

13.7.6.2.2 Large Carnivores

The grizzly bear was identified as the representative large carnivore species of concern for the Project.

13.7.6.2.2.1 Reduced Habitat Availability

The grizzly bear is a landscape species occupying a variety of habitat types within large territories, thus diminishing (but not precluding) the likelihood of significant effects on important localized habitats from oil and gas development (i.e., well site, access road and pipeline development). Grizzly bears may use the grass-dominated communities which will develop along most of the ROWs as a forage source, as these animals often rely on graminoids and early developing herbs as a year-round dietary item (Norstrom 1974; Cole 1975; IGBC 1987). Therefore, the ROWs, once reclaimed and access removed, will provide a foraging area for these species in close proximity to escape cover. In general project effects are expected to be too localized to result in significant reductions in habitat availability from physical habitat alteration.

The ongoing activities associated with pipeline construction can result in greater effects on habitat availability in the vicinity of the ROWs during construction, or occasionally during the Pipeline's operational phase. Potential disturbances during pipeline operation may occur due to pipeline maintenance activity, or indirectly, through public access and activity along the ROWs.

For grizzly bears, disturbance effects within the Project area may be similar to those observed in relation to other industrial activities including road construction, seismic testing, drilling and helicopter traffic. For example, researchers in southeastern British Columbia and Montana have observed displacement of grizzly bears from distances of 100 to >900 m from open roads (McLellan and Shackleton 1988, 1989; Kasworm and Manley 1990). In general, the significance of reductions in habitat effectiveness and availability will depend on the relative value of intersected habitats to the species of concern and duration of disturbances that can occur.

Project Effects

Potential changes in habitat availability were calculated for grizzly bear during different seasons for the mapped, 2 km-wide corridor. The cumulative effects of existing linear disturbances are reflected in the habitat values calculated for baseline. The Construction scenario reflects changes from the Project alone from baseline values. The Operations scenario reflects cumulative change from baseline from all future known projects. Values have been provided with and without the effects of the Project to indicate project contributions to cumulative effects within the corridor.

Moderate amounts (34.8 percent) of high quality habitat occurs in the Project corridor for grizzly bear during the spring, with no high quality habitat in fall or winter (Table 13.7-6, Appendix 13H-3, Figures 13.7-10, 13.7-11, 13.7-12). Because of the winter schedule for construction, effects on this spring habitat are discussed under Operations only.

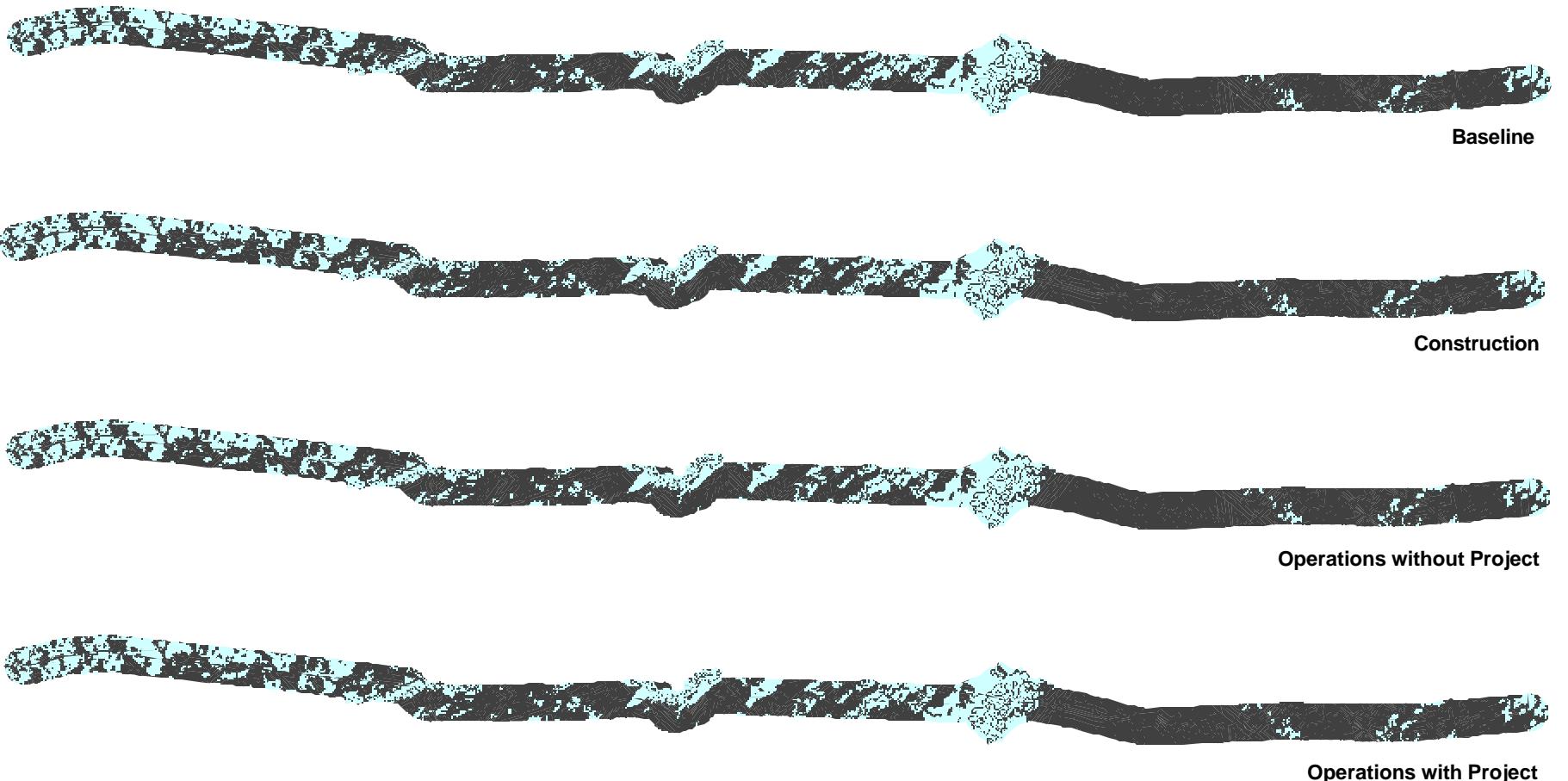
Including project effects during the Operational phase, baseline high quality habitat within the Project corridor will be increased by 2.1 percent for spring habitat (Table 13.7-6). This positive change in habitat quality is due to the increase in sedge and grass habitat types along the cleared ROW, which are preferred forage types for grizzly bear during the spring. It also reflects the fact that no reduced habitat effectiveness values will persist adjacent to the ROW from on-going recreational use of the ROW, as travel along the ROW under thawed ground conditions will not be possible east of Kyklo Creek. This long-term effect represents a positive change in habitat availability within the Project corridor, and is not considered to contribute to negative regional cumulative effects.

Table 13.7-6 High Quality Habitat Availability for Grizzly Bear in the Project Corridor at Different Assessment Scenarios

Season	Baseline (ha)	Baseline (% of high quality habitat in Project corridor)	Construction (% change from baseline)	Operations without the Project (% change from baseline)	Operations with the Project (% change from baseline)
Spring	6,044.2	34.8	N/A	0.1	2.1
Fall	0	0	-	-	-
Winter	0	0	-	-	-

Note: High quality habitat refers to >51-100 percent suitability limits (very high and high categories combined) based on British Columbia provincial benchmarks

Because of the predominance of wet, organic soils in the Project area that are generally unsuitable for denning, there is the possibility that denning habitats are limited in the area, and are possibly key habitats influencing bear and canid distributions and numbers in the area. The amount of suitable denning substrates (fluvial materials, moderately well drained, and gently sloping) for grizzly bears and other large carnivores (e.g., canids) was calculated in the Project corridor. Fluvial deposits (sands, gravels) are mainly associated with the larger drainage channels (primarily along the Hay River), and represent 1135.6 ha or 6.5 percent of total mapped 2 km-wide corridor. Under the TEM mapping, these deposits are still only considered to represent low quality denning habitats for bears, but they are still the best available within the mapped corridor. They are likely more valuable to black bears and canid species.



