9 VEGETATION AND WETLANDS

9.1 SCOPE OF ASSESSMENT

The Vegetation and Wetlands VC is composed of species and communities which are of ecological, economic, and/or human importance. Ecological communities, including wetland habitats and associated biodiversity, strongly affect ecosystem function and the ability of other organisms, including humans, to use and benefit from natural resources.

This assessment provides baseline conditions on the relative abundance and distribution of plant species and ecological communities, and assesses potential Project effects on plant species and ecological communities of interest, and wetland functions.

9.1.1 Regulatory Setting

9.1.1.1 National Energy Board Act

The assessment scope for Vegetation and Wetlands associated with the Project follows the NEB Filing Manual (NEB 2016), which provides guidance as to the type of information the NEB requires in order to make a decision pursuant to the *NEB Act*. The application must describe the biophysical setting with sufficient detail to:

- Identify the elements of importance in the area
- Identify Project-environment interactions
- Identify, predict, and determine the significance of effects of the Project
- Formulate appropriate mitigation measures and monitoring programs

9.1.1.2 Species at Risk Act

The SARA is a federal law that aims to prevent endangered or threatened species from becoming extinct or extirpated, and manages species of special concern to help prevent them from becoming endangered or threatened. The status of species is assessed and designated by COSEWIC, which then recommends a designation for legal protection by being officially listed under SARA. Both plant and animal species can be listed under SARA.

Under SARA, the individual, the residence, and the habitat are protected. There are three main prohibitions in SARA relevant to listed species:

- S. 32, which prohibits killing, harming, or taking listed species
- S. 33, which prohibits damage or destruction of residences of listed species
- Subsection 58(1), which prohibits destruction of critical habitat of listed species

9.1.1.3 Federal Policy on Wetland Conservation

Wetlands are a priority for the federal government because of their importance in providing habitat, hydrological, and biogeochemical functions within their respective regions or watersheds. The Federal Policy on Wetland Conservation (FPWC) applies to this Project because of potential effects on wetland functions. The FPWC strives to 'promote conservation of Canada's wetlands to sustain their ecological and socio-economic functions, now and in the future (Government of Canada 1991). One of the stated goals of the FPWC is to commit all federal departments and activities to the goal of no net loss of wetland functions that:

- Are on federal lands and waters; or
- Are in areas affected by the implementation of federal programs and activities where the continuing loss or degradation of wetlands or their functions have reached critical levels; or
- May affect wetlands that are ecologically or socioeconomically important to a region, which in BC include: provincially red- and blue-listed wetlands, estuarine wetland communities, and wetlands within areas of continental or regional importance to waterfowl according to habitat joint ventures

Wetland functions that coincide with areas of federal regulatory jurisdiction, such as habitat for species listed under SARA and migratory birds considered under the *Migratory Bird Convention Act* (MBCA), are of particular concern to federal regulatory agencies during environmental assessments. The NEB filling manual includes the requirement to identify and describe the capacity of wetlands within the Project area to perform ecological functions and includes guidance on this topic that references the Policy.

9.1.1.4 BC Oil and Gas Activities Act

The passing of the OGAA, on October 4, 2010, represented a significant change to the legal regime for oil and gas activities in BC. The BC OGC, the regulatory agency that oversees oil and gas operations in BC, is continued under OGAA. The BC Provincial Cabinet has introduced the OGAA EPMR, which addresses the subjects listed below. BC OGC has also published a guide which outlines strategies for the permit applicant to utilize in order to comply with the regulations. The guide (BC OGC 2015a) provides direction in the following areas, which are pertinent to vegetation and wetlands:

- Waterbody classification with associated setbacks
- Riparian management areas with associated Best Management Practices
- Wetland crossings
- Old growth management areas
- Natural range barriers
- Integrated management of invasive plants

9.1.1.5 Species and Ecosystems at Risk

In BC, species and ecosystems are ranked using a global standard (NatureServe), administered by the BC Conservation Data Centre (BC CDC). Using these ranks, species and ecosystems are 'listed' by colour, in association with their respective status. Yellow-listed represents no concern, blue-listed represents special concern, and red-listed represents serious concern (extinct, extirpated, or endangered). The red and blue lists serve two purposes:

- To provide a list of species for consideration for more formal designation as Endangered or Threatened (see SARA above); or
- To help set conservation priorities for species and ecosystems considered at risk in BC

Provincially-listed species and ecosystems at risk are not protected by specific legislation or setback distances. However, avoidance of these resources is considered best practice and is reflected by various policies and frameworks.

9.1.1.6 Invasive and Non-native Plant Species

In BC, the *Weed Control Act* requires landowners or occupiers to eradicate noxious plants upon discovery and control populations of noxious species to prevent the spread of those species. The Weed Control Regulation identifies which species are listed as noxious weeds. The PRRD has identified additional non-native invasive plant species that threaten native vegetation communities and agricultural resources in the Invasive Plant Committee of the Peace River Regional District's (IPCPRRD) *Strategic Plan and Profile of Invasive Plants and Noxious Weeds* (IPCPRRD 2016). Certain non-native invasive plant species are to be controlled within the PRRD in accordance with this management plan.

9.1.1.7 Forest and Range Practices Act

The *Forest and Range Practices Act* (FRPA) and regulations govern the activities of forest and range licensees in BC. The statute sets the requirements for forest land users related to planning, road building activities, logging, reforestation, and old growth management areas. Under FRPA Old Growth Management Areas (OGMAs) have been established in some regions of the province where timber harvesting within the boundaries of an OGMA requires a notification to the Integrated Land Management Bureau (ILMB), Planning Team Leader and that incursions into the OGMA cannot exceed legislated thresholds unless approved through an amendment process. In addition to spatially designated OGMAs, a Provincial Non-Spatial Old Growth Order has been developed which legally establishes old growth objectives for landscape units across BC. Forest licensees are required to assess old forest distribution within their timber supply areas (TSA) and maintain old forest distributions within established retention targets. FRPA also provides direction on the management and control of invasive plant species listed in the Invasive Plants Regulation pursuant to s. 47 of FRPA.

9.1.2 Selection of Potential Environmental Effects and Measurable Parameters

Potential effects on vegetation and wetlands can occur wherever Project activities interact with vegetation or wetlands resources. The key focus for the Vegetation and Wetlands VC is the sustainability of plant species and ecological communities of interest, and the maintenance of wetland functions. Potential environmental effects may occur through the direct loss of plant species and ecological communities that support traditional use activities, provide habitat, and support intrinsic ecological values such as biodiversity. Another potential effect is the loss of wetland functions as a result of clearing, ground disturbance, or altering natural drainage patterns.

Potential effects on Vegetation and Wetlands include:

- Change in the abundance of plant species of interest
- Change in abundance or condition of ecological communities of interest
- Change in wetland functions

Table 9-1 summarizes the potential effects, measurable parameters, and the associated rationale for those measurable parameters.

Table 9-1 Potential Effects and Measurable Parameters for Vegetation and Wetlands

Potential Effect	Rationale for Inclusion of the Potential Effect in the Assessment	Measurable Parameter(s) for the Effect	Rationale for Selection of the Measurable Parameter
Change in the abundance of plant species of interest	Interaction with Project activities may impact the viability of plant species of interest, and may alter species-level diversity at the local and regional levels. Species of interest include plant species at risk, traditional use plant species (i.e., plants of socio-economic, cultural, and regional importance to Aboriginal people), and non-native invasive plants species or noxious weeds.	Number of occurrences (locations recorded in the field) and population attributes (frequency, density, and/or cover recorded in the field) of: 1. Provincially- and federally-listed plant species at risk 2. Non-native invasive plant or noxious weed species, identified by provincial and regional regulatory lists Distribution of plant species important to Aboriginal communities identified by literature and/or publicly available data for projects occurring in the region	Plants at risk are tracked by the federal and provincial governments and established as conservation priorities. Invasive plant species identified by provincial or regional agencies require management and control as per legislation. Traditional plant species are important as they are of interest (for food, medicinal, technological, or spiritual uses), to regional Aboriginal communities.
Change in abundance or condition of ecological communities of interest	Interaction with the Project may limit distribution and extent or potentially cause the direct mortality of important ecological communities. These communities contribute to community-level and landscape-level biodiversity and provide important habitat for wildlife. They also provide potential habitat for species at risk and are valued within regional resource management plans.	Area (ha) and relative distribution of: 1. Provincially -listed ecological communities at risk 2. Wetlands 3. Old forest *Note: For this assessment 'riparian' is captured as either wetland or listed ecological communities.*	Abundance of ecological communities of interest may change directly due to clearing and site preparation, or their condition may change due to altered abiotic conditions (e.g., soil moisture or drainage).

Table 9-1 Potential Effects and Measurable Parameters for Vegetation and Wetlands

Potential Effect	Rationale for Inclusion of the Potential Effect in the Assessment	Measurable Parameter(s) for the Effect	Rationale for Selection of the Measurable Parameter
Change in wetland functions	Wetlands play an important role in maintenance of wildlife habitat, hydrological regimes, and water quality	Area (ha) of wetland ecosystems lost or disturbed by wetland class. This assessment will use a qualitative assessment of hydrological, biogeochemical and habitat functions with a focus on functions within federal regulatory jurisdiction.	The FPWC commits all federal departments to the goal of no net loss of wetland according to criteria described in Section 9.1.1. Project activities may result in a change in the abundance of wetland communities or a change in wetland soils, hydrology or vegetation that may affect the potential for a wetland to provide a certain ecological function.

9.1.3 Boundaries

9.1.3.1 Spatial Boundaries

Project Development Area

The PDA is defined as the physical area that is disturbed by the Project footprint and includes a 20 to 35 m permanent pipeline ROW, and 20 to 60 m wide intermittent TWS over an approximate length of 28 km. The PDA is the area in which direct effects on vegetation and ecosystems can be measured. The total area of the PDA by Project feature is shown in Table 9-2.

Table 9-2 Project Features and Footprint Determination of the PDA

Project Feature	Land Requirements (ha)		Total Footprint[2] (ha)
	New Clearing[1]	Existing Clearing	
Pipeline Permanent ROW	42.8	20.8	63.6
Pipeline Temporary Workspace and Log Decks	47.1	48.8	95.9
Access Roads	1.2	10.2	11.4
Total[2]	91.1	79.8	170.9

NOTES:
1 New clearing includes greenfield areas with minimal existing vegetation removal.
2 May not sum due to rounding.

Local Assessment Area

The LAA is the area in which both the direct effects of the PDA and the indirect effects resulting from Project activities can be measured and assessed. The LAA boundary is defined as a 100 m buffer around the PDA and is about 784.0 ha in size.

Regional Assessment Area

The RAA is used to establish the significance of residual effects and cumulative effects on vegetation and wetlands caused by Project activities. The RAA includes the PDA and LAA and is defined by a 1 km buffer around the PDA. The total area of the RAA is 6,168.3 ha.

Figure 9-1 shows the boundaries of the PDA, LAA and RAA for the Vegetation and Wetlands effects assessment.

9.1.3.2 Temporal Boundaries

Section 2.4 provides the planned Project schedule and temporal boundaries. For the Vegetation and Wetlands effects assessment, the temporal boundaries assessed include construction and operation of the Project. At this time there is no schedule to decommission or abandon the Project. Therefore, this temporal boundary is not included in the Vegetation and Wetlands effects assessment.

9.1.4 Residual Environmental Effects Description Criteria

The criteria used to assess residual effects on Vegetation and Wetlands are provided in Table 9-3. Effects were assessed at the LAA scale, except for cumulative effects, which were assessed at the RAA scale (see Section 9.5).

Table 9-3 Characterization of Residual Environmental Effects on Vegetation and Wetlands

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories	
Direction	The ultimate long-term trend of the environmental effect	Positive	Residual effect is an increase of individuals or populations of species of interest, or a decrease in invasive species, or an increase in the areas of ecological communities of interest and/or wetland ecosystems
		Adverse	Residual effect is a decrease of individuals or populations of species of interest, or an increase in invasive species, or a decrease in the areas of ecological communities of interest and/or wetland ecosystems
		Neutral	Residual effect is no net change from baseline conditions for species of interest, invasive species, ecological communities of interest, or wetland ecosystems
Magnitude	The amount of change in a measurable parameter relative to baseline case	Negligible	No measurable change detected
		Low	Residual effect is detectable for plant species and ecological communities of interest and/or wetlands, but is within normal variability of baseline conditions
		Moderate	Residual effect on plant species and ecological communities of interest and/or wetlands is measurable, and outside the normal variability of baseline conditions, but is within regulatory limits and goals
		High	Residual effect would singly, or as a substantial contribution in combination with other sources, exceed regulatory limits and goals for plant species and ecological communities of interest and/or wetlands

Table 9-3 Characterization of Residual Environmental Effects on Vegetation and Wetlands

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories	
Geographic Extent	The geographic area in which an environmental, economic, social, heritage, or health effect of a defined magnitude occurs	PDA	Residual effect limited to the PDA
		LAA	Residual effect extends to the LAA
		RAA	Residual effect is prevalent within the RAA
Duration	The period of time required until the VC returns to its baseline condition, or the effect can no longer be measured or otherwise perceived	Short-term	Residual effect is restricted to construction
		Medium-term	Residual effect occurs throughout construction and up to 10 years during operation
		Long-term	Residual effect continues through the life of the Project or beyond
		Permanent	Resource is unlikely to recover to baseline conditions
Timing and Frequency	When the effect occurs and the number of times during the Project or a specific Project phase that an environmental effect may occur	Single	Single event
		Multiple / Irregular	Multiple irregular intervals/events (no set schedule)
		Multiple / Regular	Multiple regular intervals/events
		Continuous	Residual effect occurs continuously over assessment period
Reversibility	Pertains to whether the residual effect can be reversed once the physical work or activity causing the disturbance ceases.	Reversible	Return to baseline conditions, through active management and mitigation, is expected
		Partially Reversible	Partial return to baseline conditions is likely through active management and mitigation
		Irreversible	Return to baseline conditions is unlikely
Ecological and Socio-economic Context	Resilience to stress due to ecological fragility and degree of disturbance of area in which the Project is located.	Undisturbed	Area is relatively undisturbed or not adversely affected by human activity
		Disturbed	Area has been altered or disturbed by human development or human development is still present

9.1.5 Significance Thresholds for Residual Environmental Effects

Thresholds represent the limits of an acceptable state for an environmental component based on resource management objectives, community standards, scientific literature, or ecological processes. There are no specific provincial or federal regulations that set thresholds for determining the significance of effects on vegetation resources. In the absence of specific thresholds set by legislation, professional judgment is used to qualitatively assess the potential Project effects on Vegetation and Wetlands.

