountain riverine habitats during the spring snow and ice melt (RISC, 1998b). Breeding Harlequin Ducks generally require relatively undisturbed, low-gradient, meandering mountain streams that contain dense shrubby riparian areas, woody debris, and mid-stream boulders (Spahr et al., 1991; B.C. CDC, 1995b). Nesting occurs in hollows, such as under the cover of bushes, rock crevices among boulders, rock cavities in cliff faces, tree cavities, puffin burrows, or other small hidden sites (Ehrlich et al., 1992; Cassirer et al., 1993; B.C. CDC, 1995b). Individuals tend to utilize the same area in successive years for breeding (B.C. CDC, 1995b). Female Harlequin Ducks raise one brood per season, with incubation occurring from mid-May to late June and clutch sizes ranging from approximately four to seven eggs, (B.C. CDC, 1995b; Robertson and Goudie, 1999; COSEWIC, 2013b).

In the Rocky Mountains, Harlequin Duck time their arrival to match up with the spawning of Long-nosed Sucker (*Catostomus catostomus*), which is an important food source (RISC, 1998b). Later in the season, Harlequin Duck feed on insect larvae and crustaceans before returning to the coast between September and November (B.C. CDC, 1995b; RISC, 1998b). Harlequin Ducks exhibit delayed sexual maturity, low annual production, variable breeding success, and long lifespans (Goudie et al., 1994). Potential threats to Harlequin Ducks at breeding sites include degradation of riverine habitats by logging, mining, and power projects, and disturbance from white-water rafting, fishing, and other recreational activities (Robertson and Goudie, 1999).

15.7.1.5.4 Red-winged Blackbird

The Red-winged Blackbird is Yellow-listed in B.C. and is not listed federally under SARA nor by COSEWIC. Red-winged Blackbird habitat includes freshwater and brackish marshes, brushes and small trees along watercourses, and upland cultivated fields (B.C. CDC, 2010a; Ryder, 2015). During the winter and while migrating, the species also utilizes open cultivated lands, plowed fields, pastures, and prairie habitats (B.C. CDC, 2010a; Ryder, 2015). Nesting habitat is usually near water in cattails, rushes, sedges, and occasionally in shrubs or trees (B.C. CDC, 2010a). Nesting begins between April and May and can continue into July, with most clutch sizes between three to five eggs (B.C. CDC, 2010a). Red-winged Blackbirds feed on both vegetation and animal matter, including grains, seeds, fruit, mayflies, moths, beetles, caterpillars, grubs, and molluscs (B.C. CDC, 2010a). Overwintering occurs throughout much of the southern U.S.A. (B.C. CDC, 2010a). Pre-breeding migration occurs from early February to end of April, and the post-breeding migration occurs from mid-August to mid-December (Yasukawa and Searcy, 2019). Although it is not a species of conservation concern, crop control measures and habitat loss from destruction of wetlands are major sources of mortality in some parts of the species' range (Ryder, 2015).

15.7.1.5.5 Spotted Sandpiper

The Spotted Sandpiper is Yellow-listed in B.C. and is not listed federally under SARA nor by COSEWIC. In the Rocky Mountains, Spotted Sandpiper begin arriving in late May and early June. Breeding habitat occurs along riparian, marine, and freshwater systems including lakes, ponds, wetlands, rivers, and creeks from sea level to above 2,100 m asl (Burger, 2015). Nest sites within 15 m of water and with restricted predator access are favoured, especially islands or open areas with herbaceous cover (Campbell et al., 1990; Reed et al., 2020). Females typically lay four eggs, but clutches can range from one to six eggs. Spotted Sandpipers feed in shallow edges on insects, small fish, and crustaceans (Cogswell, 1977). Spotted Sandpiper is the most widespread breeding sandpiper in North America; however, localized threats include predation (particularly by mink); development and loss of wetland habitat; and compromised water quality (Cornell University, 2019).

15.7.2 Existing Conditions

This section describes the existing conditions of bird VCs in the Terrestrial LSA and Birds, Bats, and Amphibians RSA in sufficient detail to enable potential effects of the Project on birds to be identified, understood, and assessed.