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Grizzly Bear Habitat Availability during the Winter Season

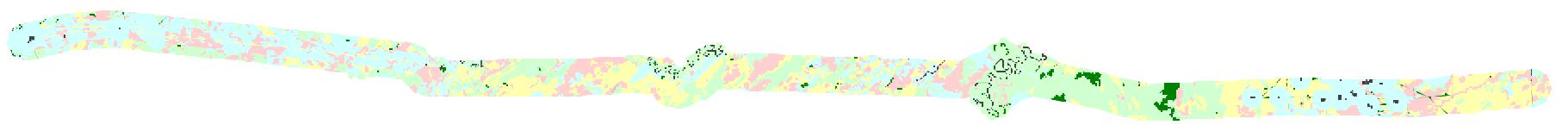


NORTH

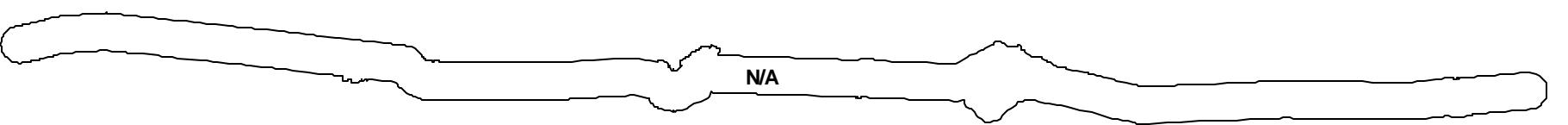
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Scale in kilometres

Acknowledgements:
Original drawing by AXYS Environmental Consulting Ltd.

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Baseline



N/A

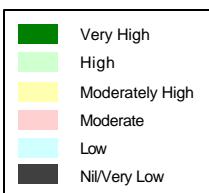
Construction



Operations without Project



Operations with Project



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Grizzly Bear Habitat Availability during the Spring Season



NORTH

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Scale in kilometres

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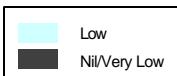
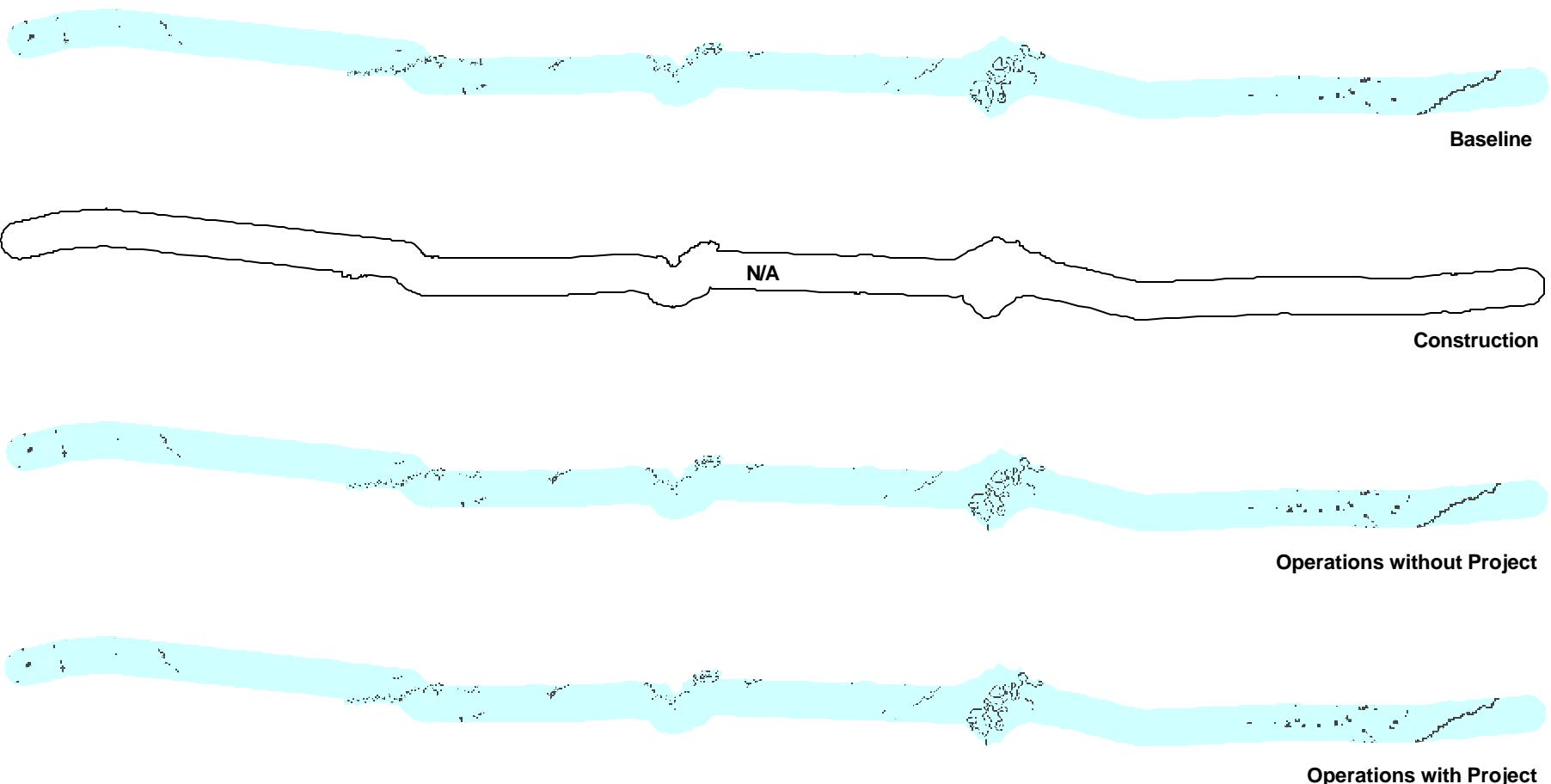
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Grizzly Bear Habitat Availability during the Fall Season



NORTH

3 0 3 6 9
Scale in kilometres

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During construction, the Project will result in the direct disturbance to 7.6 ha (0.67 percent) of available fluvial deposits in the 2 km-wide corridor. With the disturbance buffering included for an active ROW (i.e., 500 m buffer), potential short-term project effects could extend over 264.2 ha, or 23.3 percent of the available deposits in the corridor. These project effects represent moderate magnitude reductions over the short-term in undisturbed fluvial habitats. These short-term effects are not expected to contribute in a meaningful fashion to cumulative habitat trends over the region. However, because of the potential local importance of these habitats, surveys to identify signs of bear or canid denning activity in these habitats will be undertaken within the 2 km-wide corridor in 2003, and will be used to develop any necessary mitigation to reduce possible localized effects during construction.

With the implementation of proposed access control measures associated with these fluvial habitats (see Access Management Plan), long-term effects of the Project on denning habitats will be negligible.

13.7.6.2.2.2 Habitat Diversity

Changes to habitat diversity for grizzly bears may affect the availability of habitat types for specific seasonal requirements. This may include habitat requirements for foraging (e.g., sedge and grass habitats) or denning (e.g., mature forests on suitable substrates for establishing winter dens).