A significant adverse residual effect on Vegetation and Wetlands is defined as one that results in:

- Effects on a plant species of interest that cannot be mitigated, and that compromise the long-term viability of the species population within the RAA.
- Effects on an ecological community of interest such that the long-term viability of the community of interest is compromised within the RAA.
- For wetlands, residual effects from the Project are significant if they result in an unmitigated net-loss of wetland functions in the RAA.

9.2 EXISTING CONDITIONS

9.2.1 Methods

Baseline vegetation and ecosystem information was collected in the field September 22 to October 3 and October 16 to 19, 2015 and September 13, 2016. The survey focused on vegetation communities and wetlands that may be affected by the Project. Occurrences of non-native invasive plant species that are listed by IPCPRRD or Schedule A of the BC *Weed Control Act* were recorded incidentally in survey plots and along the existing ROW. A rare plant survey was completed June 14 to 15 and July 2 to 4 2016 to identify occurrences of provincially or federally listed plant species at risk.

An ecosystem characterization approach was used to identify ecological communities of interest such as wetlands, old forest, and ecosystems at risk. The rare plant surveys followed methods similar to those described by Penny and Klinkenberg (2012). Details on the methods and survey protocols used for ecosystem mapping, rare plant and invasive species surveys are described in Appendix B.3 Vegetation and Wetlands Technical Memorandum.

In total, 77 ecosystem survey plots and 22 rare plant plots were established in the LAA and 15 invasive plant species were identified in 50 locations (see Appendix B.3 Vegetation and Wetlands Technical Memo). Using field collected ecosystem data in conjunction with two-dimensional imagery and provincial spatial data sets (i.e., Terrain Resource Information Management, Vegetation Resource Inventory, Freshwater Atlas, and Earth Observation for Sustainable Development [EOSD]) ecosystems at risk, wetlands, and old forest in the LAA were delineated in ArcGIS and used to assess Project effects. Ecosystem mapping of ecological communities of interest and wetlands was completed in November 2015.

The analysis of baseline conditions and Project effects were completed using the spatial data layer of mapped ecosystems of interest overlain with a spatial data layer of existing disturbances and the PDA. Existing disturbances included linear features from BC TRIM (2013), BC OGC (2016a), CanVec (1987-1989), GeoBC (Forest Tenure Road Sections, OGC Pipeline ROWs [2013]. and GDC Data [1986-2012]); linear features were converted to polygons for use in the analysis. Polygon features such as cutblocks, inactive industrial areas, primary industrial areas, rural residential areas, tertiary industrial areas, and active airstrips, also available in the datasets, were used in the analysis.

9.2.2 Overview

The Project lies within the Moist Warm Boreal White and Black Spruce subzone (BWBSmw) and overlaps with cultivated land, industrial developments, forested, riparian and wetland habitat within both Crown and privately held lands. Of the total 28 km long proposed pipeline route, 12.0 km falls within ALR, of which, 8.9 km is privately owned.

Forests in the BWBSmw are often dominated by trembling aspen (*Populous tremuloides*) and lodgepole pine (*Pinus contorta*), with white spruce (*Picea glauca*) as the dominant climax species. Wetter upland sites with rich soils are generally dominated by balsam poplar (*Populus balsamifera*) or white spruce, while black spruce (*Picea mariana*) is generally the dominant tree species on lowland sites on poorer soils with a thick organic layer (DeLong et al. 2011).

The following section provides an overview of land cover types in the RAA and LAA as well as the mapped ecological communities of interest in the LAA and PDA.

9.2.2.1 Regional Assessment Area

Ecosystem classification for the RAA used EOSD data to describe the general land cover types in the region. Table 9-4 provides a summary of the broad land cover types that occur in the RAA. The RAA is composed of a mixture of coniferous and deciduous forest, shrub and herb dominated units, wetlands, sparsely vegetated and anthropogenic units.

Coniferous and broadleaf (deciduous) forest make up the majority of the land cover types with vegetated upland areas comprising approximately 78% of the total RAA area. Treed, shrub, herbaceous and open water wetlands total 110.9 ha or 1.8% of the RAA area. About 15% of the RAA is anthropogenic disturbance and includes roads, cutblocks, buildings, railway, pipelines and oil and gas facilities and about 5% is covered by water or is sparsely vegetated (Table 9-4).

Old forest area in the RAA is estimated at 1,317 ha based on spatial data available from the BC OGC Area Based Analysis (ABA; BC OGC 2015b) for the Upper Pine River watershed. Two legal OGMAs overlap with the RAA and are identified as Upper Moberly 12 and Upper Moberly 19. All of the Upper Moberly 12 OGMA occurs within the RAA and is 97.3 ha in size. Approximately 17% or 316 ha of the Upper Moberly 19 OGMA occurs within the RAA.

Table 9-4 Summary of Broad Land Cover Types in the Regional Assessment Area

Land Cover Type	Area (ha)	Percent of RAA
Vegetated uplands		
Dense broadleaf forest	19.9	0.3
Open broadleaf forest	2,269.1	36.8
Sparse broadleaf forest	45.9	0.7
Dense coniferous forest	5.7	0.1
Open coniferous forest	816.7	13.2
Sparse coniferous forest	81.6	1.3
Low shrub	320.7	5.2
Herb	1,265.8	20.5
Subtotal vegetated uplands	4,825.4	78.2
Wetland		
Treed wetland	6.8	0.1
Shrub wetland	32.2	0.5
Herb wetland	41.6	0.7
Herb wetland - disturbed	3.1	0.1
Open water wetland	27.2	0.4
Subtotal wetlands	110.9	1.8
Sparsely vegetated or anthropogenic units		
Exposed or barren land	169.8	2.8
Water	105.2	1.7
Building	5.3	0.1
Cutblock	298.2	4.8
Cutline	4.8	0.1
Oil & gas facility	0.8	0.0
Oil & gas well	0.5	0.0
Abandoned pipeline	6.3	0.1
Active pipeline	177.8	2.9
Road primary	175.1	2.8
Road secondary	208.6	3.4
Railway	65.7	1.1
Trail	13.9	0.2
Subtotal sparsely vegetated or anthropogenic units	1,232.0	20.0
Grand Total	6,168.3	100.0

9.2.2.2 Local Assessment Area

Land cover and ecosystems within the LAA are described using the EOSD data as well as sensitive ecosystem mapping prepared for the Project assessment. Table 9-5 provides an area summary of the EOSD land cover types that occur in the LAA. Similar to the RAA, the LAA is composed of a mixture of coniferous and deciduous forest, wetlands, sparsely vegetated and anthropogenic units.

Broadleaf (deciduous) forest, herb and shrub dominated units make up the majority of land cover types in the LAA with vegetated upland areas comprising 60% of the total LAA area. Treed, shrub and herbaceous wetlands total 13 ha or 1.7% of the LAA area. Almost 300 ha or 38% of the LAA is comprised of anthropogenic units such as pipelines, cutblocks, roads and railway.

Table 9-5 Summary of Broad Land Cover Types in Local Assessment Area

Land Cover Type	Area (ha)	Percent of LAA (%)
Vegetated uplands		
Dense broadleaf forest	1.3	0.2
Open broadleaf forest	254.6	32.5
Sparse broadleaf forest	1.2	0.2
Open coniferous forest	13.0	1.7
Sparse coniferous forest	1.7	0.2
Low shrub	27.4	3.5
Herb	172.0	21.9
Subtotal vegetated uplands	471.2	60.1
Wetland		
Shrub wetland	6.3	0.8
Herb wetland	6.0	0.8
Open water wetland	0.2	<0.1
Subtotal wetlands	12.6	1.6
Sparsely vegetated or anthropogenic units		
Exposed or barren land	13.8	1.8
Water	1.0	0.1
Building	0.8	0.1
Cutblock	57.9	7.4
Cutline	1.0	0.1
Abandoned pipeline	1.3	0.2
Active pipeline	146.7	18.7
Road primary	28.8	3.7

Table 9-5 Summary of Broad Land Cover Types in Local Assessment Area

Land Cover Type	Area (ha)	Percent of LAA (%)
Road secondary	40.6	5.2
Railway	5.8	0.7
Trail	2.0	0.2
Subtotal sparsely vegetated or anthropogenic units	299.8	38.2
Grand Total	784.0	100

Area summaries of ecosystems at risk, and wetlands mapped within the LAA are provided in Table 9-6. Within the LAA, ecosystems at risk and wetlands total 18.1 ha. Wetlands cover a total of 12.6 ha of which 4.4 ha are ecosystems at risk. Red- and blue-listed ecosystems at risk cover a total of 9.9 ha of the LAA. Figure 9-2 provides the locations of these communities in the LAA.

Where more than one ecological community of interest occurs together in the LAA these communities are identified in the legend and separated by a semicolon (e.g., wetland; blue-listed wetland).

Within the LAA, one red-listed ecosystem and four blue-listed ecosystems were identified and mapped (Appendix B.3 Section 4.1.1 and Table 4-1). The red-listed sandbar willow (Fl06/SA) ecosystem was identified and mapped adjacent to the Pine River and was observed to be disturbed by invasive plant species.

Four blue-listed ecosystems were identified and mapped in the LAA:

- Balsam poplar – white spruce – mountain alder – dogwood (112/CD)
- White spruce – currant – horsetail (111/SH)
- Bebb's willow – bluejoint swamp (Ws03/BJ)
- Swamp horsetail – beaked sedge (Wm02/BM)

Wetlands mapped in the LAA generally occur in the valley bottom adjacent to the Pine River where subdued topography and seasonal flooding promotes the development of wetlands (Appendix B.3 Section 4.1.2 and Table 4-2). Marshes, swamps, and shallow open water wetlands were identified in the LAA; swamps occupy the greatest area followed closely by marshes. Table 9-7 provides the area of wetlands mapped in the LAA by wetland class. The total wetland area in the LAA is 12.6 ha and includes the following blue-listed as well as non-listed wetlands:

- Beaked sedge – water sedge marsh
- Swamp horsetail – beaked sedge marsh (blue-listed)
- Bebb's willow – bluejoint swamp (blue-listed)
- Uncorrelated marsh
- Uncorrelated swamp
- Shallow open water wetlands

An uncorrelated marsh or a swamp wetland is a wetland area that has been identified by photo-interpretation and/or those that do not correlate well with recognized association as described in *Wetlands of British Columbia* (MacKenzie and Moran 2004) due to some factor such as disturbance.

Swamp, marsh, and open water wetlands provide hydrologic functions by moderating water flows and storing water. They may also provide protection from erosion and sedimentation by slowing water velocities and capturing sediments among wetland vegetation. The amount and type of vegetation in a wetland is important in facilitating these functions in that shrubs and larger herbaceous plants dissipate water velocity more effectively than lower stature vegetation.

Biogeochemical functions provided by wetlands include nutrient transformation, biomass production and soil production. However, no peat forming wetlands (i.e., fens and bogs) were identified within the LAA. Swamp, marsh, and open water wetlands also function to provide wildlife habitat for birds, mammals and amphibians.

A description of the habitat attributes, including wetlands, for focus wildlife species used to assess the effects to wildlife habitat is presented in Table 10-4 (Wildlife and Wildlife Habitat, Section 10). Wildlife species that depend on wetland habitat for a life requisite and are assessed in Wildlife and Wildlife Habitat (Section 10) include grizzly bear (*Ursus arctos*), black bear (*Ursus americanus*), moose (*Alces alces*), yellow rail (*Coturnicops noveboracensis*), rusty blackbird (*Euphagus carolinus*) and western toad (*Anaxyrus boreas*).

While wetlands in the RAA provide habitat for a variety of species, the Project falls beyond the boundary of the area in northeast BC designated as one of three areas of continental or regional significance to waterfowl (Joint Venture planning boundaries) within BC (EC 2014). In addition to providing habitat for wildlife, wetlands provide unique habitats for plant species and support the development of a variety of plant communities including red- and blue-listed communities tracked by the BC CDC. Red-and blue-listed communities identified in the LAA are summarized in Table 9-6 while the potential effects to these communities are discussed in Section 9.4.2.