15.7.2.1 Existing Regional and Local Information

Existing regional and local information for bird VCs was compiled by conducting a desktop assessment of background information for habitat availability, occurrence and distribution, abundance, and connectivity in the Project study areas (i.e., the Project footprint, the Terrestrial LSA, and the Birds, Bats, and Amphibians RSA). Data sources included:

- Canadian Species at Risk Public Registry;
- British Columbia Conservation Data Centre iMap and Species and Ecosystems Explorer (B.C. CDC, n.d.a.; n.d.b.);
- B.C. Breeding Bird Atlas;
- Scientific literature; and
- Other baseline studies completed for projects in the region.

15.7.2.1.1 Landbirds

Breeding bird baseline studies completed by Golder Associates (2015a) in the vicinity of Teck's Elkview Operations documented 105 bird species within that study area. Frequently observed breeding birds included Swainson's Thrush (*Catharus ustulatus*), Warbling Vireo (*Vireo gilvus*), MacGillivray's Warbler (*Geothlypis tolmiei*), Townsend's Warbler (*Setophaga townsendi*), Dark-eyed Junco *(Junco hyemali*s), and Yellow-rumped Warbler (*Setophaga coronate*). No Barn Swallow were detected, but Olive-sided Flycatcher were observed 19 times during the breeding bird surveys (Golder Associates Ltd., 2015a). Woodpecker species encountered as part of the baseline program completed by Golder Associates (2015a) included 13 Pileated Woodpecker and indirect observations of Northern Flicker, Black-backed Woodpecker, American Three-toed Woodpecker, Hairy Woodpecker, and Red-naped Sapsucker.

Teck conducted breeding bird baseline studies in 2010 in the vicinity of the Line Creek Operations (Teck Coal Limited, 2011). The baseline study included observations of 47 individual birds during breeding bird surveys and incidentally during other surveys conducted in 2009 and 2010 (Teck Coal Limited, 2011). The most frequently observed bird species were Yellow-rumped Warbler, Ruby-crowned Kinglet (*Regulus calendula*), Dark-eyed Junco, Black-capped Chickadee (*Poecile atricapillus*), Hermit Thrush (*Catharus guttatus*), Chipping Sparrow (*Spizella passerina*), Gray Jay (*Perisoreus canadensis*), Varied Thrush (*Ixoreus naevius*), and Swainson's Thrush. Olive-sided Flycatcher were identified twice by song (Teck Coal Limited, 2011). Woodpeckers were also observed incidentally during the breeding songbird surveys: three Hairy Woodpecker and five Northern Flicker were recorded (Teck Coal Limited, 2011). Historical observations of other Woodpeckers were recorded in 1985 and included Pileated Woodpecker, American Three-toed Woodpecker, and Yellow-bellied Sapsucker (Teck Coal Limited, 2011).

Limited information is available on Barn Swallows in the Elk Valley; however, regional information on Olive-sided Flycatcher occurrence distribution and habitat availability exists. Activities including the clearing of valley-bottom forests for agriculture and settlements, fire-suppression, forestry, and mining have likely resulted in a reduction of available Olive-sided Flycatcher habitat in the Elk Valley since the

1890s (Golder Associates, 2014 in Teck Coal Limited, 2015a). Forestry, fire suppression, and mining have likely had both positive and negative effects of regionally available Olive-sided Flycatcher habitat because activities such as small clear-cuts and land-clearing for mining that create early seral habitat and increase forest to edge ratios that may improve Olive-sided Flycatcher habitat (Altman and Sallabanks, 2020). Large clear-cuts do not appear to result in as favourable habitat for Olive-sided Flycatchers (Beese and Bryant, 1999). Fire suppression in the Elk Valley has resulted in more dense forested conditions compared to pre-settlement conditions (Davis, 2009), which may have reduced the amount of suitable habitat for Olive-sided Flycatchers. Fire suppression has also increased the amount of mature forest and total area of forest (Davis, 2009), which can create habitat conditions suitable for Olive-sided Flycatchers, especially where variable canopy height is created. Regardless, it is believed that disturbance activities has resulted in a net negative effect on Olive-sided Flycatcher habitat in the Elk Valley since the 1890s because forested ecosystems with the potential to create suitable habitat have declined overall (Golder Associates, 2014).

Olive-sided Flycatcher breeding has been confirmed in and around the Elk Valley (Davidson et al., 2014). Historical abundance data are unavailable; however, abundance has likely decreased since pre-development conditions, consistent with the general pattern of population decline observed across this species' breeding range (Environment Canada, 2016a; COSEWIC, 2018a). Data collected for Canfor's Tree Farm Licence 14 in the Columbia Valley showed a stable Olive-sided Flycatcher population between 1999 and 2004 (Bayne, 2005).