Results from the vegetation assessment suggested that the Project would result in minor changes to the aerial extent of different site series and structural stages, but would not reduce botanical diversity at the community level in any way. Therefore, adverse changes to habitat diversity for grizzly bear are not expected to result from the Project.

13.7.6.2.2.3 Direct and Indirect Mortality

Given the low density of grizzly bear occurring in the Project area and the winter schedule for construction (i.e., when bears are inactive), direct interactions between the Project and this species that lead to wildlife mortalities are expected to be unlikely occurrences. Perhaps the greatest risk for direct mortality would result from the disruption of active dens during the construction period. As discussed previously, suitable denning habitat is largely restricted to fluvial deposits associated with major drainage channels, and project effects during construction could potential influence 23.3 percent of the available habitats within the mapped corridor. Surveys to identify signs of bear or canid denning activity in these habitats will be undertaken within the 2 km-wide corridor in 2003, and will be used to develop any necessary mitigation to reduce possible localized effects during construction.

ROW-induced access into the region and the associated effect on mortality risk from new hunting pressure is less of a concern for bears than it is for ungulates. As discussed, the ROW is not expected to provide new access potential into the area during thawed ground

conditions when the bears are active. While the existing pipeline and truck trail followed by the western 21 km of the Project will continue to provide year-round access into the area, the remainder of the Ekwan ROW will not represent a new incremental risk to bears during the active season, as the great majority of this portion of the line encounters wet, impassable terrain conditions.

13.7.6.2.3 Furbearers

Marten and beaver were identified as the representative furbearer species of concern for the Project.

13.7.6.2.3.1 Reduced Habitat Availability

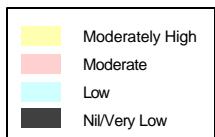
Project development will generally result in the localized conversion of a forest community to an early successional graminoid/forb and low shrub community in the short to medium term. While this conversion will locally reduce denning and escape cover for marten, it will also result in a foraging area for marten in close proximity to cover, once small mammals (e.g., voles, deer mice) reoccupy the ROW. Therefore, the ROW development is not expected to represent a significant loss of marten habitat, either locally or regionally.

The risk of significant construction-related sensory disturbance (and reduced habitat availability) will be minimal for marten, beaver, other furbearers, and small mammals in the vicinity of the Project. While small territorial animals such as marten and most other furbearers will avoid a ROW during actual construction, these animals will not significantly shift their territorial distributions in response to ROWs (Morgantini 1994; Eccles and Duncan 1987), particularly once vegetative cover has become re-established on the ROW. For beaver, wetland habitats will be avoided where possible, and impacts are therefore expected to be minor.

Project Effects

Potential changes in habitat availability were calculated for marten during different seasons for the mapped, 2 km-wide corridor. The cumulative effects of existing linear disturbances are reflected in the habitat values calculated for baseline. The construction scenario reflects changes from the Project alone from baseline values. The operations scenario reflects cumulative change from baseline from all future known projects. Values have been provided with and without the effects of the Project to indicate project contributions to cumulative effects within the corridor.

Limited high quality habitat for marten occurs in the Project corridor at baseline for spring (5.4 percent), summer/fall (5.9 percent), or winter range (4.9 percent; Table 13.7-7, Figures 13.7-13, 13.7-14, 13.7-15). Most marten habitat in the Project corridor was rated as either low (range 14.7–48.1 percent) or nil/very low (range 45.3–73.4 percent) quality during the three seasons (Appendix 13H-3).



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Marten Habitat Availability during the Winter Season



NORTH

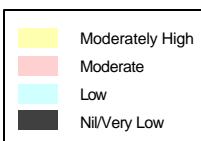
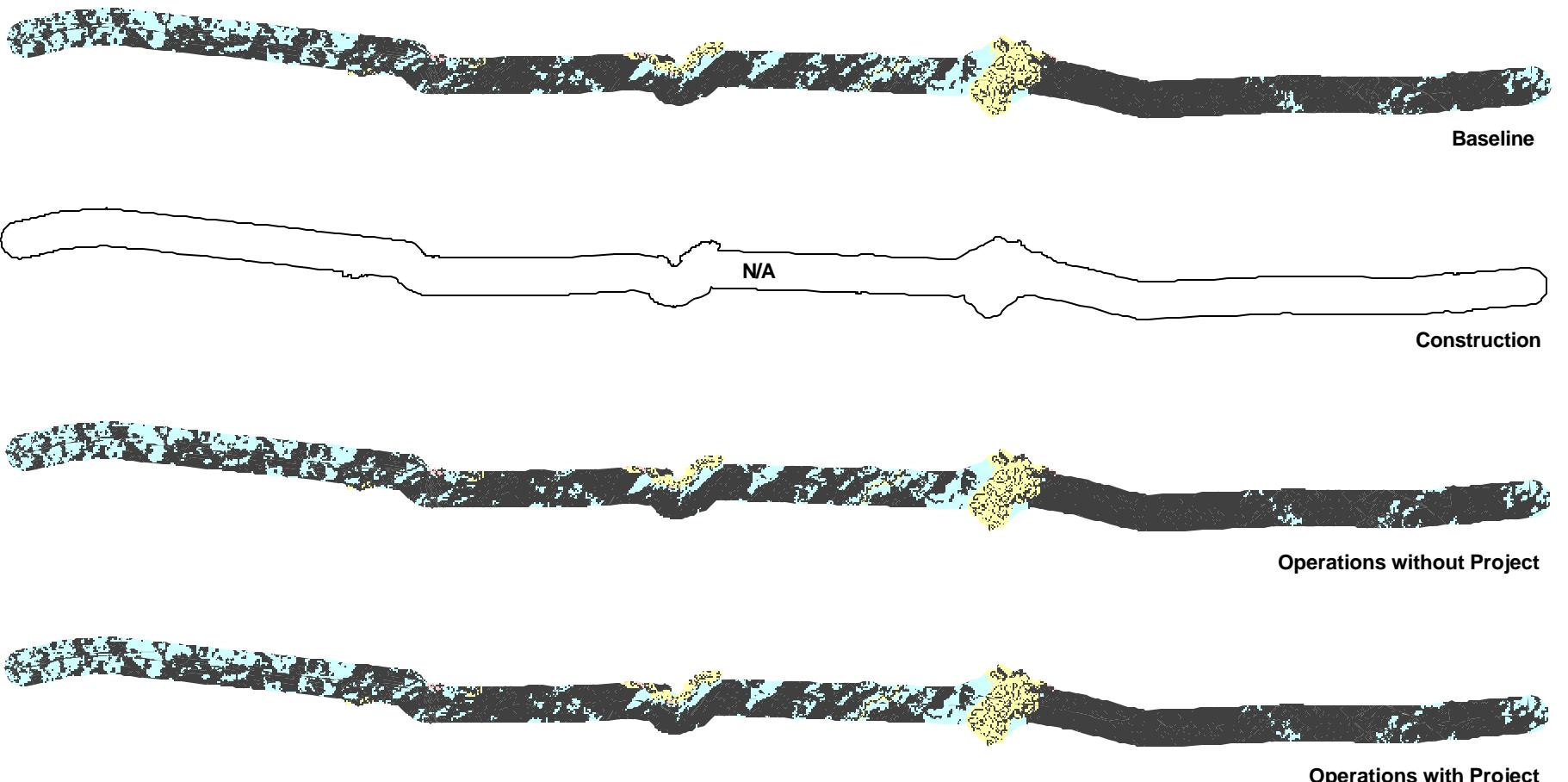
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Marten Habitat Availability during the Spring Season



NORTH

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Scale in kilometres

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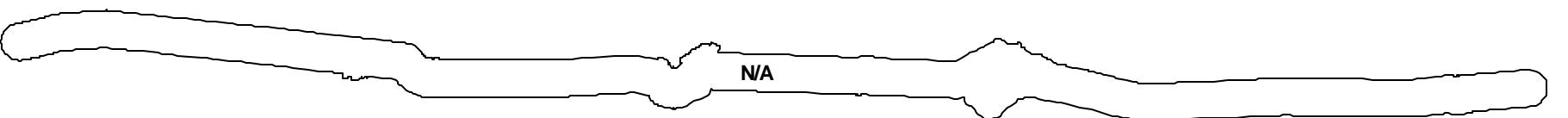
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Baseline



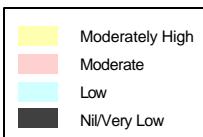
Construction



Operations without Project



Operations with Project



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Marten Habitat Availability during the Summer/Fall Season



NORTH

3 0 3 6 9
Scale in kilometres

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The construction phase of the Project will reduce high quality for marten by 13.4 percent in the winter (Table 13.7-7). Due to the short-term nature of construction effects, this moderate magnitude reduction in habitat is not considered to contribute to regional cumulative effects.