The BC MOF (2009) Dawson Creek Timber Supply Area Old Growth Management Project defines the minimum age requirements for old forest within the Dawson Creek TSA based on natural disturbance units (NDUs). NDUs are geographic areas with similar disturbance regimes caused by forest fire (frequency and extent), insects and landslides, for example. There are several NDUs within the Dawson Creek TSA, one of which is the Boreal Foothills NDU which overlaps with the LAA.

The minimum age requirement for forests to be considered old in the Boreal Foothills NDU is greater than 140 years (BC MOF 2009). Field surveys and ecosystem mapping did not confirm the presence of old forest within the LAA by this age definition. An estimate of old forest area in the LAA derived from the BC OGC ABA data for the Upper Pine River watershed (BC OGC

2015b) is presented in Table 9-8. It is important to note that the ABA for the Upper Pine River watershed includes deciduous forests that are greater than 100 years old, mixed forests greater than 120 years old and coniferous forest greater than 140 years in age. Based on the ABA the total area of old forest within the LAA is 76.5 ha (Table 9-8).

Two legally established OGMAs overlap with the LAA (Table 9-9). These are the Upper Moberly 12 and Upper Moberly 19 OGMAs. Approximately 5.2 ha of the Upper Moberly 12 OGMA and 1.3 ha of the Upper Moberly 19 OGMA occur within the LAA.

Table 9-6 Mapped Ecological Communities of Interest in the Project Development Area and Local Assessment Area

BEC Zone	Site Series	Map Code	Structural Stage	Ecosystem Name	BC CDC List	PDA Area (ha)	LAA Area (ha)	Change from Baseline in LAA (%)
Upland Forest Units								
BWBSmw	111	SH	6 - mature forest	White spruce - Currant - Horsetail	blue-list	0.3	3.6	8.6
	112	CD	6 - mature forest	Balsam poplar - White spruce - Mountain alder - Dogwood	blue-list	0.2	1.6	14.5
Subtotal Upland Forest Units						0.5	5.2	10.4
Riparian Flood Units								
BWBSmw	Fl06	SA	3b - tall shrub	Sandbar willow	red-list	<0.1	0.3	4.5
Subtotal Riparian Flood Units						<0.1	0.3	4.5
Wetland Units								
BWBSmw	Wm00	Wm	2b - graminoid	uncorrelated wetland marsh[1]	-	0.2	1.7	14.1
	Wm01	MA	2b - graminoid	Beaked sedge - Water sedge	-	0.1	3.1	4.6
	Wm02	BM	2b - graminoid	Swamp horsetail - Beaked sedge	blue-list	0.1	1.2	8.8
	Ws00	Ws	3b - tall shrub	uncorrelated wetland swamp[1]	-	0.3	3.1	10.6
	Ws03	BJ	3a - low shrub	Bebb's willow - Bluejoint	blue-list	<0.1	0.4	5.6
			3b - tall shrub			0.6	2.8	20.2
			Total BJ			0.6	3.2	18.2
	Ww00	OW	2c - aquatic	Shallow open water	-	<0.1	0.2	10.9
Subtotal Wetland Units						1.4	12.6	11.3
Grand Total						2.0	18.1	11.0

NOTE:
[1] uncorrelated wetland marsh and uncorrelated wetland swamp are units that do not correlate well with published wetland field guides for accurate classification

Table 9-7 Wetlands in the Project Development Area, Local Assessment Area and Regional Assessment Area by Wetland Class

Wetland Class	Site Series	Map Code	Structural Stage	Ecosystem Name	PDA Area (ha)	LAA Area (ha)	Change from Baseline in LAA (%)	RAA Area (ha)	Change from Baseline in RAA (%)
Marsh	Wm00	Wm	2b - graminoid	uncorrelated wetland marsh[1]	0.2	1.7	14.1	44.8	<0.1
	Wm01	MA	2b - graminoid	Beaked sedge - Water sedge	0.1	3.1	4.6		
	Wm02	BM	2b - graminoid	Swamp horsetail - Beaked sedge	0.1	1.2	8.8		
Marsh Total					0.5	6.0	8.1		
Swamp	Ws00	Ws	3b - tall shrub	uncorrelated wetland swamp1	0.3	3.1	10.6	32.2	<0.1
	Ws03	BJ	3a - low shrub	Bebb's willow - Bluejoint	0.0	0.4	5.6		
			3b - tall shrub		0.6	2.8	20.2		
			Total BJ		0.6	3.2	18.2		
Swamp Total					0.9	6.3	14.5		
Shallow open water	Ww00	OW	2c - aquatic	Shallow open water	0.0	0.2	10.9	27.2	<0.1
Grand Total					1.4	12.6	11.3	104.1	<0.1

NOTE:

[1] uncorrelated wetland marsh and uncorrelated wetland swamp are units that do not correlate well with site series described in Wetlands of British Columbia (MacKenzie and Moran 2004)

Table 9-8 Old Forest in the Project Development Area, Local Assessment Area and Regional Assessment Area

Natural Disturbance Unit	BEC Unit	Minimum age of old forest [a]	Retention Target (%)[a]	Old Forest Age [b]	PDA Area (ha)[b]	LAA Area (ha)[b]	RAA Area (ha)[b]	Change from Baseline LAA (%)	Change from baseline RAA (%)
Boreal Foothills	BWBSmw	>140	23	100	13.5	76.5	1,312.8	17.6	1.0
Boreal Plains	BWBSmw	conifer >140	16	100	0.0	0.0	0.0	0.0	0.0
		deciduous >100	16	100	0.0	0.0	4.4	0.0	0.0
		mixedwood >120	16	100	0.0	0.0	0.0	0.0	0.0
Grand Total					13.5	76.5	1,317.2	17.6	1.0

NOTES:

[a] Ministry of Forests (2009) Dawson Creek Timber Supply Area Old Growth Management Project

[b] British Columbia Oil and Gas Commission (2015) Area Based Analysis of Upper Pine River Old Forest

Table 9-9 OGMA in the Project Development Area and Local Assessment Area

OGMA Name	PDA Area (ha)	LAA Area (ha)	Baseline OGMA Area (ha)	Change from Baseline OGMA Area (%)
Upper Moberly 12	0.2	5.2	97.3	0.2
Upper Moberly 19	<0.1	1.3	1,879.5	<0.1
Total	0.2	6.5	1,976.8	<0.1

Plant species at risk include red and blue-listed vascular and non-vascular plant species listed by the BC CDC or listed on Schedule 1 of SARA. A search of the BC CDC Species and Ecosystems Explorer database (BC CDC 2016) did not result in known occurrences of provincially listed or federally listed plant species at risk within the LAA. Approximately 55 species or infraspecific taxa are listed by the BC CDC for the BWBSmw subzone. Of this total number, 31 are blue-listed and 24 are red-listed.

A survey for plant species at risk identified one population of a blue-listed plant species, shinleaf wintergreen (*Pyrola elliptica*), located on private land on the east bank of the Pine River approximately 45 m south of the PDA. The occurrence consisted of approximately 95 individual plants in an area of about 30 m^2 growing in silty soils and partially shaded by other native vegetation.

Non-native invasive plant species were observed and recorded during vegetation field surveys. In total 15 species of invasive plants were identified at 50 locations in the LAA (see Appendix B.3, Section 4.2 and Table 4-3). Seven of these plants, Canada thistle (*Cirsium arvense*), common tansy (*Tanacetum vulgare*), oxeye daisy (*Leucanthemum vulgare*), perennial sow-thistle (*Sonchus arvense*), quackgrass (*Elymus repens*), wild oats (*Avena fatua*), and yellow star-thistle (*Centaurea solstitialis*), are noxious weeds listed on Schedule A of the *BC Weed Control Act*.

Common tansy is the only species encountered in the LAA that is ranked as a Category A invasive plant by the IPCPRRD while oxeye daisy, Canada thistle, and meadow buttercup (*Ranunculus acris*) are ranked as Category B invasive plants by the IPCPRRD. All other invasive plants encountered are listed under the Education and Awareness category of the regional invasive plant list. Within the LAA invasive plants were encountered along the existing ROW or in disturbed habitats adjacent to the ROW such as in agricultural areas, in cut blocks, and along access roads and trails.

Many traditional use plant species that may be used by Aboriginal Groups for food and medicines are found in the LAA and RAA. Traditional use plants that are used by Aboriginal Groups in the region include white spruce, black cottonwood, trembling aspen, lodgepole pine, green alder (*Alnus viridis*), mountain alder (*Alnus incana*), willows (*Salix* species), highbush-cranberry (*Viburnum edule*), black gooseberry (*Ribes lacustre*), prickly rose (*Rosa acicularis*), red raspberry (*Rubus idaeus*), Saskatoon berry (*Amelanchier alnifolia*), kinnikinnick (*Arctostaphylos uva-ursi*), Labrador tea (*Rhododendron groenlandicum*), crowberry (*Empetrum*

nigrum), soopolallie (*Shepherdia canadensis*), fireweed (*Epilobium angustifolium*), horsetails (*Equisetum* species), cow-parsnip (*Heracleum maximum*), bluejoint reed grass (*Calamagrostis canadensis*), stinging nettle (*Urtica dioica*) and bunchberry (*Cornus canadensis*) (Kuhnlein and Turner 1991, Marles et al. 2000, Tuner 1997, Turner 1998, Glencore 2015). Plant species such as trembling aspen, white spruce, willows, bunchberry, and fireweed and berry producing shrubs such as prickly rose, highbush-cranberry and soopolallie are associated with ecosystems common in the BWBSmw subzone. Other species, adapted to specific soil moisture and nutrient regimes, such as Labrador tea, kinnikinnick and lingonberry are associated with ecosystems that are less common on the local landscape. Traditional use plant species are potentially found in all naturally occurring areas as well as some disturbed portions of the LAA.

9.3 PROJECT INTERACTIONS

Interactions between a Project activity and ecological resources have the ability to create an effect. An interaction can produce a positive, neutral, or adverse effect, which can be further characterized using the spatial, temporal, and descriptive criteria defined in Table 9-3. Potential effects on Vegetation and Wetlands include:

- Change in the abundance of plant species of interest
- Change in the abundance or condition of ecological communities of interest
- Change in wetland functions

Table 9-10 outlines Project activities which may produce interactions with Vegetation and Wetlands. Those project activities not expected to interact with the Valued Component (e.g., "-") are not carried through the effects assessment.

Table 9-10 Potential Project Effects on Vegetation and Wetlands

Associated Activities and Equipment	Change in the abundance of plant species of interest	Change in the abundance or condition of ecological communities of interest	Change in wetland functions
Pre-Construction and Pipeline Construction (Pipeline construction)			
Engineering	-	-	-
Surveying	-	-	-
Clearing	✓	✓	✓
Grubbing	✓	✓	✓
Topsoil Salvage	✓	✓	✓
Grading	✓	✓	✓
Blasting	-	-	-
Vehicle Stream Crossings	-	-	-
Trenching	-	-	✓
Stringing (i.e., pipe is lined up along the ROW)	-	-	-

Table 9-10 Potential Project Effects on Vegetation and Wetlands

Associated Activities and Equipment	Change in the abundance of plant species of interest	Change in the abundance or condition of ecological communities of interest	Change in wetland functions
Pipeline Stream Crossings	-	-	-
Lowering-in and Tie-In	-	-	-
Hydrostatic Testing	-	-	-
Backfilling	-	-	✓
Clean-up and Reclamation	✓	✓	✓
Operation Activities (from Table 2-5)			
ROW Inspection	-	-	-
Vegetation Maintenance	✓	✓	✓
Pipeline Cleaning, Maintenance, and Testing	-	-	-
Site Inspections	-	-	-

NOTES:
✓ Indicates the activity is likely to contribute to the potential effect.
- Indicates that an activity is unlikely to contribute to the potential effect.

Project interactions with vegetation resources may cause direct or indirect effects on plant species and ecological communities of interest. Direct effects on vegetation species and communities occur through vegetation clearing and site preparation activities such as grubbing, grading and top soil salvage. Subsequent construction activities such as trenching and backfilling are not expected to have any further direct effects following the disturbance of vegetation and soil cover. Indirect effects on vegetation and plant communities may also occur through changes in surface and subsurface hydrology or soil conditions as a result of Project construction.

9.4 MITIGATION

Mitigation measures provided in the Spectra EMCPC (Spectra 2014) and the Project EPP (Appendix A) will be implemented, where practical, during all phases of the Project. Key mitigation measures for Vegetation and Wetlands have been summarized in Table 9-11 and location specific mitigation measures for plant species and ecosystems of interest are listed in Table 6-3 of the Project EPP.