15.7.2.1.2 Raptors

Raptor-specific surveys other than for Northern Goshawk were not conducted near Teck's Elkview Operations (Golder Associates Ltd., 2015a), or the baseline study conducted at Line Creek (Teck Coal Limited, 2011). During the baseline program near Teck's Elkview Operations in 2012 and 2013, Turkey Vulture (*Cathartes aura*), Sharp-shinned Hawk (*Accipiter striatus*), Golden Eagle (*Aquila chrysaetos*), Red-tailed Hawk (*Buteo jamaicensis*), Swainson's Hawk (*Buteo swainsoni*), Bald Eagle (*Haliaeetus leucocephalus*), Osprey, Merlin (*Falco columbarius*), and American Kestrel (*Falco sparverius*) were observed, although the numbers of individuals were not provided (Golder Associates Ltd., 2015a). During the baseline program completed by Golder (2015) for the Elkview Operations, five Red-tailed Hawk and one Sharp-shinned Hawk were observed.

An expert-opinion model developed for Northern Goshawk nesting habitat in the East Kootenay region suggested that over half the productive forest in the Cranbrook Timber Supply Area (TSA), which overlaps with the Terrestrial LSA for this Project, is capable of providing Northern Goshawk nesting habitat (Stuart-Smith et al., 2011). Only 26% of the habitat in the TSA was rated as moderate and high suitability. Although habitat availability for Northern Goshawk in the East Kootenay region has increased over the last 100 years, the combined effects of climate change and forestry practices are anticipated to decrease habitat availability by a factor of 3 times within the next 100 years (Stuart-Smith et al., 2011).

Northern Goshawk habitat assessments were completed at call-playback survey stations near the Elk River and Harmer Creek as part of a baseline program completed by Golder Associates in 2015 (Golder Associates Ltd., 2015a). None of the survey stations assessed for Northern Goshawk habitat suitability met the high-suitability nesting habitat criteria, and only 13% of the assessed survey stations were considered to be moderately suitable nesting habitat (Golder Associates Ltd., 2015a). Call-playback surveys consistent with RISC standards were conducted in conjunction with the habitat assessment surveys, and no Northern Goshawk observations were confirmed (Golder Associates Ltd., 2015a). At Line Creek, one Northern Goshawk was detected during the baseline surveys, but no nests were detected, and no specific nest surveys were completed (Teck Coal Limited, 2011). Historically, Northern Goshawk were observed in subalpine meadow and Engelmann spruce-lodgepole pine habitats within and around Teck's Line Creek Operations (Teck Coal Limited, 2011).

15.7.2.1.3 Waterbirds

Wetland bird baseline surveys were not completed for nearby projects such as Teck's Elkview Operations or Line Creek Operations. Red-winged Blackbirds (two individuals) were observed incidentally during breeding bird studies in 2012 and 2013 completed near Teck's Elkview Operations (Golder Associates Ltd., 2015a). Mallards were also observed for this study; however, specific numbers were not provided (Golder Associates Ltd., 2015a). To the north of the Crown Mountain Coking Coal Project, baseline surveys conducted near the Line Creek Operations noted that wetlands within that study area evaluated accounted for less than 1% of the land cover (Teck Coal Limited, 2011), and wetland bird observations during the baseline program were sparse.

Riverine bird baseline surveys conducted in 2013 near Teck's Elkview Operations found American Dipper and Spotted Sandpiper along the Elk River and Spotted Sandpiper in Erickson Creek (Golder Associates Ltd., 2015a). In addition, American Dipper, Spotted Sandpiper, and Harlequin Duck were observed in Harmer, Dry, and Michel Creeks. Spotted Sandpiper were the most frequently observed species for other baseline surveys in the area (Golder Associates Ltd., 2015a). No riverine birds were observed during the targeted baseline surveys conducted near the Line Creek Operations; however, America Dipper, Harlequin Duck, and Red-winged Blackbird have been recorded at the site during other surveys (Teck Coal Limited, 2011).