Table 13.7-7 High Quality Habitat Availability for Marten in the Project Corridor at Different Assessment Scenarios

Season	Baseline (ha)	Baseline (% of high quality habitat in Project corridor)	Construction (% change from baseline)	Operations without the Project (% change from baseline)	Operations with the Project (% change from baseline)
Spring	944.9	5.4	N/A	0	-0.7
Summer/fall	1,035.6	5.9	N/A	0	-0.7
Winter	851.6	4.9	-13.4	0	-13.4

Note: High quality habitat refers to >26-100 percent suitability limits (very high, high, and moderately high categories combined) based on British Columbia provincial benchmarks

Including project effects during the operational phase, baseline high quality habitat for marten will be reduced by 0.7 percent in the spring and summer fall, and by 13.4 percent in the winter (Table 13.7-7). It should be recognized that these reductions do not represent an absolute loss of habitat for these animals, but rather a conversion of higher quality habitats to moderate or lower quality habitats that will still be available for marten. Therefore, although long-term, these shifts in habitat quality are not expected to significantly change marten distributions and numbers within the 2 km-wide and are rated as low to moderate magnitude effects. These effects are not considered to contribute to measurable regional cumulative effects.

Potential changes in habitat availability were calculated for beaver. The amount of high quality habitat (i.e., suitable open water wetland habitat with a 60 m buffer) intercepted by the proposed pipeline footprint (cleared habitat) was calculated during the different assessment scenarios.

At baseline, limited (13.4 percent) high quality habitat for beaver exists in close proximity to the Pipeline (Table 13.7-8). Both the construction and operations phase of the Project will reduce baseline high quality habitat for beaver by 0.5 percent (Table 13.7-8). In addition, <1 km of the Pipeline corridor alignment will directly intercept open water (i.e., wetland types that may support beaver; see Section 13.6.1.3). Although long-term, these effects represent a low magnitude change in habitat availability, and are therefore not considered to contribute to cumulative effects.

Table 13.7-8 High Quality Habitat Availability for Beaver in Close Proximity to the Proposed Ekwan Pipeline at Different Assessment Scenarios

	Baseline	Baseline (% of high quality habitat)	Construction (change from baseline)	Operations (change from baseline)
Area (ha)	2320.3	13.4	-11.6	-11.6
% change from baseline)	-	-	- 0.5	- 0.5

13.7.6.2.3.2 Habitat Diversity

Changes to habitat diversity for furbearers may affect the availability of habitat types for specific seasonal requirements. This may include habitat requirements for foraging (e.g., old growth mixed wood forests for marten; deciduous species close to wetlands for beaver) and thermal, security, or breeding (e.g., old growth forest structural stages for marten; permanent wetlands for beaver).

Results from the vegetation assessment suggested that the Project would result in minor changes to the aerial extent of different site series and structural stages, but would not reduce botanical diversity at the community level in any way. Therefore, adverse changes to habitat diversity for furbearers are not expected to result from the Project.

13.7.6.2.3.3 Direct and Indirect Mortality

Project-related mortality may occur as a result of collisions with project vehicles or direct destruction of roosts or maternal dens for martens. Similarly, beaver dams or lodges may be destroyed during construction activities. However, mortalities incurred from destruction of these sites are expected to be minimal (i.e., low magnitude) and restricted to the short-term construction phase. For example, because marten typically establish dens within interior old-growth forest stands and the proposed pipeline route largely follows existing ROWs, the potential of den destruction will be limited. For beaver, wetland habitats will be avoided where possible, reducing the risk of mortality. However, locations where the Pipeline route may intercept beaver dams or lodges will require local trappers to remove these animals prior to construction.

Wide, multi-utility corridors that are subjected to intensive vegetation management can become an impediment to marten movements, and can fragment otherwise usable marten habitat. However, for this Project, the developed ROW will be 25 m in width, and even combined with existing linear corridors, will not be sufficiently wide to impair cross ROW movements. The establishment of a graminoid/forb/low shrub community on the ROW over the medium term will further encourage use by marten, as will the coarse woody debris left in rollback areas. Beaver are not expected to be effected by fragmentation of forested blocks, as seasonal movements are generally restricted to aquatic environments. Overland dispersal movements by juvenile beaver are not expected to be impeded by the width of the proposed ROW.

13.7.6.2.4 Birds

The black-throated green warbler and the trumpeter swan were identified as representative bird species of concern for the Project.

13.7.6.2.4.1 Reduced Habitat Availability

Pipeline construction will result in some alteration of forest and wetland habitat. While some loss of forest nesting habitat for the black-throated green warbler and other songbirds will occur along the proposed Project area due to land clearing, this loss is expected to be negligible given the availability of habitat on a regional basis. Similarly, wetland habitats used by trumpeter swans will generally be avoided where ever possible.

Construction for the Project will result in no sensory disturbance to the black-throated green warbler, trumpeter swan, and other migratory birds, as winter clearing activities for the construction phase will avoid the incubating and fledging period for neotropical migrant and waterfowl species (May to mid-July). The potential for significant construction-related sensory disturbances and associated reductions in habitat availability will be minimal for winter resident bird species. These winter-resident species are highly mobile and, in the event of temporary disturbance from pipeline construction, will be able to select temporary alternate habitat situated away from the source of disturbance.

Project Effects

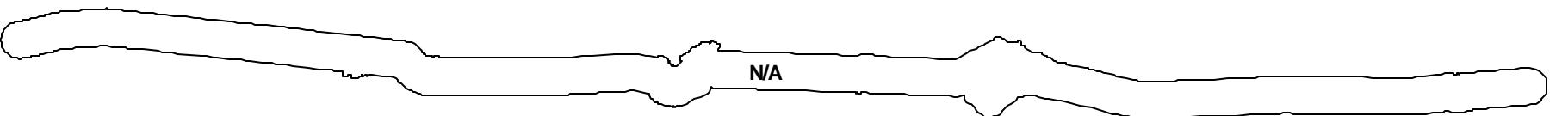
Potential changes in habitat availability were calculated for the black-throated green warbler during different seasons for the mapped, 2 km-wide corridor. The cumulative effects of existing linear disturbances are reflected in the habitat values calculated for baseline. The Operations scenario reflects cumulative change from baseline from all future known projects. Values have been provided with and without the effects of the Project to indicate project contributions to cumulative effects within the corridor.

Moderate amounts (21.9 percent) of high quality habitat occur in the Project corridor for the black-throated green warbler during spring or summer/fall seasons (Table 13.7-9, Appendix 13H-3, Figures 13.7-16, 13.7-17). Because of the winter schedule for construction, effects on this spring habitat are discussed under Operations only.