Table 9-11 Mitigation Measures for Vegetation and Wetlands

Potential Effect	Mitigation Measures
Change in the abundance of plant species of interest	• Locations of plant species at risk will be staked and flagged, if found. If an occurrence cannot be avoided a species specific mitigation plan will be developed. • Unnecessary loss of traditional use plants or other species of interest in areas around the PDA will be reduced by adhering closely to construction plans and limiting machine use to defined areas. • The extent of grubbing and clearing of shrubs and herbaceous species will be limited where practical. • Topsoil will be stripped from ROW or other work areas, stored, and returned during clean-up in accordance with mitigation measures outlined in Table 7-2, Table 7-10, and 7-16 of the EPP. • All heavy equipment will arrive on site clean and free of soil or vegetative debris to limit the spread of invasive plant propagules and seeds. • Within the PDA signs will be posted at areas identified as having noxious weed infestations prior to start of construction. • Within the PDA noxious weeds will be controlled during construction as required. • Topsoil piles will be monitored for weed growth during construction; corrective measures will be implemented to avoid infestation as required. • If seed mixes are used, use Certified No. 1 seed where practical, unless for a chosen reclamation seed species. • If practical, native species will be used in seed mixes. • Imported fill (if required) will come from verified weed free sources.
Change in abundance or condition of ecological communities of interest	• Wetlands will be avoided where practical. • Work site dimensions will be reduced to limit disturbance to vegetation in riparian communities where practical. • The boundaries of listed wetlands and associated riparian management areas will be clearly delineated in proximity of planned disturbances to facilitate avoidance during construction. Buffers at wetlands and riparian ecosystems will be established as prescribed in Fish and Fish Habitat (Section 8) and in Sections 6 and 7 of the EPP • The presence/absence of red-listed ecosystems at risk will be confirmed and boundaries staked within clearing areas to limit disturbance of these ecosystem occurrences beyond the PDA. • Removal of trees and land clearing or disturbance will be limited to the PDA. • The extent of grubbing and clearing of shrubs and herbaceous species will be limited wherever practical. • Topsoil will be stripped from ROW or other work areas, stored, and returned during clean-up in accordance with mitigation measures outlined in Table 7-2, Table 7-10, and 7-16 of the EPP.

Table 9-11 Mitigation Measures for Vegetation and Wetlands

Potential Effect	Mitigation Measures
Change in wetland functions	• Wetlands will be avoided where practical. • The boundaries of wetlands in proximity of planned disturbances will be clearly delineated to facilitate avoidance during construction. • Buffers prescribed in Section 7 of the EPP will be applied to wetland crossings (in accordance with the OGAA EPMR); where practical, a 20 m buffer will be established in natural areas adjacent to wetlands and riparian areas where a buffer is not specified by the watercourse and wetlands crossing table within the PDA. • Unnecessary vegetation loss in areas around the PDA will be avoided by adhering closely to construction plans and limiting off-site machine use to defined areas. • The extent of grubbing and clearing of shrubs and herbaceous species will be limited wherever practical. • Topsoil will be stripped from ROW or other work areas, stored and returned during clean-up in accordance with mitigation measures outlined in Table 7-2, 7-10, and 7-16 of the EPP. • Refueling and lubrication of equipment will be conducted a minimum of 100 m away from any wetlands where practical. • Extra work areas (such as staging areas and additional spoil storage) will be minimized in wetlands. • Bell holes will be pumped onto stable well-vegetated areas or constructed containment areas in a manner that does not cause erosion or sedimentation of a wetland. Discharge locations will be pre-determined and monitored by the EI to limit the potential for flooding or erosion. • Post-construction monitoring will be conducted to verify that identified wetlands are restored to typical baseline conditions with no net-loss of functions.

9.5 RESIDUAL EFFECTS

The total area affected within the PDA (170.9 ha) includes existing pipeline ROW, forestry cutblocks, agricultural lands and undisturbed forest; the PDA crosses both Crown and privately held lands. The Project will result in the direct loss of 91.19 ha of newly cleared area within the LAA (Table 9-2). The following subsections present the residual environmental effects with respect to species of interest, communities of interest, and wetland functions.

9.5.1 Change in the Abundance of Plant Species of Interest

Change in the abundance of species of interest is a key issue for vegetation. Of particular importance are plant species at risk and traditional use plants that may be affected by the Project and the potential for invasive plant species to be introduced and displace native species thereby indirectly changing native plant species abundance. Project activities could result in changes in species abundance through the direct loss of individual plants or populations during Project construction. Indirect effects such as changes in hydrology and changes to light levels may also result in changes to native species composition.

Vegetation clearing and grubbing during Project construction will result in the direct loss of plant species used for traditional purposes where these species occur in the PDA. Since the distribution of traditional use plants is not uniform within and amongst ecosystem units, the loss of traditional use plant species will be less than the total area of new clearing in the PDA (91.19 ha or 14% of total LAA). The general mitigation measures listed in Section 9.3 and the EPP (Appendix A) will limit the loss of traditional use plants within the PDA; populations of traditional use plants are expected to remain intact in existing undisturbed portions of the LAA and RAA. The direct loss of traditional use plant species in the PDA is considered adverse, low magnitude, restricted to the PDA, occurs as a single event, is long-term and partially reversible. The residual effect is considered partially reversible since the intermittent TWS areas will be left to revegetate after construction. Revegetation may occur quickly for some species of traditional use plants, such as fireweed, while others will take a longer time to re-establish, such as spruce. Therefore, the residual effect is considered long-term in duration.

Ground disturbance activities such as clearing, grubbing and grading during construction activities have the potential to introduce non-native invasive plant species or noxious weeds to the LAA. Invasive plants tend to readily invade disturbed areas and spread easily into adjacent habitats to the extent that they can change native plant species assemblages. In the context of this assessment, invasive plant species have the potential to change the abundance of plant species of interest within the LAA, if allowed to invade and infest areas of disturbance and adjacent habitats. Mitigation measures aimed at reducing the introduction and spread of invasive plant species as described in Section 9.3, and Section 6.2 of the EPP will limit the potential for these species to establish themselves within the PDA; therefore, adverse residual Project effects are not predicted on plant species of interest as a result of invasive plants.

Plant species at risk include red and blue-listed vascular and non-vascular plant species listed by the BC CDC or listed on Schedule 1 of SARA. Vegetation clearing and ground disturbance may result in direct or indirect effects on plant species at risk within the LAA. A search of the BC CDC Species and Ecosystems Explorer database (BC CDC 2016) did not result in known occurrences of provincially listed or federally listed plant species at risk within the LAA. However, a rare plant field survey identified a population of shinleaf wintergreen, a blue-listed plant species, within the LAA. The shinleaf wintergreen population was encountered approximately 55 m south of kilometer post 17.55 and is located outside of the PDA. Since the shinleaf wintergreen population lies outside of the PDA residual Project effects on this population are limited to potential indirect residual effects. In addition to the mitigation measures outlined in Section 9.3 the following specific mitigation measures will be implemented to further reduce potential residual project effects to this population.

- Confirm, stake and clearly flag the boundaries of the shinleaf wintergreen population prior to vegetation clearing and construction activities.
- Strictly adhere to PDA clearing boundaries and limit the removal of trees and shrubs where practical.
- Avoid vegetation loss or disturbance within 20 m of the staked population boundary at a minimum.
- Monitor the health, distribution and abundance of the shinleaf wintergreen population post-construction. A species at risk management plan will be developed and implemented if the heath, distribution and abundance of the population decline post-construction.

Implementation of the specific mitigation measures for shinleaf wintergreen will limit the indirect residual Project effects on this plant species at risk. In the absence of other confirmed occurrences of plant species at risk within the LAA the residual Project effects on plant species at risk are characterized as neutral in direction and negligible in magnitude since no net loss or measurable change from baseline conditions is predicted. As a result, adverse residual Project effects are not predicted on plant species of interest in terms of plant species at risk. Residual Project effects are not predicted during the operations phase of the Project for plant species of interest since minor disturbances due to vegetation maintenance are not expected to cause a change in the abundance of plant species of interest.

Table 9-12 summarizes the residual Project environmental effects on change in the abundance of plant species of interest for construction and operations.

9.5.2 Change in Abundance or Condition of Ecological Communities of Interest

Change in abundance or condition of ecological communities of interest is a key issue for the sustainability of healthy and diverse ecosystems. Of particular importance are ecosystems at risk, wetlands and old forest.

Project activities could result in changes in the abundance or condition of ecological communities of interest through the direct loss of vegetation due to site clearing, grubbing, grading and trenching or through indirect effects such as changes to hydrology, soil conditions or light levels as a result of construction activities.

In total, 18.1 ha of ecological communities of interest were mapped in the LAA (refer to Section 9.1.2.2, Table 9-6). Of this total, 5.2 ha are blue-listed upland forest communities, 12.6 ha are wetlands (of which 4.4 ha are blue-listed) and 0.3 ha is a red-listed riparian community.

Construction activities will result in the direct loss of 2.0 ha of ecological communities of interest in the PDA (refer to Table 9-6). Of this, 0.5 ha are blue-listed upland forests, 1.4 ha are wetlands (0.7 ha are blue-listed wetlands) and less than 0.1 ha is covered by the red-listed Sandbar willow community. As a result of construction activities, approximately 11% of the mapped ecological communities of interest in the LAA will be lost within the PDA. Over time the residual effect on ecological communities of interest as a result of vegetation clearing will be reduced as TWSs, log deck areas and wetlands are left to naturally regenerate after construction activities.

Direct losses to old forest communities as a result of Project construction are estimated based on BC OGC ABA as described in Section 9.1.2.2. Based on this analysis, old forest area within the LAA is estimated at 76.5 ha. Vegetation clearing for Project construction assumes a direct loss of 13.5 ha of old forest area in the PDA (refer to Table 9-8). The LAA overlaps with two legal OGMAs identified as Upper Moberly 12 and Upper Moberly 19 (refer to Section 9.1.2.2, Table 9-9). Of the 6.5 ha of OGMA that overlap with the LAA, only 0.2 ha of the Upper Moberly 12 OGMA and less than 0.1 ha of the Upper Moberly 19 OGMA will be directly affected by Project construction activities, resulting in less than 0.1% reduction of the total OGMA area (Table 9-9). The guidance for dealing with incursions into OGMAs within the Dawson Creek TSA requires that an amendment be prepared where 5% or 40 ha, whichever is less, of an OGMA 50 ha or greater in size is disturbed (BC Ministry of Agriculture and Lands (BC MAL) 2009). Therefore, the incursions (0.2 ha and <0.1 ha) into the Upper Moberly 12 and Upper Moberly 19 OGMAs will not trigger an amendment.

The adverse residual Project effects of construction activities, following the application of mitigation measures listed in Table 9-11 and in Table 6-3 of the Project EPP (Appendix A), on the abundance or condition of ecological communities of interest are considered adverse in direction, are limited to the PDA, will occur once during construction, and are partially reversible since the intermittent TWS will be left to naturally revegetate after construction. The residual Project effects are considered long-term in duration since mature forest communities may take up to 80 years to regenerate post-construction. Given that 2 ha of ecological communities of interest mapped in the LAA (11%) will be lost to construction activities and that the intermittent TWS will be left to regenerate naturally post-construction, the magnitude of the effect is considered moderate and within the natural range of variability of baseline conditions.

Project activities during the operations phase of the Project are not predicted to effect a change in abundance or condition of ecological communities of interest. Minor disturbances such as brushing during vegetation maintenance are considered negligible in magnitude and reversible such that ecological communities are resilient to minor perturbations over time.

9.5.3 Change in Wetland Functions

Wetlands provide a number of ecosystem functions and are important areas for biological diversity and fish and wildlife habitat. Wetlands present in the LAA include swamps, marshes and shallow open water wetlands. Wetland functions can vary between and amongst wetland classes depending on their position in the landscape, their chemical and physical properties and vegetation composition and cover. Of the 110.9 ha of wetlands in the RAA, 12.6 ha occur in the LAA (refer to Section 9.1.2.2, Table 9-7). Construction activities will result in the disturbance of 1.4 ha of wetland area including 0.5 ha of marsh, 0.9 ha of shrub swamp and less than 0.1 ha of shallow open water wetlands; the disturbance affects about 1.3% of the total wetland area present in the RAA.

Project construction has the potential to affect hydrological, biogeochemical and habitat functions. Swamp, marsh and open water wetlands provide hydrologic function by moderating water flows and storing water. They may also provide protection from sedimentation and erosion by slowing water velocities and capturing sediments among wetland vegetation. Removal of vegetation cover may interrupt hydrological functions (described in Section 9.1.2.2) in the short- to medium-term.

Biogeochemical functions may be impacted by the removal of vegetation, disturbance of soils and change to water storage capabilities (e.g., depth) within a wetland system. There is also potential for the flow of surface water and/or shallow groundwater to a wetland to be altered by construction activities (e.g., grading; trenching).

Clearing of vegetation will alter habitat functions through a loss of habitat and/or a change in structure (e.g., removal of shrubs). These changes will affect species that depend on wetlands to provide some habitat function; a discussion of the change in habitat availability for selected focus species is presented in Section 10.4.2 and Table 10-8.