Concentrations of selenium in Spotted Sandpiper eggs ranged from 3.0 to 4.2 mg/kg dw at reference sites sampled during the baseline program conducted near Teck's Line Creek Operations (Teck Coal Limited, 2011). Spotted Sandpiper egg samples from mine-exposed areas in the Elk Valley generally showed higher selenium concentrations, with ranges from 3.3 to 9.0 mg/kg dw measured during baseline studies for the Line Creek Operations (Teck Coal Limited, 2011) and 3.6 to 9.1 mg/kg dw measuring during baseline studies for the Elkview Operations (Golder Associates Ltd., 2015b). Selenium concentrations in Spotted Sandpiper eggs collected from a lentic exposed site in the Harmer Sediment Pond ranged from 7.16 to 14.1 mg/kg dw (Golder Associates Ltd., 2015b). Portions of the Harmer Creek watershed contain active coal mining (i.e., Teck's Elkview Operations), which likely contributes to elevated selenium levels in Harmer Creek.

Although there is limited historical information on riverine birds in the Elk Valley, available data indicate good distribution of American Dipper in the Elk Valley despite a decrease in river and riparian habitat relative to pre-disturbance conditions (TAESCO, 1985; EBA Engineering Consultants Ltd., 2004; Teck Coal Limited, 2011). Riverine habitat is naturally uncommon in the Elk Valley (Golder Associates Ltd., 2015a) and is mainly comprised of first order streams, which represent moderately-low and low quality breeding habitat for American Dipper (RISC, 1998b). Available breeding habitat has been diminished due a reduction in the number of small streams as a result of mining development; however, many larger streams and rivers remain connected in the Elk Valley (Golder Associates, 2014 in Teck Coal Limited, 2015a), and successful breeding has been recorded along Dry and Harmer Creeks.

15.7.2.1.4 Transboundary Considerations

Birds are highly mobile and, for those species that are migratory, spend a substantial amount of the year outside Canada. Bird populations within the Terrestrial LSA and Birds, Bats, and Amphibians RSA are likely part of larger populations that spans across both the B.C./Alberta and the Canada/U.S.A. borders.

15.7.2.2 Baseline Programs

15.7.2.2.1 Methods

Bird baseline surveys were conducted in 2014, 2017, 2018, and 2019 to support the Project's baseline studies and the development of this Application/EIS. The surveys were completed to obtain information on bird habitat occupancy (presence/non-detect), extent of occurrence and abundance, and habitat availability and distribution within the Terrestrial LSA. The bird community baseline surveys were conducted within the Project footprint and the Terrestrial LSA. Survey methods followed provincial survey standards, where applicable, and were conducted during the spring, summer, and fall to capture the migration periods and the breeding bird nesting window. No winter surveys were conducted due to safety concerns. The bird surveys completed as part of the baseline program included the following survey types:

- Landbird breeding and migration point count and transect surveys;
- Common Nighthawk (*Chordeiles minor*) surveys;
- Raptor migration standwatch surveys;
- Northern Goshawk call-playback and habitat assessment surveys;
- Nocturnal owl surveys;
- Wetland bird breeding and migration season standwatch surveys;
- Riverine bird surveys; and
- Riverine bird egg tissue collection.

Guidance documents that were used to develop survey and assessment methods included:

- Inventory Methods for Forest and Grassland Songbirds (RISC, 1999f);
- Handbook of Field Methods for Monitoring Landbirds (Ralph et al., 1993);
- Monitoring Bird Populations by Point Counts (Ralph et al., 1995);
- Inventory Methods for Raptors (RISC, 2001);
- Bird Studies Canada Guidelines for Nocturnal Owl Monitoring in North America (Takats et al., 2001);
- Inventory Methods for Waterfowl and Allied Species: Loons, Grebes, Swans, Geese, Ducks, American Coot, and Sandhill Crane (RISC, 1999e); and
- Inventory Methods for Riverine Birds: Harlequin Duck, Belted Kingfisher and American Dipper Version 2.0 (RISC, 1998b).

Collected baseline data were used in the development of models for habitat classification (further described in Section 15.7.2.3). Guidance documents that were used to develop modelling methods included:

- Resource Selection by Animals (Manly et al., 2002), and
- British Columbia Wildlife Habitat Rating Standards (RISC, 1999b).