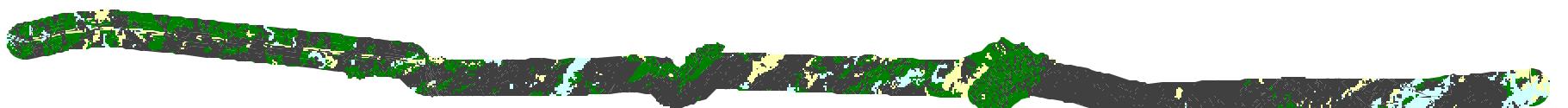
Including Project effects during the Operational phase, high quality habitat for the black-throated green warbler within the Project corridor will be reduced by 0.7 percent for both spring and late summer/fall habitat (Table 13.7-9). Although long-term, these effects represent a low magnitude change in habitat availability within the Project corridor, relative to baseline conditions, and are therefore not considered to contribute to cumulative effects.



Baseline



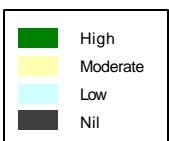
Construction



Operations without Project



Operations with Project



EKWAN PIPELINE PROJECT

Black-throated Green Warbler Habitat Availability during the Spring Season



NORTH

3 0 3 6 9
Scale in kilometres

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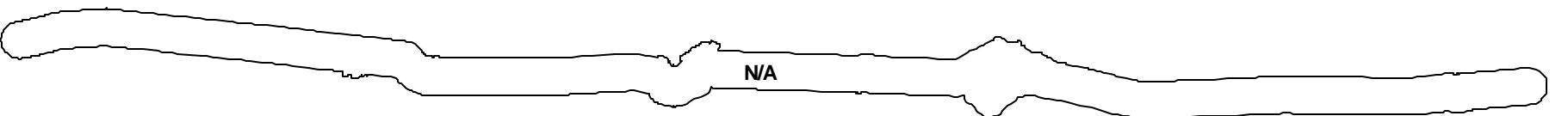
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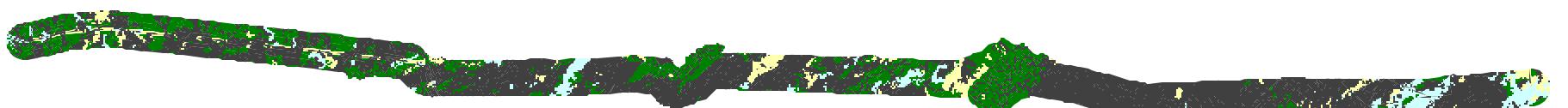
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Baseline



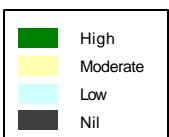
Construction



Operations without Project



Operations with Project



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Black-throated Green Warbler Habitat Availability during the Summer/Fall Season



NORTH

3 0 3 6 9
Scale in kilometres

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Table 13.7-9 High Quality Habitat Availability for Black-throated Green Warbler in the Project Corridor at Different Assessment Scenarios

Season	Baseline (ha)	Baseline (% of high quality habitat in Project corridor)	Construction (% change from baseline)	Operations without the Project (% change from baseline)	Operations with the Project (% change from baseline)
Spring	3,809.8	21.9	N/A	-0.2	-0.7
Summer/fall	3,809.8	21.9	N/A	-0.2	-0.7

Note: High quality habitat refers to >76-100 percent suitability limits based on British Columbia provincial benchmarks

Potential changes in habitat availability were calculated for trumpeter swan. The amount of high quality habitat (i.e., suitable open water wetland habitat with a 250 m buffer) intercepted by the Pipeline footprint (cleared habitat) was calculated during the different assessment scenarios.

At baseline, limited (2.9 percent) high quality habitat exists in close proximity to the proposed pipeline for trumpeter swan (Table 13.7-10). Both the construction and operations phase of the Project will reduce baseline high quality habitat for trumpeter swan by 0.7 percent (Table 13.7-10). In addition, <1 km of the Pipeline corridor alignment will directly intercept open water (i.e., wetland types that may support trumpeter swan; see Section 13.6.1.3). Although long-term, these effects represent a low magnitude change in habitat availability, and are therefore not considered to contribute to cumulative effects.

Table 13.7-10 High Quality Habitat Availability for Trumpeter Swan in Close Proximity to the Proposed Ekwan Pipeline at Different Assessment Scenarios

	Baseline	Baseline (% of high quality habitat in Project corridor)	Change between Construction and Baseline	Change between Operations and Baseline
Area (ha)	519.2	2.9	N/A	-3.7
% change from baseline)	-	-	N/A	- 0.7

13.7.6.2.4.2 Habitat Diversity

Changes to habitat diversity for birds may affect the availability of habitat types for specific seasonal requirements. This may include habitat requirements for foraging (e.g., old growth mixed wood forests for black-throated green warblers; wetlands for trumpeter swan) or breeding (e.g., old growth forest structural stages for black-throated green warblers; permanent wetlands for trumpeter swans).

Results from the vegetation assessment suggested that the Project would result in minor changes to the aerial extent of different site series and structural stages, but would not reduce botanical diversity at the community level in any way. Therefore, adverse changes to habitat diversity for birds are not expected to result from the Project.

13.7.6.2.4.3 Direct and Indirect Mortality

The greatest mortality risk to birds such as the black-throated green warbler or trumpeter swan from pipeline developments is the destruction of active nests, with an associated mortality to young-of-the-year. The potential for active nests to be encountered and destroyed by construction for this Project will not be a concern as clearing will occur outside the breeding season.

The potential for forest clearing to add to the regional fragmentation of forest nesting habitat is of low magnitude as most clearing will occur along existing forest edges and linear clearings. Related to fragmentation, mortality resulting from nest predation and parasitism along new ROWs in forested habitats may locally affect black-throated green warbler distribution and abundance. However, such parasitism is generally reported along larger agriculturally-related edges rather than edges developed from narrow ROWs. Revegetation along the ROW over the medium term will further reduce indirect mortality risks. Similarly, increased nest predation is not expected to affect trumpeter swans. Therefore, overall Project related effects on bird mortality risks are considered negligible.

13.7.6.3 Abandonment

For abandonment, the Pipeline is generally pigged to remove internal residues, prepared for in ground containment and capped, and surface facilities (e.g., block valves) removed. Decommissioning work activities would occur at only a few locations (e.g., end-points, each side of river crossings), and for any given site would be completed within several days. Any residual access potential provided by the ROW at that time would be further reduced, as the ROW would be revegetated to forest cover, or allowed to naturally colonize with encroaching native species. Therefore, Project effects on wildlife at abandonment would be negligible or positive in direction.

13.7.6.4 Summary of Residual Project Effects

Residual Project effects for the Project for the key impact questions are summarized below (Table 13.7-11). In general, because of the short construction window (and therefore short duration), impacts during the construction phase for wildlife species of concern are not considered to contribute to cumulative effects. During the operational and abandonment phases, most impacts are not considered to contribute to cumulative effects. The exception is for ungulates (caribou, moose), where increases in access potential may contribute to regional cumulative effects on core security and indirect mortality risk. These potential regional cumulative effects are addressed in Section 13.7.7.