While construction activities will result in the removal of vegetation during clearing and grubbing the implementation of subsequent clean-up and reclamation measures as prescribed in the EPP are expected to create conditions suitable for re-establishment of wetland vegetation associated with wet mineral soils (especially on the intermittent TWS). Since the wetland classes and site associations disturbed by construction are generally associated with mineral soils (with and without organic veneers) (MacKenzie and Moran 2004), marshes and shrub swamps have the potential to re-establish in the medium to long-term. Some hydrological functions would also be restored with establishment of wetland graminoid and/or shrub vegetation in the medium-term. The change in loss of wetland habitat will be limited by paralleling the existing ROW, limiting vegetation clearing within wetlands associated with stream crossings and by

encouraging natural revegetation in wetlands following disturbance. In addition, changes to habitat function of wetlands are further limited because no treed wetlands are affected by the Project. Some habitat function will also return following the establishment of hydrological function (e.g., presence of standing water for amphibians in marshes) and the re-establishment of vegetation. The implementation of the Project mitigation measures is anticipated to allow for the restoration of hydrological, biogeochemical and habitat functions in the marsh and shrub swamp wetlands in the medium- to long-term.

Indirect effects from construction activities may affect naturally occurring wetlands in the LAA, by potentially altering their hydrological balance through changes in surface and groundwater flows and soil sedimentation. During the operations phase of the Project, no additional direct impacts to wetlands are predicted. However, potential indirect effects on wetland functions may occur for the 12.6 ha identified in the LAA, particularly within the wetland complex located between kilometer posts 13 and 14. This wetland complex is located on the flat fluvial plain adjacent to the Pine River and consists of both swamp and marsh wetlands; it is currently disturbed by the existing ROW. Other smaller swamp and marsh wetlands occur in the PDA within the Pine River floodplain along low-gradient drainages on agricultural lands and along the edges of old oxbow lakes. Many of the wetlands in the LAA have been disturbed to some extent by the existing ROW and/or agriculture.

Indirect effects to wetland functions will most likely occur during the construction period; however, surface water drainage patterns and revegetation are to be restored during clean-up and reclamation. The indirect effects on wetland functions can be limited by implementing mitigation measures outlined in Section 9.3 and Table 9-11, as well as measures described in the Project EPP (Appendix A, Section 6.3 Table 6-2).

With the implementation of the mitigation measures, the residual Project effect to wetlands is a 1.4 ha loss that occurs once during construction, is limited to the PDA and is considered long-term but partially reversible during the life of the Project. With the implementation of the EPP, residual Project effects on wetland functions, therefore, are characterized as adverse in direction, low in magnitude, limited to the LAA (both direct and indirect effects), and short- to medium-term in duration for the shrubby and herbaceous wetlands found within the intermittent TWS. The effects are partially reversible through active management during operations. The residual Project effect to wetland functions within the operational ROW may be medium to long-term in duration if management requires the removal of shrub cover. The residual effects to wetland area and wetland functions occur in a disturbed ecological context.

9.5.4 Summary of Residual Effects

Project residual effects on Vegetation and Wetlands are summarized in Table 9-12.

Table 9-12 Summary of Residual Environmental Effects on Vegetation and Wetlands

Project Phase	Residual Environmental Effects Characterization						
	Direction	Magnitude	Geographic Extent	Duration	Timing and Frequency	Reversibility	Ecological and Socio-economic Context
Change in abundance of plant species of interest[1]							
Construction	Adverse	Low	PDA	Long-term	Single event	Partially Reversible	Disturbed
Operation	With the implementation of mitigation measures, no residual effects are predicted						
Change the abundance or condition of ecological communities of interest							
Construction	Adverse	Moderate	PDA	Long-term	Single event	Partially Reversible	Disturbed
Operation	With the implementation of mitigation measures, no residual effects are predicted						
Change in wetland functions							
Construction	Adverse	Low	LAA	Short- to Medium-term	Single event	Partially reversible	Disturbed
Operation	Adverse	Low	PDA	Medium- to Long-term	Single event	Partially reversible	Disturbed

NOTE:
[1] Characterization for traditional use plant species

9.6 CUMULATIVE EFFECTS

As discussed in Section 4.3, the approach used in the assessment of cumulative effects involves the identification of projects and activities within the RAA that may overlap and act cumulatively with the Project. Further, it considers the predicted residual effects of the Project in combination with the potential residual effects of other past, present or foreseeable future activities. The following sections present the cumulative effects assessment for Vegetation and Wetlands.

The identification of residual effects on Vegetation and Wetlands that are likely to interact cumulatively with past, existing, and foreseeable future activities, and the rationale for their selection is presented in Table 9-13.

The Project results in adverse residual effects on plant species, ecological communities of interest and wetland functions (Table 9-12). As indicated in Table 9-13, these residual effects have the potential to act cumulatively with the effects of other activities within the RAA. Oil and gas development, forest and agriculture activities, transportation infrastructure and other human developments have the potential to act cumulatively with the Project effects on plant species, ecological communities of interest and wetland functions. The primary mechanism for the interaction is vegetation clearing and the direct and indirect effects that result from this activity. However, there is no reasonable expectation that the Projects incremental contribution to cumulative effects will affect the sustainability of plant species, ecological communities of interest and wetlands within the RAA for the following reasons:

- The PDA affects an area of less than 3% of the RAA.
- The RAA is moderately disturbed with 15% currently cleared by anthropogenic developments including forestry cutblocks, agriculture, roads, and pipelines.
- The loss of traditional use plant species habitat is approximately 3% of what is expected to be potentially available in the RAA. Within the RAA, the loss of less than 91 ha of habitat for traditional use plants is not expected to affect the sustainability of traditional use plants since these species are commonly associated with deciduous seral forests and young to mature conifer forests found in the RAA.
- The area of communities of interest, wetlands and traditional use plants disturbed by the Project is expected to partially recover during the operation phase as the intermittent TWS and log deck space are allowed to regenerate within the PDA. Certain traditional use species as well as wetland functions are anticipated to recover on the permanent ROW to the extent possible give maintenance requirements.
- The residual loss of 1.4 ha of wetland area will result from the Project; this loss includes 0.5 ha of marsh, 0.9 ha of shrub swamp and less than 0.1 ha of shallow open water wetlands. The disturbance of about 1.3% of the wetland area present in the RAA is not expected to affect the sustainability of wetlands and wetland functions in the RAA following Project development.
- The residual loss of ecological communities of interest is 11% of the total mapped in the LAA (2 ha); the individual loss of any single community ranges between 4% and 20% in the LAA. While the full extent of ecological communities in the RAA (especially upland communities) is not known, these communities will persist in the LAA and therefore the RAA following construction of the Project. The loss of ecological communities of interest in the PDA is less than 1% of the total area capable of supporting these communities in the RAA. Furthermore, certain shrub and herbaceous communities (shrub wetland and marshes) are expected to persist in the ROW due to their species composition and structure providing that hydrological conditions are maintained at similar conditions to the existing. Therefore, it is expected that the remaining occurrence of these ecosystems will persist and will be sustainable in the RAA following Project development.

Mitigation measures are provided in Section 9.3, the Project EPP (Appendix A) and the Spectra EMCPC (Spectra 2014). It is expected that existing developments are implementing similar measures in accordance with industry and provincial regulatory guidelines for management of Vegetation and Wetlands. No mitigation measures beyond those included in this ESA, the Project-specific EPP, and the Spectra EMCPC are predicted to be necessary for mitigation of cumulative effects.

Table 9-13 Potential Cumulative Effects on Vegetation and Wetlands

Past, Existing and Future Physical Activities with Potential for Cumulative Effects	Potential Cumulative Effects			Rationale
	Change in Abundance of Plant Species of Interest	Change in Abundance or Condition of Ecological Communities of Interest	Change Wetland Functions	
• Past, existing and future agricultural operations, residential development, and commercial developments. • Past, existing and future forestry operations. • Past, existing and future well sites and small facilities such as gathering points, test facilities, and sales meters. • Past, existing and future pipelines. • Past, existing and future transportation infrastructure (e.g., highways, roads, access roads and rail).	✓	✓	✓	• Past or existing physical activities have occurred within the RAA and have affected the quantity and diversity of plant species and ecological communities of interest. Residual effects of the Project occur in the context of these existing conditions. • Future physical activities have the potential to contribute to the loss of plant species and ecological communities of interest. Residual effects of the Project have the potential to act cumulatively with these future activities.

NOTES:

✓ Indicates that potential effects are likely to act cumulatively with those of other physical activities

– Indicates that potential effects are unlikely to act cumulatively with those of other physical activities

9.7 DETERMINATION OF SIGNIFICANCE

The assessment of residual Project effects on plant species of interest, ecological communities of interest and wetland functions considered changes to measurable parameters both quantitatively and qualitatively based on field data and observations, existing vegetation information, and spatial analyses of mapped ecosystems. In the context of sustaining healthy and diverse plant species, ecological communities, and wetland functions within the RAA, the determination of significance is based on the residual environmental Project effects characterization and significance thresholds (refer to Section 9.0.5).

The residual effects on plant species of interest are predicted to be not significant with the implementation of mitigation measures to limit impacts to traditional use plant species and to control noxious weeds and invasive plants. Confidence in this prediction is high because the effects mechanism is clearly understood (i.e., clearing of 91.19 ha of vegetated ecosystems in the PDA; 11.6 % of the total LAA) and because traditional use plants are expected to be common within the ecosystems found in LAA (and by extension the RAA) following Project development. In addition, it is expected that some traditional use species will re-establish and persist in the ROW following Project development. Therefore, the incremental loss of lands supporting traditional use plants is not expected to affect the long-term persistence or viability of traditional use plants in the RAA.

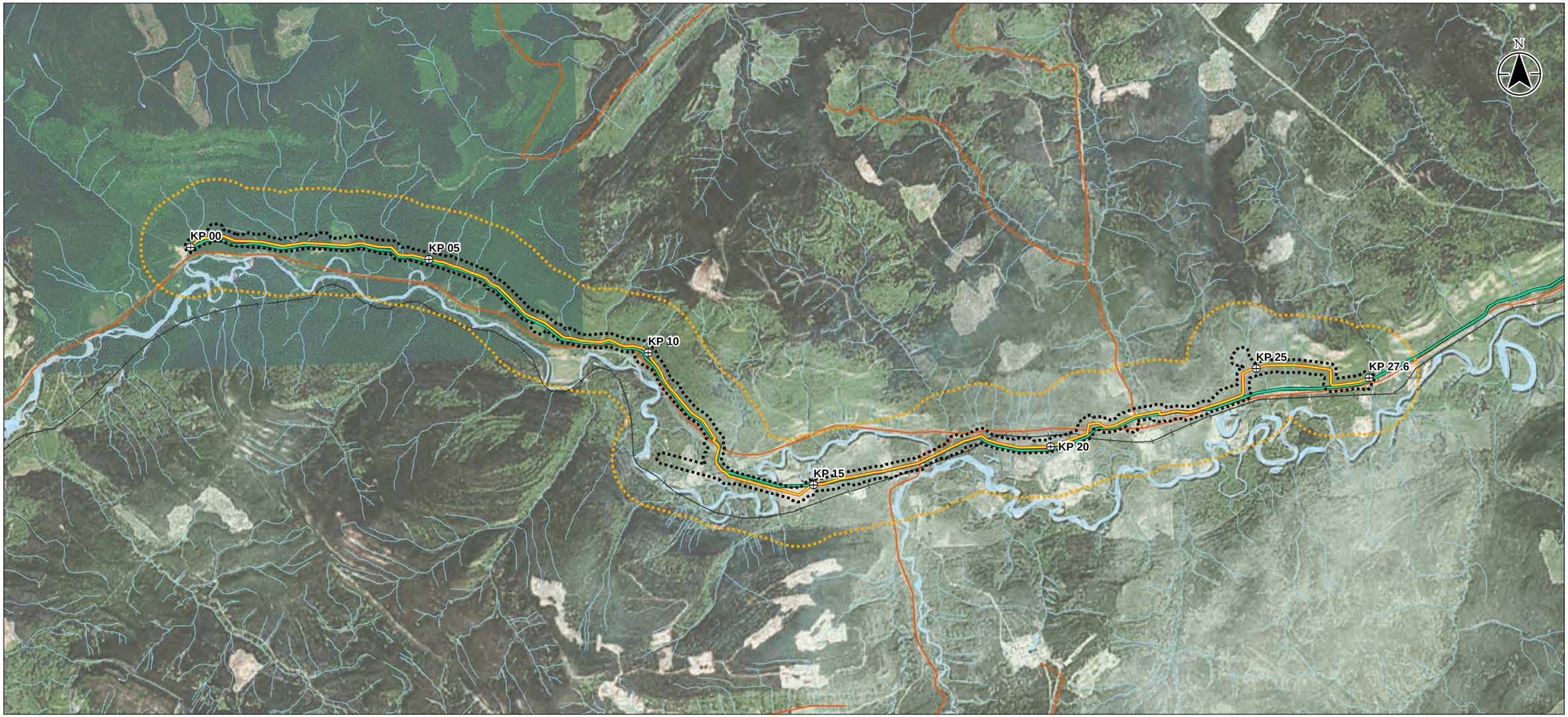
Residual effects on ecological communities of interest are predicted to be not significant in the context of the RAA. The direct loss of 2.0 ha of mapped ecological communities of interest within the PDA results is an 11% reduction in the areas of ecological communities of interest within the LAA. Since the incremental loss of any ecological community of interest with the LAA ranges between 4 and 20% the remaining areas of these communities are expected to support their persistence in the undisturbed portions of the LAA following Project development. Based on the continued presence in the LAA the disturbance of ecological communities of interest will not compromise the long-term sustainability of these communities in the RAA.