Canadian Wildlife Service's *A Framework for the Scientific Assessment of Potential Project Impacts on Birds* (Hanson et al. 2009) recommends habitat classification, point counts, density x habitat = loss, nest searches, and tissue sampling and testing as recommended techniques to assess impacts of open pit minng on migatory birds (Appendix 3). The surveys and analyses conducted for birds include habitat classification, points counts, nest searches, and tissue sampling, where relevant for the bird VCs. "Density x habitat = loss" relates to a quantitative estimation of the number of individual birds twithin the footprint to estimate the effects of the Project on bird abundance. The effects assessment (described in Section 15.7.3) used habitat mapping and baseline species data detections to qualitatively characterize the effect of the Project on bird abundance.

No woodpecker-specific surveys were completed as part of the bird community baseline program; however, woodpeckers were observed over the four survey years during breeding bird surveys (i.e., point counts), migratory bird surveys (i.e., point counts and transects), and incidentally. Incidental observations of woodpecker activity (e.g., cavities, and foraging signs) on wildlife trees within the Terrestrial LSA were also recorded during the field surveys. A summary of the bird community baseline program surveys is outlined in Table 15.7-3 and survey locations are shown in Figure 15.7-1 to Figure 15.7-5. Birds were also recorded when observed incidentally during other baseline surveys (e.g., wetland and amphibian surveys) and recorded. For additional details on the bird community baseline survey methods, refer to Appendix 15-E.

To support an understanding of bird communities within the Terrestrial LSA, metrics to quantify average bird abundance and species richness were calculated for each survey location, where possible. Incidental observations were not included in the population metrics. Relative abundance is defined as the number of individual birds observed per unit of area (Gaines et al., 1999). The relative abundance of breeding birds was estimated based on the number of birds detected at each survey location. Species richness refers to the number of bird species present in a given area (Gaines et al., 1999) and was tallied for each survey location.

15.7.2.2.2 Results

Landbirds

Breeding Bird Surveys

Within the breeding bird window of June and July 2014 and 2017 to 2019, a total of 2,088 individual birds of 80 species were observed: 72 species during point count surveys and 8 additional species incidentally (Table 15.7-4). The most frequently encountered species across the survey years were Swainson's Thrush, Pine Siskin, and Yellow-rumped Warbler (*Setophaga coronate*). Two federal SARA-listed (2002) and provincially Blue-listed species were observed: Barn Swallow and Olive-sided Flycatcher. Species that are federally-listed under SARA (2002), but provincially Yellow-listed, included Common Nighthawk and Evening Grosbeak (*Coccothraustes vespertinus*). Great Blue Heron (*Ardea herodias herodias*) is provincially Blue-listed, but is not federally listed under SARA (2002; Table 15.7-4; Figure 15.7-6).