Table 13.7-11 Summary of Project Effects for Wildlife

Wildlife Species	Assessment Scenario	Measurable Parameter	Magnitude/Extent¹	Duration²	Reversible/ Non-Reversible³	Potential for Measurable Contribution to Cumulative Effects⁴
Caribou	Construction	Habitat Availability	Low	Short-term	Reversible	No
		Habitat Diversity	Low	N/A	N/A	No
		Indirect Mortality Risk–new access potential	Low	Short-term	Reversible	No
		Direct Mortality Risk–vehicle strikes	Low	Short-term	Reversible	No
	Operations	Habitat Availability	Low	Long-term	Reversible	No
		Indirect Mortality Risk– new access potential	High	Medium term	Reversible	Yes
Moose	Construction	Habitat Availability	Low to Moderate	Short-term	Reversible	No
		Habitat Diversity	Low	N/A	N/A	No
		Indirect Mortality Risk– new access potential	Low	Short-term	Reversible	No
		Direct Mortality Risk – vehicle strikes	Low	Short-term	Reversible	No
	Operations	Habitat Availability	Low to Moderate	Long-term	Reversible	No
		Indirect Mortality Risk– new access potential	High	Medium term	Reversible	Yes

Table 13.7-11 Summary of Project Effects for Wildlife (cont'd)

Wildlife Species	Assessment Scenario	Measurable Parameter	Magnitude/Extent¹	Duration²	Reversible/ Non-Reversible³	Potential for Measurable Contribution to Cumulative Effects⁴
Grizzly Bear	Construction	Habitat Availability	Low to Moderate	Short-term	Reversible	No
		Habitat Diversity	Low	N/A	N/A	No
		Indirect Mortality Risk– new access potential	Low	N/A	N/A	No
		Direct Mortality Risk– winter den disruption	Low	Short-term	Reversible	No
	Operations	Habitat Availability	Low	Long-term	Reversible	No
		Indirect Mortality Risk– new access potential	Low	N/A	N/A	No
		Indirect Mortality Risk–new fragmentation and blockage of cross-ROW movements	Low	Short-term	Reversible	No
		Direct Mortality Risk–den disruptions	Low	Short-term	Reversible	No
Marten	Construction	Habitat Availability	Low to Moderate	Short-term	Reversible	No
		Habitat Diversity	Low	N/A	N/A	No
		Indirect Mortality Risk–new fragmentation and blockage of cross-ROW movements	Low	Short-term	Reversible	No
		Direct Mortality Risk–den disruptions	Low	Short-term	Reversible	No
	Operations	Habitat Availability	Low to Moderate	Long-term	Reversible	No
		Indirect Mortality Risk–new fragmentation and blockage of cross-ROW movements	Low	Medium term	Reversible	No

Table 13.7-11 Summary of Project Effects for Wildlife (cont'd)

Wildlife Species	Assessment Scenario	Measurable Parameter	Magnitude/Extent¹	Duration²	Reversible/ Non-Reversible³	Potential for Measurable Contribution to Cumulative Effects⁴
Beaver	Construction	Habitat Availability	Low	Short-term	Reversible	No
		Habitat Diversity	Low	N/A	N/A	No
		Indirect Mortality Risk-new fragmentation	Low	N/A	N/A	No
		Direct Mortality Risk-dam removals	Low	Short-term	Reversible	No
	Operations	Habitat Availability	Low	Long-term	Reversible	No
		Indirect Mortality Risk-new fragmentation	Low	N/A	N/A	No
Black-throated Green Warbler	Construction	Habitat Availability	Low	N/A	N/A	No
		Habitat Diversity	Low	N/A	N/A	No
		Indirect Mortality Risk-new fragmentation	Low	N/A	N/A	No
		Direct Mortality Risk-nest destruction	Low	N/A	N/A	No
	Operations	Habitat Availability	Low	Long-term	Reversible	No
		Indirect Mortality Risk-new fragmentation	Low	Medium term	Reversible	No

Table 13.7-11 Summary of Project Effects for Wildlife (cont'd)

Wildlife Species	Assessment Scenario	Measurable Parameter	Magnitude/Extent ¹	Duration ²	Reversible/Non-Reversible ³	Potential for Measurable Contribution to Cumulative Effects ⁴
Trumpeter Swan	Construction	Habitat Availability	Low	N/A	N/A	No
		Habitat Diversity	Low	N/A	N/A	No
		Indirect Mortality Risk-new fragmentation	Low	N/A	N/A	No
		Direct Mortality Risk-nest destruction	Low	N/A	N/A	No
	Operations	Habitat Availability	Low	Long-term	Reversible	No
		Indirect Mortality Risk-new fragmentation	Low	N/A	N/A	No

Notes: * For analytical purposes, caribou were considered the representative species for ungulates, including moose.

¹ **Magnitude/Extent** – refers to the degree of change (or risk) to biodiversity

Low – Change in measurable parameter will have no effect on local species abundance or diversity (i.e., within two km mapped corridor)

Moderate – Change in measurable parameter will have possible effect on local species abundance or diversity (i.e., within two km mapped corridor)

High – Change in measurable parameter will have possible measurable effect on species abundance or diversity within Etsho RMZ

² **Duration** – refers to the length of time over which the project-related effect is measurable

Short term – less than 1 year

Medium term – greater than 1 year but not beyond life of project

Long term – beyond life of project

³ **Reversibility** – refers to the potential for conditions to return to baseline conditions, in the absence of the project

Reversible – Will likely revert to baseline conditions following end of project life or before

Non-reversible – unlikely to revert to baseline conditions following end of project life

⁴ **Potential for Measurable Contribution to Cumulative Effects**

Yes – measurable contribution to CE within Etsho Resource Management Zone(generally requires high magnitude and medium to long-term impact on species)

No – no measurable contribution to CE within Etsho Resource Management Zone

13.7.7 Cumulative Effects Implications

13.7.7.1 Combined Project Effects

Potential effects on wildlife from the Project may occur from overlapping effects of:

- reduced habitat availability
- reduced habitat diversity
- direct mortality
- indirect mortality

Specifically, temporary habitat alteration with the conversion of the ROW to a younger seral stage (i.e., altered habitat availability and diversity) and reduced habitat effectiveness due to sensory disturbance may interact with reduced core security habitat due to increased access potential (i.e., increased indirect mortality risk) for some species. Species most affected by this interaction of project effects may include caribou, moose, and grizzly bear, while marten and black-throated green warbler may be affected to a lesser degree. The implications of these overlapping effects may result in smaller habitat blocks of core secure habitat, which may in turn reduce the carrying capacity for certain patch size dependent species (e.g., grizzly bear). However, this overlapping effect will be of a short-term nature, as access control measures will return the habitat effectiveness to near baseline conditions, and sensory disturbance will be limited to the short-term construction phase. In addition, the generally wet conditions of the Ekwan pipeline area prevent most access during the summer, and further limits potential cumulative effects on some species (e.g., grizzly bears), which are only active during this season. Direct mortality risk (e.g., vehicle collisions) may also interact with all of the above potential impacts. However, this overlapping effect will also be short-term and restricted to the construction phase of the Pipeline development.

13.7.7.2 Project Contributions to Regional Cumulative Effects

As indicated in Table 13.7-11 above, the only relevant project effect that may measurably contribute to cumulative effects within Etsho RMZ is increased mortality risk for caribou (and moose). The analytical procedures, results, and significance of this potential project contribution to regional cumulative effects are discussed below.

13.7.7.2.1 Analytical Procedures

Core security habitat analysis (Appendix 13H-2) was used to assess cumulative changes in core security habitat and the associated effects on mortality risk to ungulates within the CSSA. Changes in core security habitat were related back to hypothetical baseline conditions, as well as forward to construction and operational phases of the Pipeline, including other reasonably foreseeable developments in the future (see Section 13.7.4).

Analyses were completed for the ungulate species group, focusing on caribou as a representative species. Moose may also be subjected to increased mortality risk related to increased access potential, and are assumed to respond in a similar fashion as caribou. Therefore, for analytical purposes, potential effects on moose were considered under the core security analyses for ungulates, using caribou as the representative species.