The direct loss of 13.5 ha of old forest within the PDA results in a 1% reduction in available old forest area in the RAA. This incremental loss is not predicted to compromise the long term viability of old forest ecosystems in the RAA. In addition, incursions into the two OGMAs are considered minor as they amount to an area of 0.2 ha (0.2%) of the total Upper Moberly 12 OGMA area which is 97.3 ha and a less than 0.1 ha (<0.1%) reduction in the 1,879.5 ha Upper Moberly 19 OGMA. These incursions are well below legislated threshold values prescribed in the Dawson Creek OGMA Order (BC MAL 2009) which states that minor intrusions into OGMAs is permitted provided the disturbance to the gross OGMA area does not exceed 5% or 50 ha, whichever is less, in OGMAs 50 ha or greater. The incremental Project effects on Upper Moberly 12 and 19 OGMAs are not predicted to compromise the integrity of the OGMAs or the long term viability of old forest in the RAA.

The disturbance of 1.4 ha of wetland ecosystems within the PDA results in a potential loss of about 1.3 % of the total wetland area present in the RAA. As described in Section 9.4.3, wetland plant species are anticipated to re-establish within the PDA following construction. Further, a loss of wetland functions within the wetlands intersected by the PDA in the medium to long-term is not expected following implementation of the Project mitigation measures. Therefore, the residual effect on wetland functions is predicted to be not significant.

Prediction confidence in the assessment of Project effects on the change in abundance or condition of ecological communities of interest and wetland functions are considered high due to professional experience in the identification and understanding of these ecological communities in the region.

With the application of recommended mitigation measures, Project and cumulative residual environmental effects on Vegetation and Wetlands are anticipated to be not significant.



- Road
- Railway
- Watercourse
- Existing Right of Way
- Waterbody
- Kilometre Post (KP)
- Proposed Loop
- Local Assessment Area
- Regional Assessment Area

0 1 2 3 4 km

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Notes
1. Coordinate System: NAD 1983 UTM Zone 10N
2. Data Sources Include:DataBC, Government of British Columbia (GovBC); Terrain Resource Information Management, GovBC; National Topographic System, GovBC; BC Stats, GovBC; BC Oil & Gas Commission, GovBC; CanVec v12, Government of Canada (GC); National Hydrology Network, GC; Atlas of Canada National Framework, GC; Fisheries and Oceans Canada, GC; Environment Canada; Natural Resources Canada; Microsoft product screen shot(s) reprinted with permission from Microsoft Corporation;
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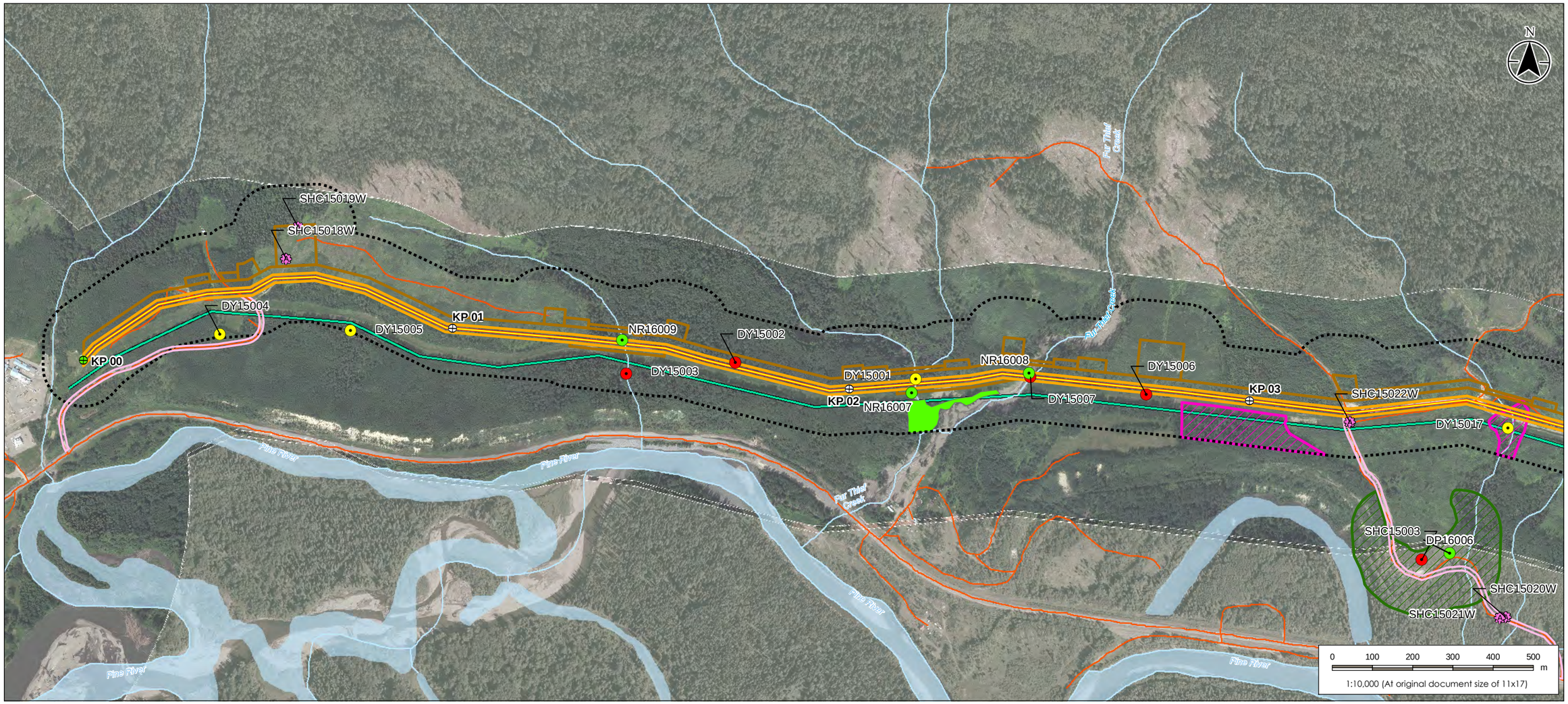
Project Location
North-Eastern British Columbia

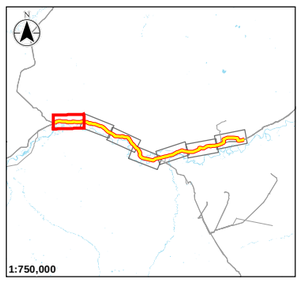
123220406
Prepared by S.Sun on 2016-09-29
Technical Review by T.Dinneen
Independent Review by K.Hewgill

Client/Project
Spectra Energy Transmission
Wyndwood Expansion Project
Environmental and Socio-Economic Assessment

Figure No.
9-1

Title
Wyndwood Expansion Project
Vegetation and Wetlands Assessment Area





- Road
- Railway
- Watercourse
- Existing Right of Way
- Freshwater Atlas Wetland
- Old Growth Management Area within Local Assessment Area
- Old Growth Management Area outside Local Assessment Area
- Kilometre Post (KP)
- Wyndwood Proposed Loop
- Proposed Right of Way
- Proposed Workspace
- Proposed Access
- Local Assessment Area

Vegetation Plot Detail
- Ground Inspection (2015)
- Visual Inspection (2015)
- Invasive Plant (2015)
- Ground Inspection (2016)
- Visual Inspection (2016)
- Rare Plant (2016)

Ecological Communities of Interest
- Blue-listed
- Blue-listed Wetland
- Blue-listed Wetland; Other
- Blue-listed Wetland; Wetland
- Blue-listed; Other
- Red-list
- Wetland
- Wetland; Blue-listed Wetland

Note: "Other indicates an un-listed community that occurs within a community of interest in a complex polygon

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Project Location
North-Eastern British Columbia

123220406

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Technical Review by T. Dinneen
Independent Review by K. Hewgill

Client/Project
Spectra Energy Transmission
Wyndwood Expansion Project
Environmental and Socio-Economic Assessment

Figure No.
9-2

Title
Wyndwood Expansion Project
Vegetation and Wetland Site Inspection Locations and Ecological Communities of Interest
Sheet 1 of 7

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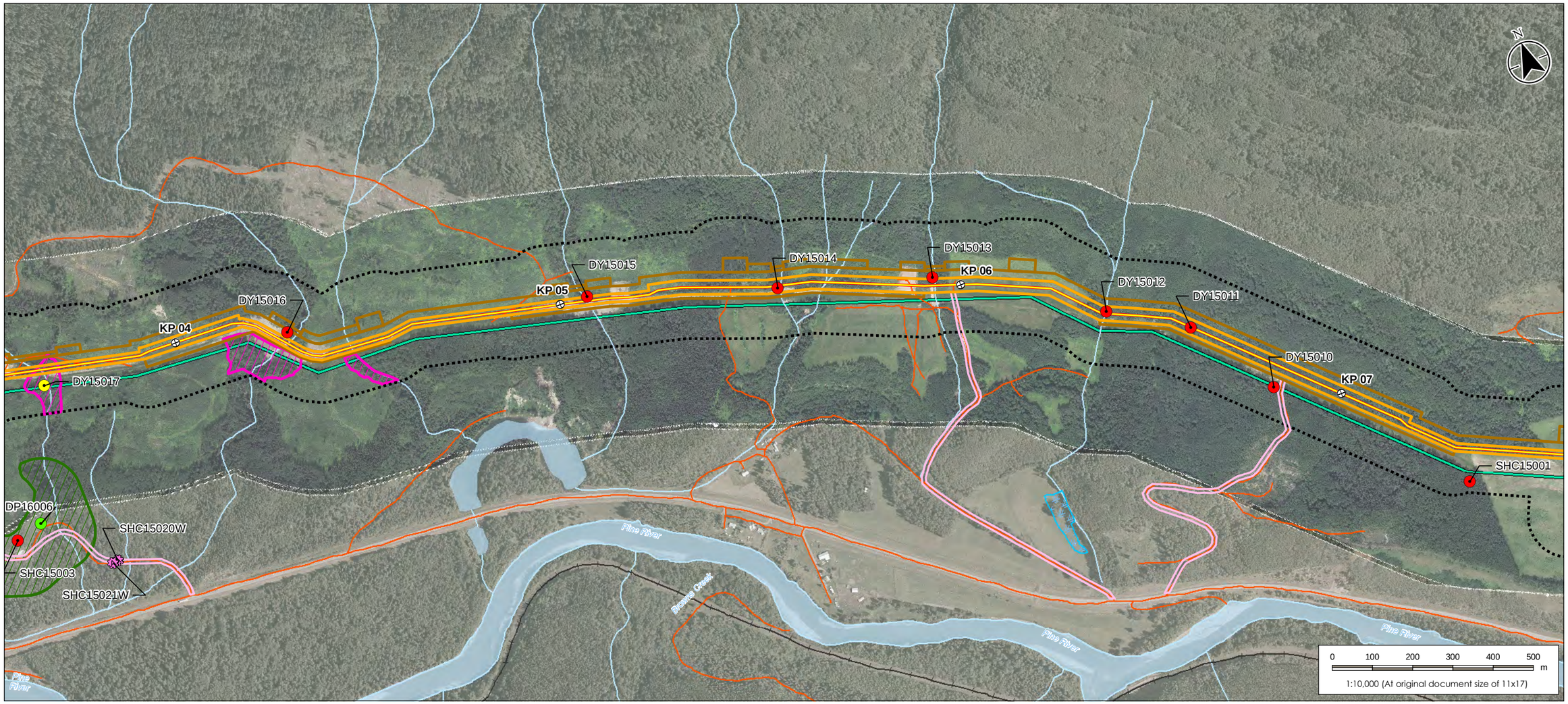

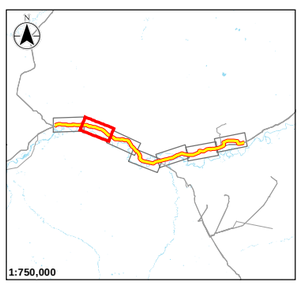

- Road
- Railway
- Watercourse
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Vegetation Plot Detail
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- Ground Inspection (2016)
- Visual Inspection (2016)
- Rare Plant (2016)

Ecological Communities of Interest
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- Blue-listed Wetland
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- Blue-listed Wetland; Wetland
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- Red-list
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- Wetland; Blue-listed Wetland

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British Columbia

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Technical Review by T. Dinneen
Independent Review by K. Hewgill

Client/Project
Spectra Energy Transmission
Wyndwood Expansion Project
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Figure No.
9-2

Title
Wyndwood Expansion Project
Vegetation and Wetland Site Inspection Locations and Ecological Communities of Interest
Sheet 2 of 7