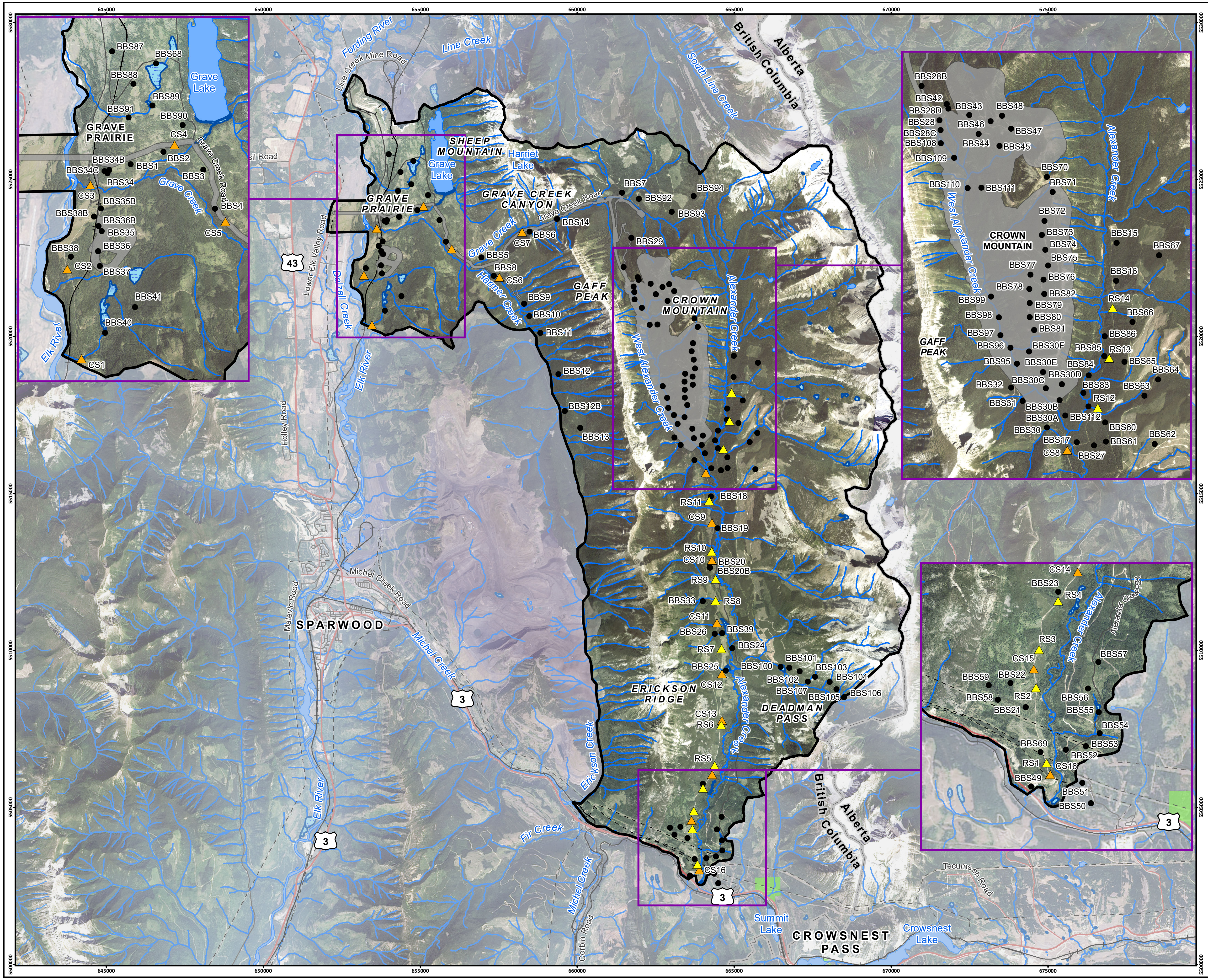
Table 15.7-3: Bird Community Baseline Program Surveys

Survey Type	Survey Dates	Target Group/ Species	Survey Methods	Number of Survey Sites/Length of Transects
Landbird Point Count Surveys	June 4 – 11, 2014 June 28 – July 5, 2014 June 5 – 11, 2017 June 29 – July 3, 2017 June 30 – July 8, 2018 July 4 – July 10, 2019	Breeding Landbirds	• *Inventory Methods for Forest and Grassland Songbirds, Version 2.0* (RISC, 1999f) • *Handbook of Field Methods for Monitoring Landbirds* (Ralph et al., 1993) • *Monitoring Bird Populations by Point Counts* (Ralph et al., 1995)	124 locations
Landbird Roadside Surveys	June 4 – 11, 2014 June 28 – July 5, 2014	Breeding Landbirds	• *Inventory Methods for Forest and Grassland Songbirds, Version 2.0* (RISC, 1999f) • *Handbook of Field Methods for Monitoring Landbirds* (Ralph et al., 1993) • *Monitoring Bird Populations by Point Counts* (Ralph et al., 1995)	14 locations
Nighthawk Surveys	July 26 – 30, 2018	Breeding Nighthawks	• *Canadian Nightjar Survey Protocol* (Knight, 2018) • *Species Detection Survey Protocols: Common Nighthawk* (Saskatchewan Ministry of Environment, 2015) • *Sensitive Species Inventory Guidelines* (Government of Alberta, 2013)	16 roadside surveys