Details on analytical techniques used for the core security habitat analysis are provided in Appendix 13H-2.

13.7.7.2.2 Results

Core security habitat analyses were used to assess the risk of access-induced mortality associated with new ROW development for caribou.

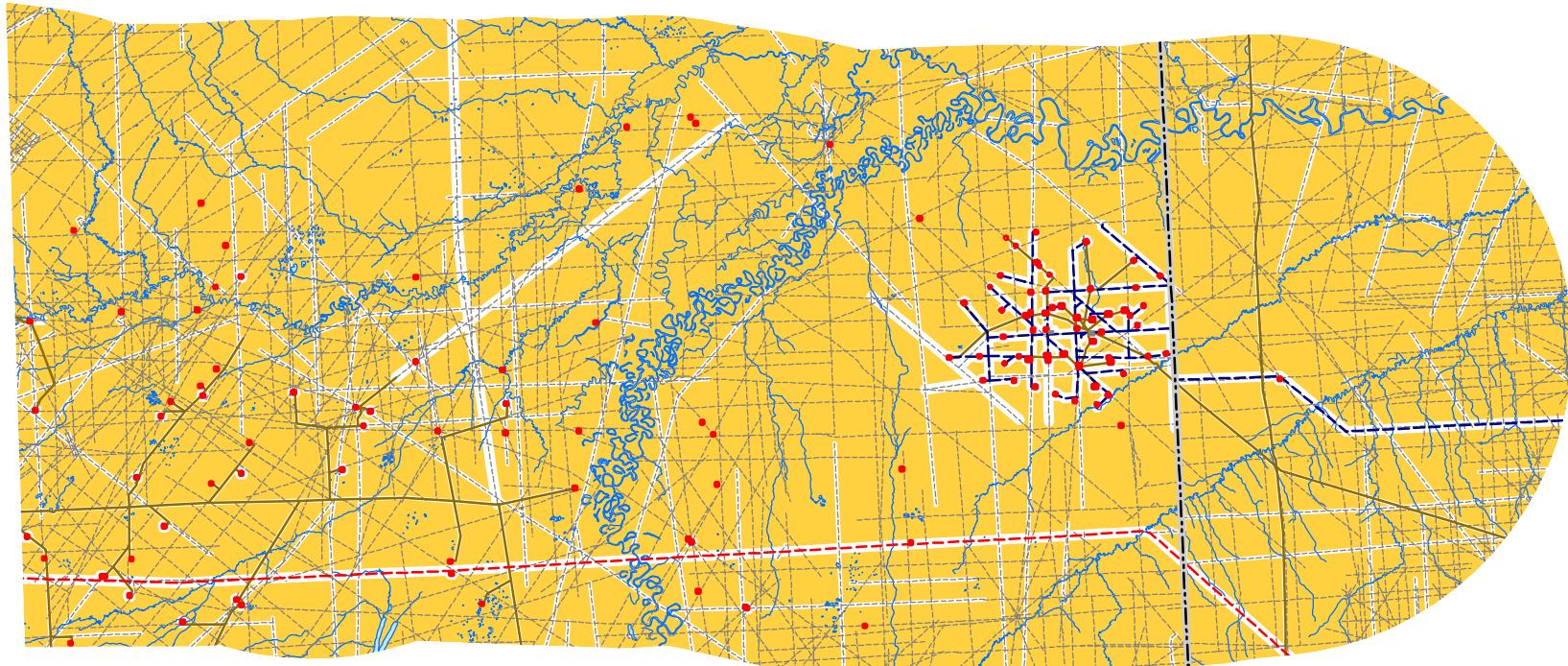
Relative to pre-disturbance conditions, it is estimated that at baseline 86.8 percent (188,215 ha) of the CSSA currently supports core security habitat for caribou (Figure 13.7-18). Without the effect of the proposed Project, core security habitat is reduced to 85.7% (185,865 ha) at construction and to 86.5 percent (187,701) at operations. With the inclusion of the proposed pipeline, core security habitat remains the same at construction (85.7 percent, 185,865 ha; Figure 13.7-19) and is reduced to 86.1 percent (187,784) at operations (Figure 13.7-20). Therefore, the proposed Project contributes incrementally to the cumulative loss of core security habitat for caribou by 0.4 percent (917 ha) at operations.

13.7.7.3 Significance of Effects

The significance of impacts on wildlife was assessed by considering the nature of potential impacts, the mitigative strategies that are available for reducing or eliminating such impacts, and the nature and anticipated severity of residual impacts after mitigation. Significance was determined for impacts where project effects were expected to contribute cumulative effects. Therefore, significance was assessed for project contributions to cumulative reductions of core security habitat for ungulates (focusing on caribou).

13.7.7.3.1 Thresholds

Determination of significance of project related and cumulative environmental effects is based on a consideration of both ecological thresholds for maintaining populations and land use policy and management goals. With respect to land use policy, management guidelines in the Fort Nelson region (Fort Nelson LRMP 1997) qualitatively stipulate the need for conservation efforts for caribou in areas that are also considered Enhanced Resource Use zones. However, there are not yet any thresholds defined for caribou habitat and population management. Although woodland caribou distributions have been found to decline near linear developments (*i.e.*, an avoidance response) (Dyer 1999; James 1999; Oberg et al. 2002), it has not yet been determined if, or how, this distribution response affects caribou demographics (P. Oberg, pers. comm., 2001).



- Woodland Caribou Core Security Habitat
- Wells
- Industrial Facilities
- High Grade Roads
- - - Secondary Roads
- - - Winter Roads
- Existing Pipelines
- - - Seismic Lines

EKWAN PIPELINE PROJECT

Woodland Caribou Core Security Habitat at Baseline



NORTH

3 0 3 6 9
Scale in kilometres

Acknowledgements:
Original drawing by AXYS Environmental Consulting Ltd.

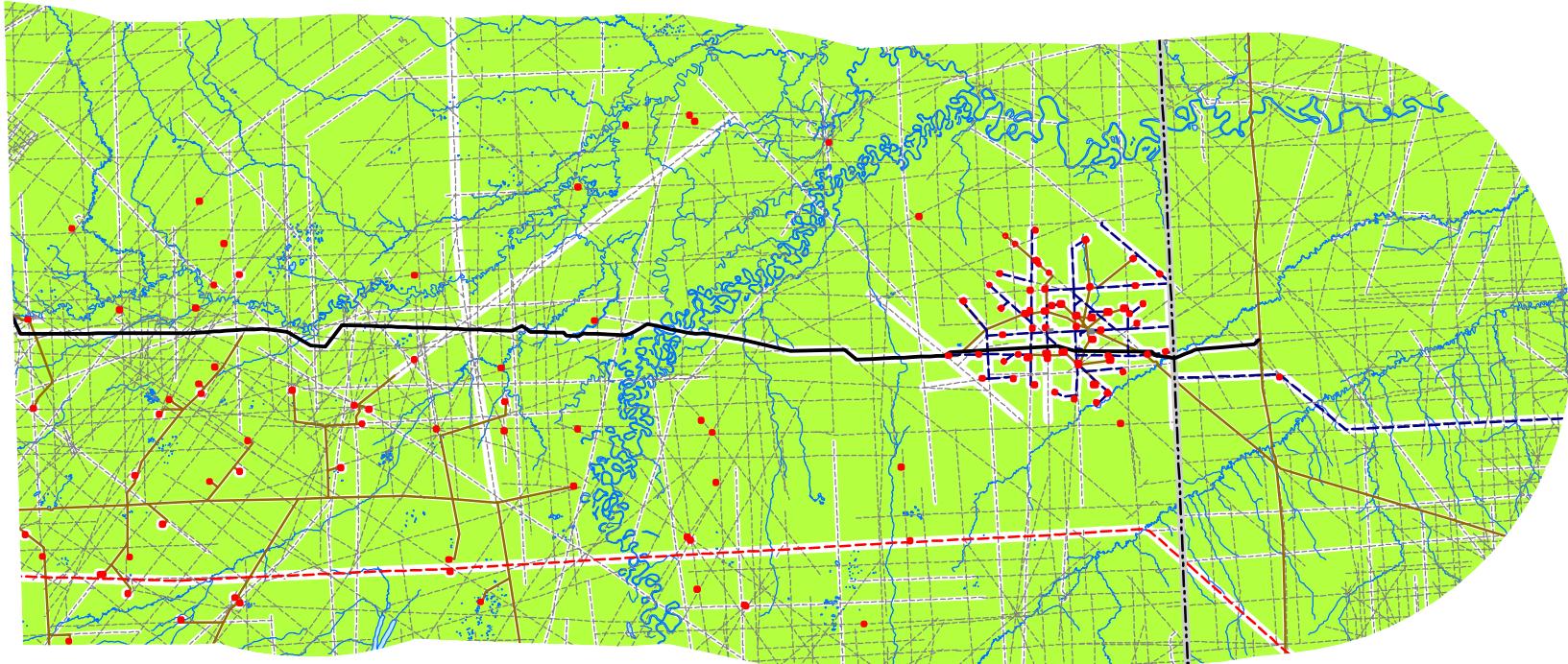
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13.7-18