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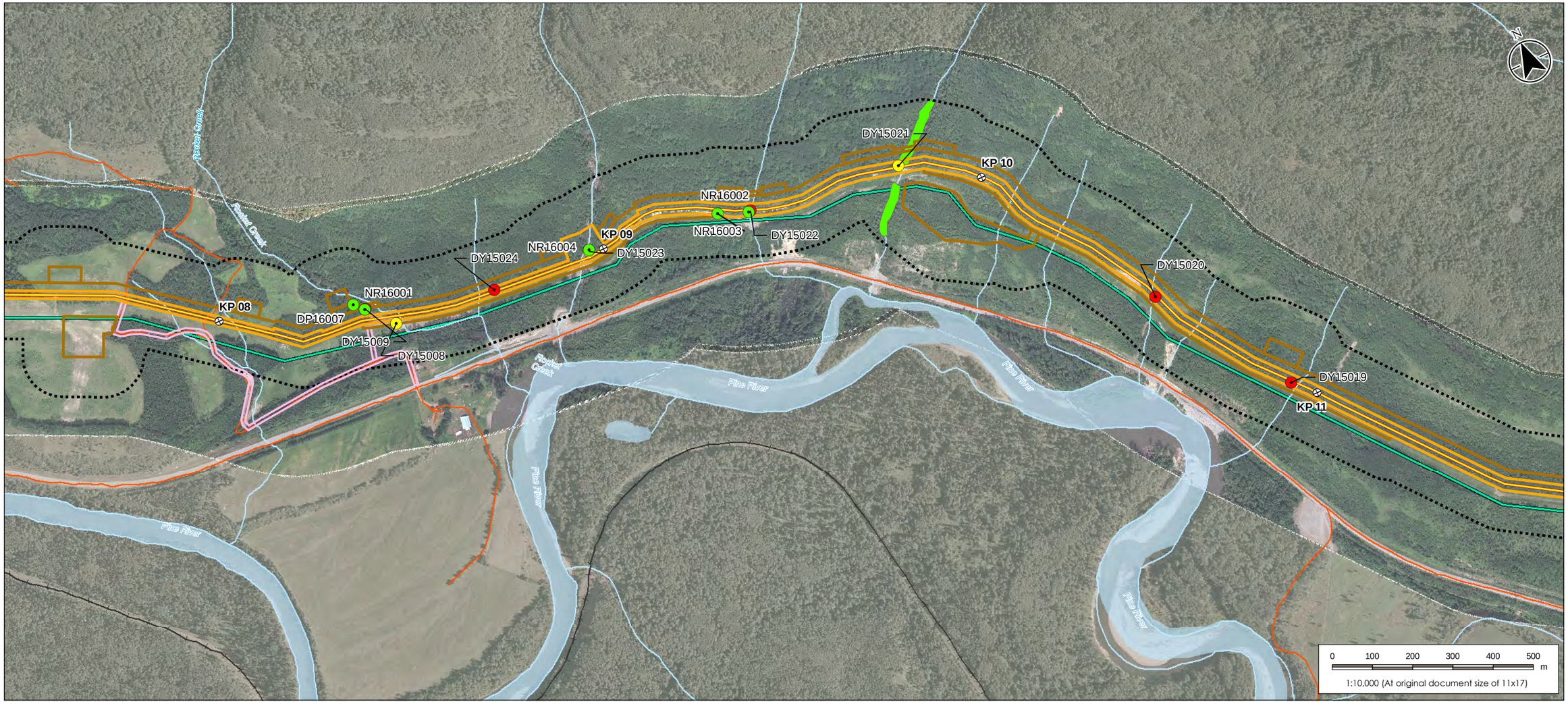

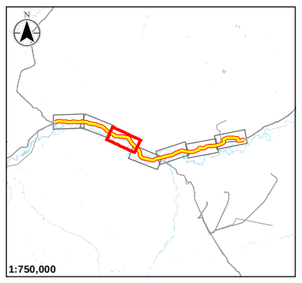

- Road
- Railway
- Watercourse
- Existing Right of Way
- Freshwater Atlas Wetland
- Old Growth Management Area within Local Assessment Area
- Old Growth Management Area outside Local Assessment Area
- Kilometre Post (KP)
- Wyndwood Proposed Loop
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Vegetation Plot Detail
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- Rare Plant (2016)

Ecological Communities of Interest
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Project Location
North-Eastern British Columbia

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Technical Review by T. Dinneen
Independent Review by K. Hewgill

Client/Project
Spectra Energy Transmission
Wyndwood Expansion Project
Environmental and Socio-Economic Assessment

Figure No.
9-2

Title
Wyndwood Expansion Project
Vegetation and Wetland Site Inspection Locations and Ecological Communities of Interest
Sheet 3 of 7

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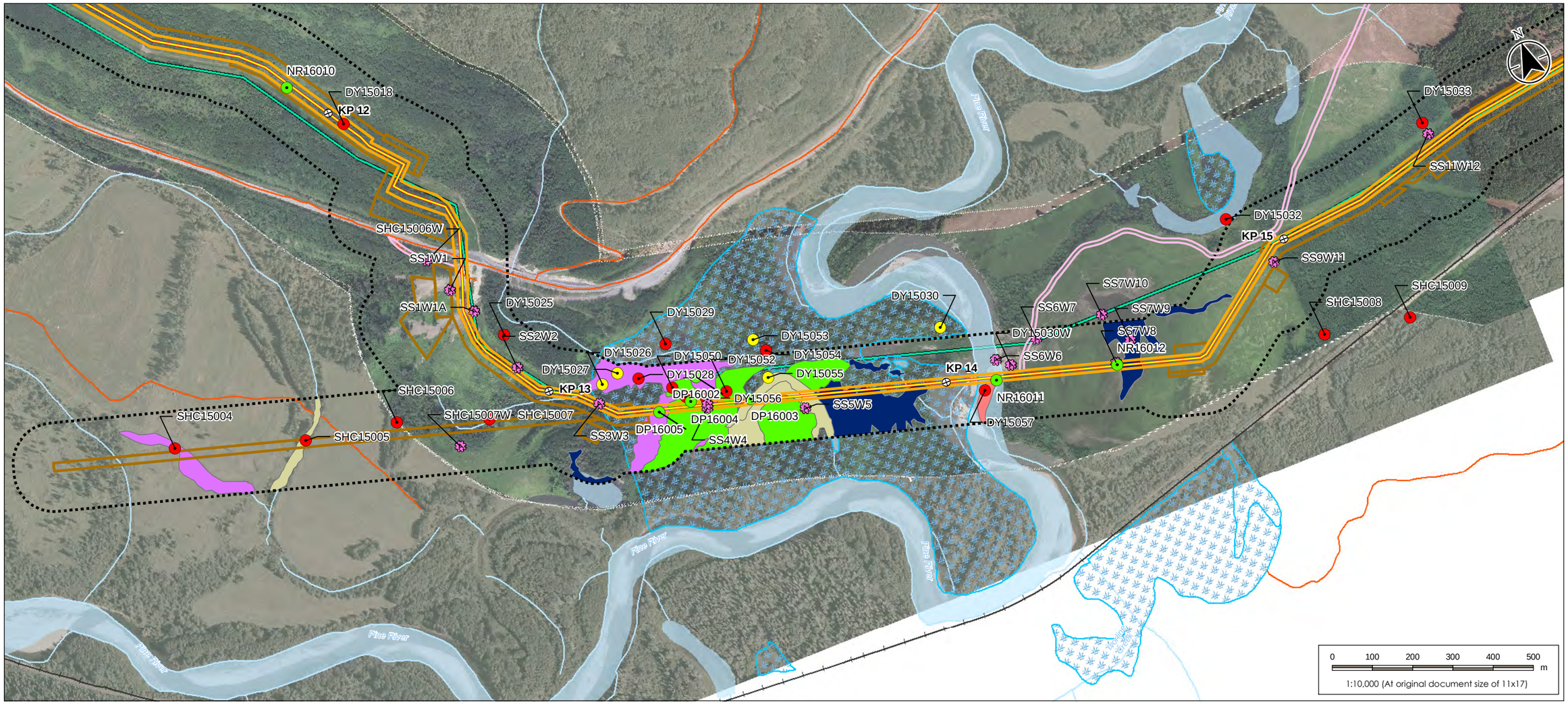

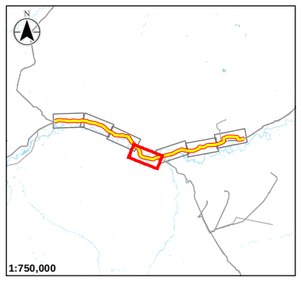

- Road
- Railway
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- Old Growth Management Area outside Local Assessment Area
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Ecological Communities of Interest
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Independent Review by K. Hewgill

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Figure No.
9-2

Title
Wyndwood Expansion Project
Vegetation and Wetland Site Inspection Locations and Ecological Communities of Interest
Sheet 4 of 7

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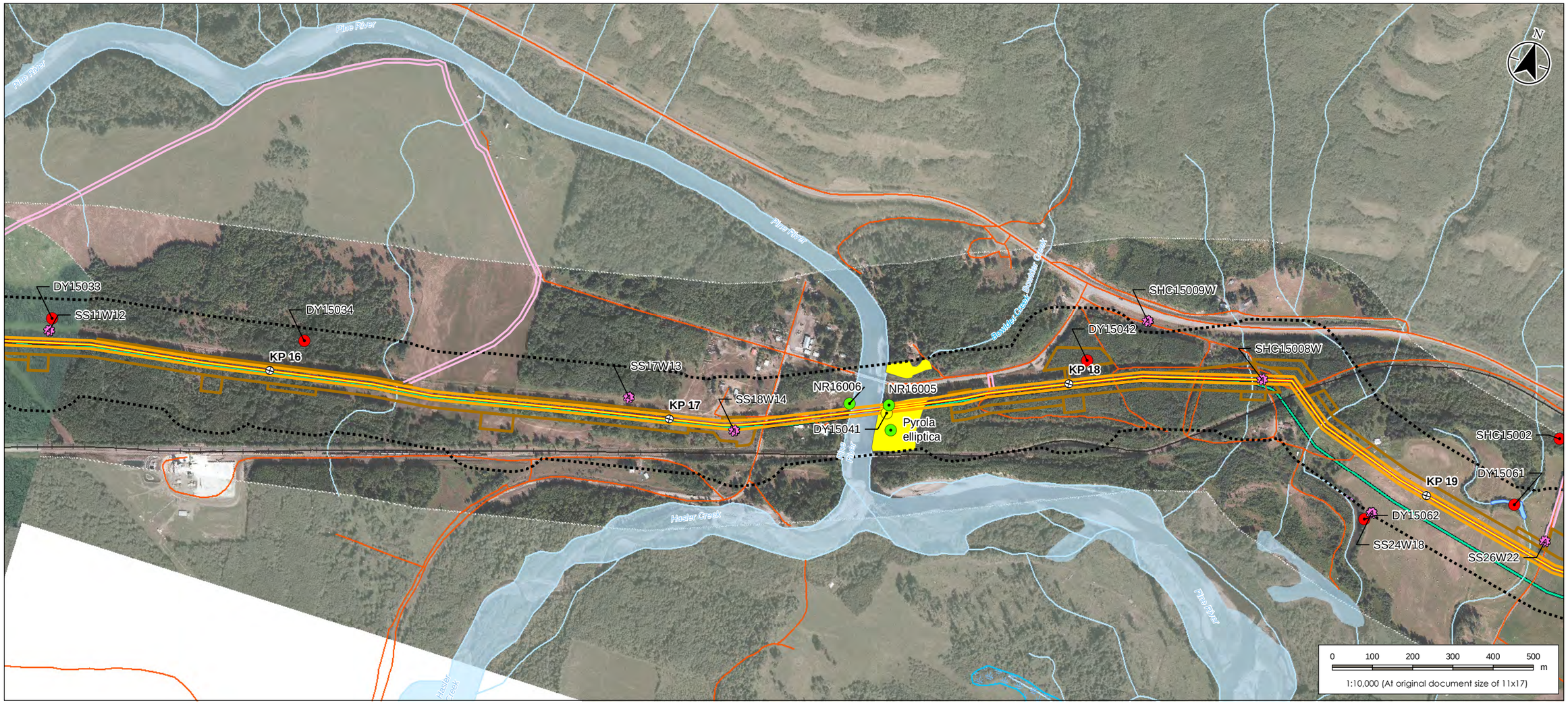

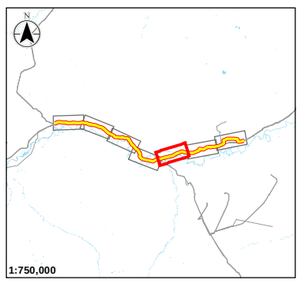

- Road
- Railway
- Watercourse
- Existing Right of Way
- Freshwater Atlas Wetland
- Old Growth Management Area within Local Assessment Area
- Old Growth Management Area outside Local Assessment Area
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Ecological Communities of Interest
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Client/Project
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Environmental and Socio-Economic Assessment

Figure No.
9-2

Title
Wyndwood Expansion Project
Vegetation and Wetland Site Inspection Locations and Ecological Communities of Interest
Sheet 5 of 7