Survey Type	Survey Dates	Target Group/ Species	Survey Methods	Number of Survey Sites/Length of Transects
Spring Landbird Migration Point Surveys	April 21 – 26, 2018 May 3 – 9, 2018 May 3 – 9, 2019 May 21 – 25, 2019	Migratory Landbirds	• *Guidance Document for Environmental Assessment for Wind Turbines and Birds* (Environment Canada, 2007c) • *Inventory Methods for Forest and Grassland Songbirds, Version 2.0* (RISC, 1999f)	35 locations
Fall Landbird Migration Point Surveys	October 3 – 5, 2018 September 10 – 13, 2019	Migratory Landbirds	• *Guidance Document for Environmental Assessment for Wind Turbines and Birds* (Environment Canada, 2007c) • *Inventory Methods for Forest and Grassland Songbirds, Version 2.0* (RISC, 1999f)	35 locations
Owl Surveys	April 21 – 26, 2018	Breeding Owls	• Bird Studies Canada *Guidelines for Nocturnal Owl Monitoring in North America* (Takats et al., 2001)	15 roadside surveys
Northern Goshawk Call-playback and Habitat Assessment Surveys	June 4 – 11, 2014 June 28 – July 5, 2014 June 5 – 11, 2017 June 29 – July 3, 2017 June 30 – July 8, 2018 July 4 – 10, 2019	Northern Goshawks	• *Inventory Methods for Raptors* (RISC, 2001)	51 locations

Survey Type	Survey Dates	Target Group/ Species	Survey Methods	Number of Survey Sites/Length of Transects
Spring Raptor Standwatch Surveys	April 21 – 26, 2018	Migratory and Resident Raptors	• *Inventory Methods for Raptors* (RISC, 2001)	6 locations
	May 3 – 9, 2018			
	May 3 – 9, 2019			
	May 21 – 25, 2019			
Fall Raptor Standwatch Surveys	October 3 – 5, 2018	Migratory and Resident Raptors	• *Inventory Methods for Raptors* (RISC, 2001)	6 locations
	September 10 – 13, 2019			
Riverine Walks	June 29 – July 3, 2017	Riverine Birds: American Dipper, Harlequin Duck, Spotted Sandpiper, Belted Kingfisher, Osprey	• *Inventory Methods for Riverine Birds: Harlequin Duck, Belted Kingfisher and American Dipper Version 2.0* (RISC, 1998b)	28.3 km
	July 25 – 28, 2017			
	June 30 – July 8, 2018			
	July 26 – July 8, 2018			
	July 6 – 8, 2019			
Summer Wetland Bird Surveys	June 14 – 11, 2014	Breeding Wetland Birds	• *Inventory Methods for Waterfowl and Allied Species: Loons, Grebes, Swans, Geese, Ducks, American Coot, and Sandhill Crane* (RISC, 1999e)	30 wetland and ephemeral sites
	June 29 – July 4, 2014			
	June 6 – 11, 2017			
	June 30 – July 6, 2017			
	July 25 – 28, 2017			

Survey Type	Survey Dates	Target Group/ Species	Survey Methods	Number of Survey Sites/Length of Transects
	June 30 – July 6, 2018			
	July 26 – 30, 2018			
	July 4 – 11, 2019			
Spring Wetland Bird Surveys	April 22 – 24, 2018 May 4 –7, 2018 May 7 –9, 2019 May 22 –24, 2019	Migratory Wetland Birds	• *Inventory Methods for Waterfowl and Allied Species: Loons, Grebes, Swans, Geese, Ducks, American Coot, and Sandhill Crane* (RISC, 1999e)	22 wetland sites
Fall Wetland Bird Surveys	October 4 – 5, 2018	Migratory Wetland Birds	• *Inventory Methods for Waterfowl and Allied Species: Loons, Grebes, Swans, Geese, Ducks, American Coot, and Sandhill Crane* (RISC, 1999e)	14 wetland sites



Crown Mountain Coking Coal Project

Figure 15.7-1
Breeding Landbird Survey Locations

LEGEND

- Point Count Survey Location
- Roadside Survey Location
- Common Nighthawk Survey Location
- Terrestrial Local Study Area
- Project Footprint
- Highway
- Arterial/Collector Road
- Local/Resource Road
- Railway
- Transmission Line
- Watercourse
- Waterbody
- Wetland
- Provincial Park/Protected Area
- British Columbia/Alberta Border

0 2.5 5
Kilometres

Scale 1:115,000

Map Drawing Information:
Data Provided By NWP Coal Canada Ltd, Dillon Consulting Limited, Province of British Columbia GeoBC Open Data, Government of Alberta Open Data, Natural Resource Canada.
Imagery Provided By Landsat 8 (Aug 2018), and GeoBC OrthoImagery (Aug 2016).