- Proposed Pipeline Route
- Woodland Caribou Core Security Habitat
- Wells
- Industrial Facilities
- High Grade Roads
- - Secondary Roads
- - Winter Roads
- Existing Pipelines
- - Seismic Lines

EKWAN PIPELINE PROJECT

Woodland Caribou Core Security Habitat at Construction



NORTH

3 0 3 6 9
Scale in kilometres

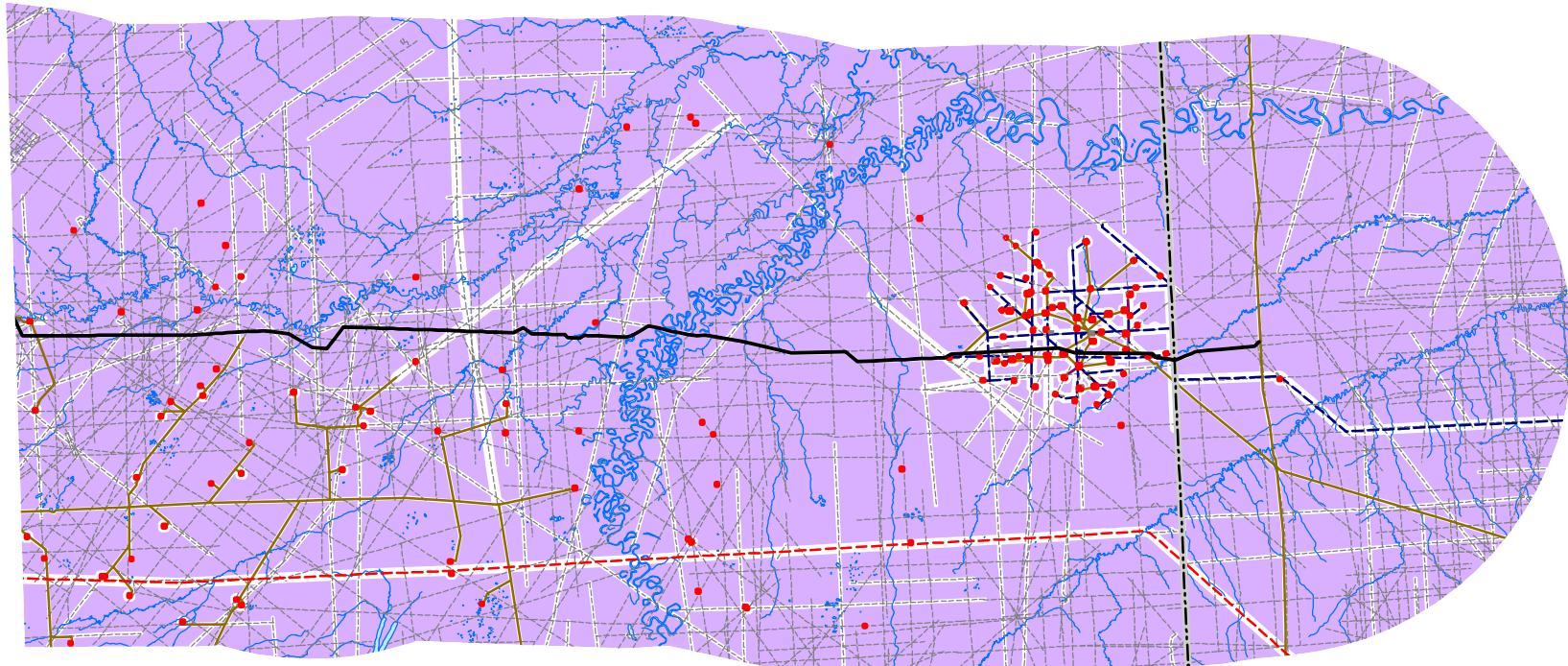
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13.7-19



- Proposed Pipeline Route
- Woodland Caribou Core Security Habitat
- Wells
- Industrial Facilities
- High Grade Roads
- Secondary Roads
- Winter Roads
- Existing Pipelines
- Seismic Lines

EKWAN PIPELINE PROJECT

Woodland Caribou Core Security Habitat at Operations With Project



NORTH

3 0 3 6 9
Scale in kilometres

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13.7-20

In the absence of quantitative goals for habitat protection and road access development, and undefined terms for overall land use direction, a clear determination of the significance of cumulative regional environmental effects with specific respect to provincial land use policy is not possible. Currently, cumulative environmental effects and development thresholds (based on demographic response) are highlighted as primary research objectives for the Boreal Caribou Committee (BCC).

13.7.7.3.2 Significance Summary

In general, the Project will not contribute significantly to mortality risks for caribou. This is due to the limited amount of new ROW proposed for the Project, its proximity to existing linear corridors in many areas, and the access control mitigation proposed for the Project. Plans for access control measures to minimize new access potential meet the intent of access management strategies in the Fort Nelson LRMP.

The minor contributions of the Project to reductions in core security habitat for caribou reflect the degree to which core security habitat has already been compromised by existing land use disturbances. This is also compounded with the general poor quality of habitat for caribou in the Project corridor (see Section 13.7.6.2.1). As described above, no thresholds for caribou exist in the Project area. However, a large amount (approximately 86 percent) of core security habitat exists for caribou at operations, and it is expected that the small contribution (0.4 percent) to cumulative reductions in core security habitat from the Project will not significantly affect the mortality risk for caribou.

13.7.8 Follow-up and Monitoring

Habitat reclamation, following pipeline construction (i.e., planting native shrubs and seeding with native seed mixes) and access control measures (i.e., gates, rollback, berms, and planting of native shrubs as visual barriers) are the primary mitigation options for ensuring that long-term negative impacts to wildlife are minimized. Effectiveness of these mitigation activities will be monitored as part of routine pipeline inspection. If revegetation activities in some areas of the ROW fail, the necessary actions will be taken until functional plant communities are firmly established. If breaches in access barriers are noted, other access control measures may be implemented.

Since Project effects on wildlife species of concern are not anticipated to significantly contribute to cumulative effects, long-term monitoring of these wildlife populations has not been proposed.