Map Created By: RB
Map Checked By: HEB
Map Coordinate System: NAD 1983 UTM Zone 11N

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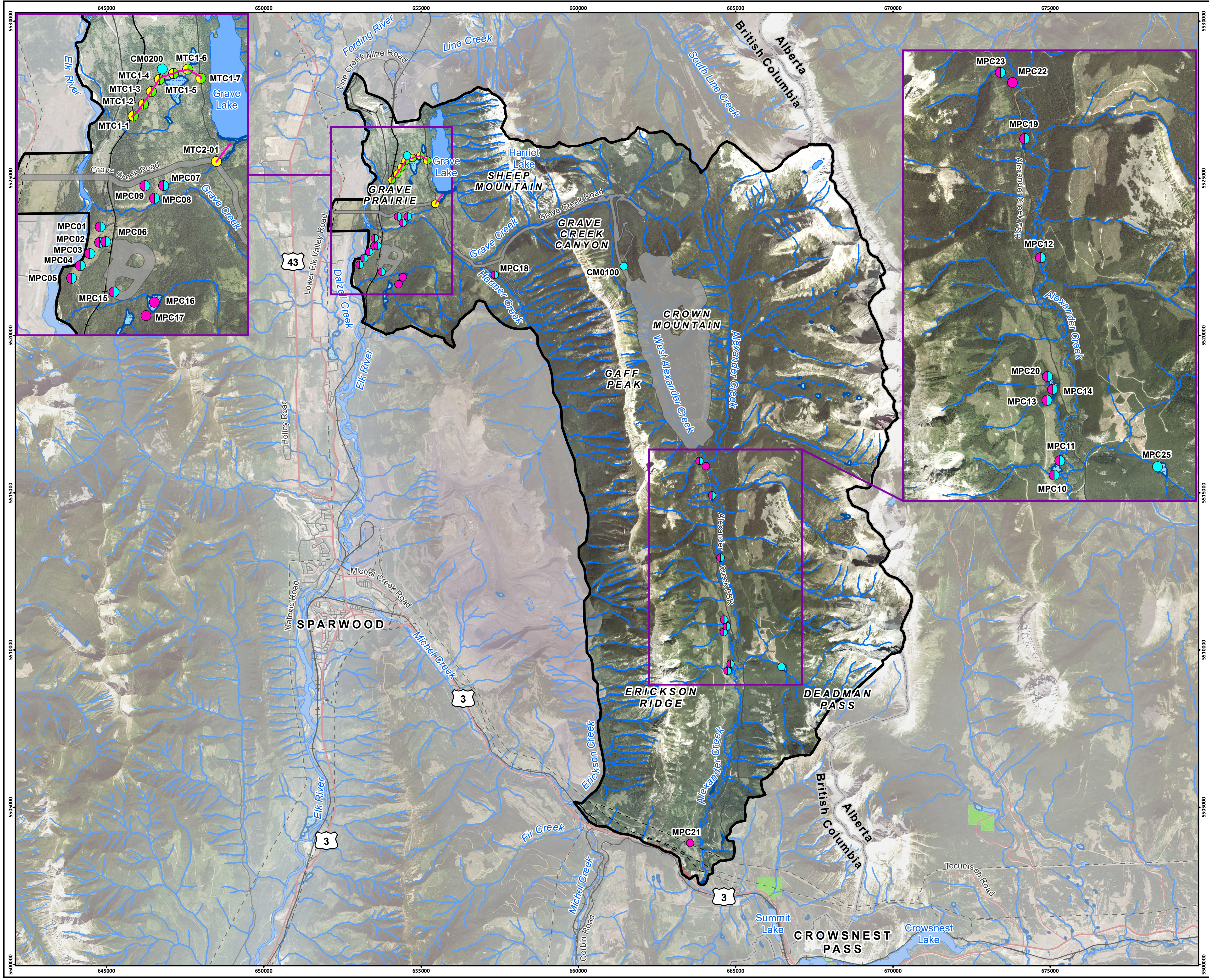

Crown Mountain Coking Coal Project

Figure 15.7-2
Landbird Migration Survey Point Count Locations

LEGEND

- Point Count Survey: Spring → ← Fall
- Survey Transect: Spring → ← Fall
- Migratory Bird Survey Transect
- Terrestrial Local Study Area
- Project Footprint
- Highway
- Arterial/Collector Road
- Local/Resource Road
- Railway
- Transmission Line
- Watercourse
- Waterbody
- Wetland
- Provincial Park/Protected Area
- British Columbia/Alberta Border

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Scale 1:115,000

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