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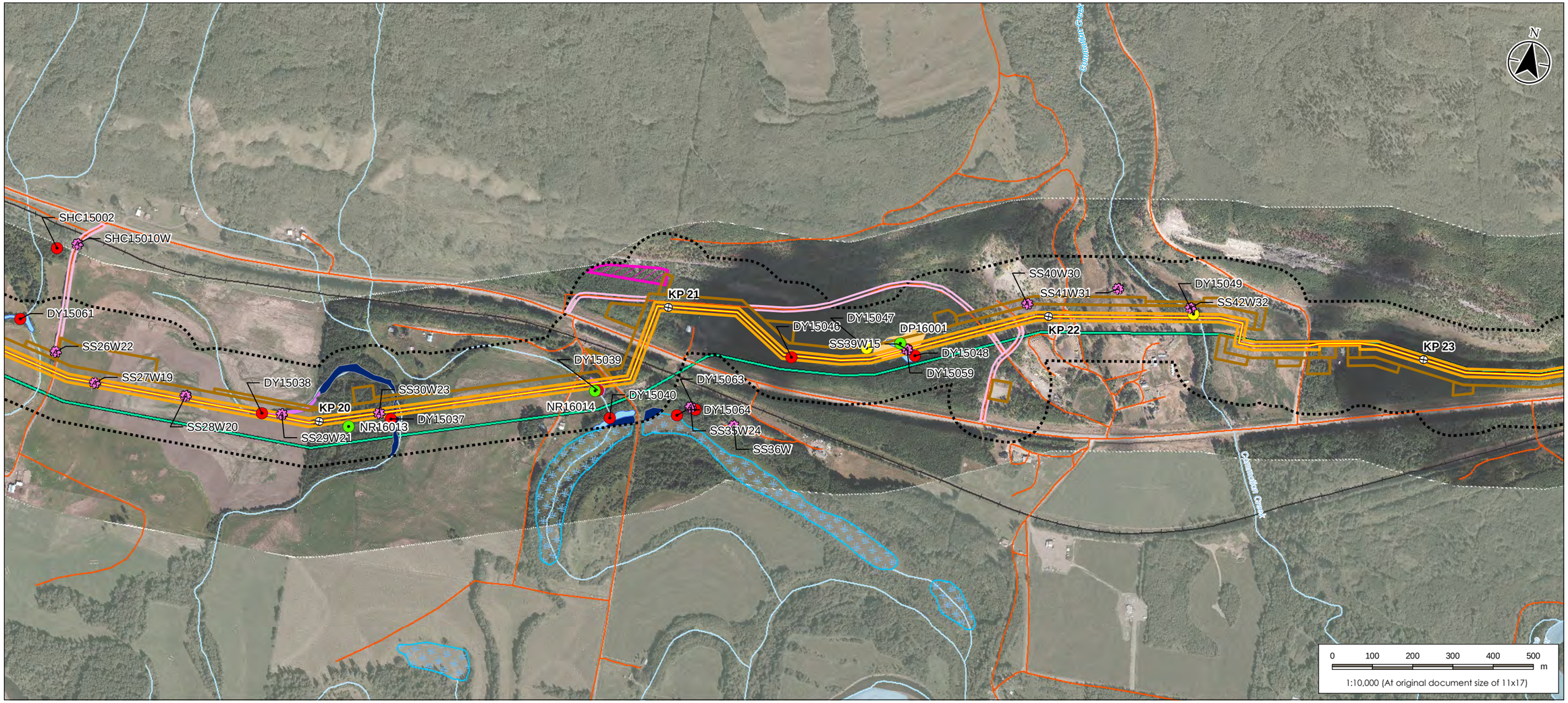

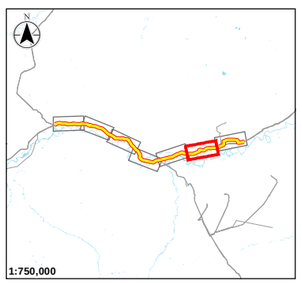

- Road
- Railway
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Ecological Communities of Interest
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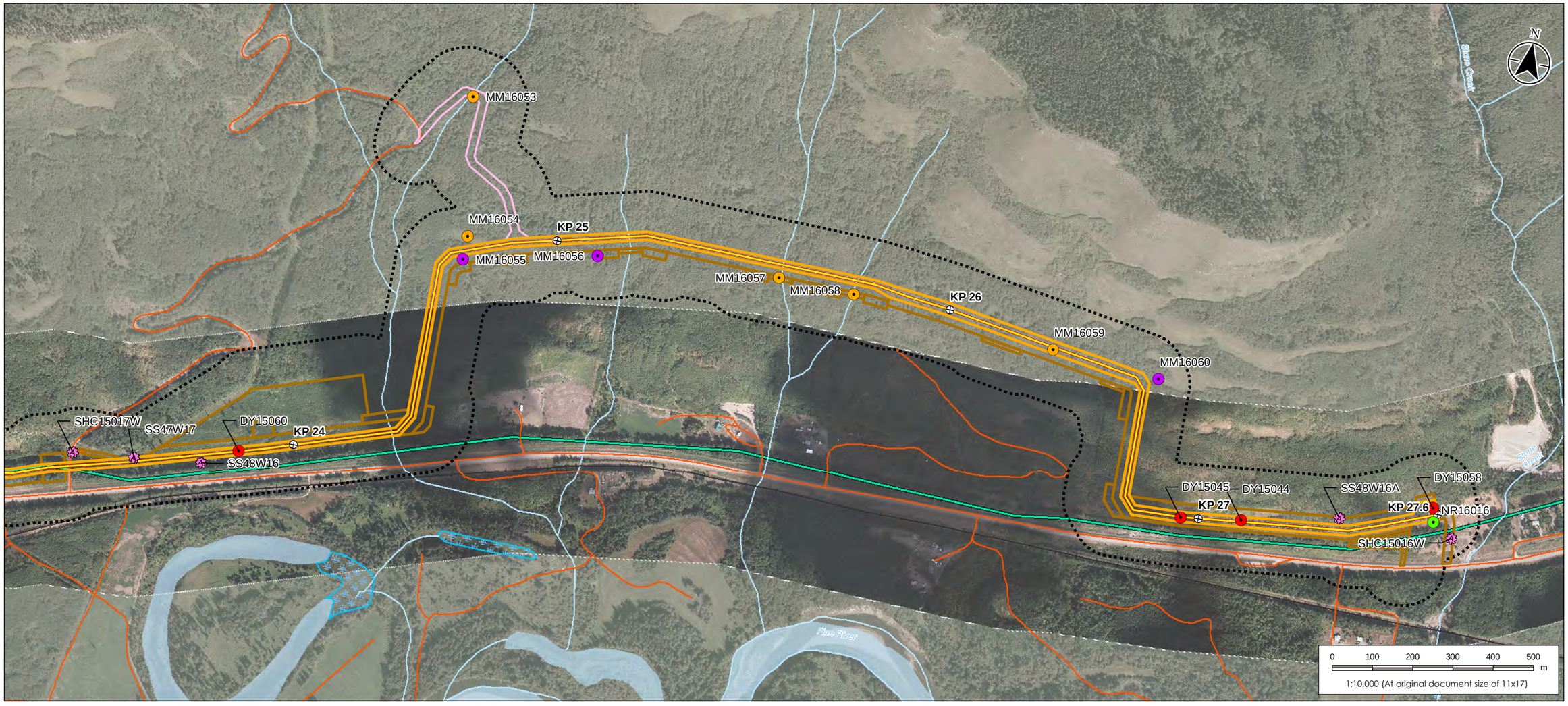
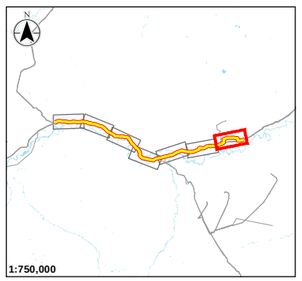
Environmental and Socio-Economic Assessment

Figure No.
9-2

Title
Wyndwood Expansion Project
Vegetation and Wetland Site Inspection Locations and Ecological Communities of Interest
Sheet 6 of 7





- Road
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Vegetation Plot Detail

- Ground Inspection (2015)
- Visual Inspection (2015)
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Ecological Communities of Interest

- Blue-listed
- Blue-listed Wetland
- Blue-listed Wetland; Other
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Figure No.
9-2

Title
Wyndwood Expansion Project
Vegetation and Wetland Site Inspection Locations and Ecological Communities of Interest
Sheet 7 of 7

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10 WILDLIFE AND WILDLIFE HABITAT

Wildlife and Wildlife Habitat was selected as a VC because of the potential to interact with Project activities and because it is considered by the proponent, the public, Aboriginal Groups, the scientific community, and government agencies to have ecological, aesthetic, recreational, economic and cultural importance.

The Project will interact directly and indirectly with wildlife and wildlife habitat. Potential effects include direct and indirect habitat loss, increased mortality risk, and disruption of movement patterns.

The wildlife and wildlife habitat assessment is linked to the assessments for other VCs, including Atmospheric Environment (Section 5), Acoustic Environment (Section 6), Fish and Fish Habitat (Section 8), and Vegetation and Wetlands (Section 9). The Wildlife and Wildlife Habitat assessment is informed by the descriptions of the baseline conditions for these VCs and the residual effects predictions for these VCs are evaluated for their potential to affect Wildlife and Wildlife Habitat. Information on Wildlife and Wildlife Habitat is also relevant to Land and Resource Use (Section 12).

10.1 SCOPE OF ASSESSMENT

This section describes the scope of the Wildlife and Wildlife Habitat assessment including regulatory setting, potential environmental effects, measurable parameters, spatial and temporal boundaries, the approach to residual environmental effects characterization, and significance thresholds.

10.1.1 Regulatory Setting

10.1.1.1 Federal Regulatory Requirements

Project effects on Wildlife and Wildlife Habitat are subject to regulatory requirements under the *NEB Act*. For all requirements related to Wildlife and Wildlife Habitat, see Table A-2 in the NEB Filing Manual (NEB 2016).

Some wildlife species in Canada are afforded federal protection through two pieces of legislation: 1994 MBCA and SARA. The MBCA applies to species of migratory birds that are identified in the Act and occur on federal, provincial, and private lands. The MBCA prohibits the disturbance, destruction, or possession of migratory birds, and their nests or eggs (section 5[9]). SARA applies to species that are listed in Schedule 1 of SARA and occur on federal lands. Under SARA, it is prohibited to kill, harm, harass, capture or take an individual designated as extirpated, endangered, or threatened (section 32[1]). SARA requires the Government of Canada to produce recovery strategies for species on Schedule 1 listed as threatened, endangered,

or extirpated. Recovery strategies identify critical habitat for listed species and SARA prohibits the destruction of critical habitat on federal lands.

10.1.1.2 Provincial Regulatory Requirements

Management of wildlife on public lands in BC occurs primarily through the provincial *Wildlife Act*. Under this legislation, provincial biologists manage wildlife populations by regulating and restricting the harvest of individuals. The *Wildlife Act* prohibits the killing, capture, and harassment of native wildlife, except where a permit or regulation allows these activities. Like the MBCA, section 34 of the *Wildlife Act* specifically prohibits disturbance or destruction of any bird or eggs. It is also an offence to destroy the nest of an eagle, peregrine falcon (*Falco peregrinus*), gyrfalcon (*Falco rusticolus*), osprey (*Pandion haliatus*), heron or burrowing owl (*Athene cunicularaia*), regardless of the time of year.

Section 103 of the BC OGAA, explains that certain wildlife or wildlife habitat may be subject to specific environmental protection and management regulations. The regulations could apply to wildlife, wildlife habitat, trees, other wildlife habitat features, biodiversity, ungulate winter ranges (UWR), and wildlife habitat areas (WHA). As an example, several UWRs and WHAs have been designated under the Forest Practices Code and subsequently adopted under the FRPA. Those UWRs and WHAs that were legally established under the FRPA have been continued by Order to apply under the OGAA and Environmental Protection and Management Regulation. Under OGAA, effective management of the WHAs and UWRs is the direct responsibility of the BC OGC, which determines whether or not to issue a permit for oil and gas activity. Subsequently, oil and gas activity may be subject to General Wildlife Measures prescribed within the legal Order that designates UWRs and WHAs.

10.1.2 Selection of Potential Environmental Effects and Measurable Parameters

Potential environmental effects on Wildlife and Wildlife Habitat are direct and indirect habitat loss, increased mortality risk, and disruption of movement patterns. These effects, associated measurable parameters, and the rationale for their selection are provided in Table 10-1.

Table 10-1 Potential Effects and Measurable Parameters for Wildlife and Wildlife Habitat

Potential Effect	Rationale for Inclusion of the Potential Project Effect in the Assessment	Measurable Parameter(s) for the Effect	Rationale for Selection of the Measurable Parameter
Change in Habitat Availability	Project activities may result in the direct loss, alteration and fragmentation of wildlife habitat, and indirect loss of habitat due to sensory disturbance.	• Amount (ha) of focus species habitat directly affected (lost) by the Project (quantitative) • Indirect habitat loss due to sensory disturbance (qualitative)	The measurable parameters are focused on quantifying direct and indirect loss of habitat.
Change in Mortality Risk	Vegetation clearing, increased traffic, attraction to facilities and other human activities, and encounters with equipment or Project components (e.g., trenching), may increase mortality risk.	• Risk (qualitative) of mortality due to vegetation clearing, site preparation and maintenance • Risk (qualitative) of collisions with Project vehicles • Risk (qualitative) of adverse human-wildlife interactions • Risk of mortality due to increased human and predator access (quantitative for caribou as defined in the recovery strategy (EC 2014a) and qualitative for other species)	The measurable parameters are focused on the most likely sources of wildlife mortality associated with the Project.
Change in Movement Patterns	Project activities may create impermeable or semi-permeable barriers across wildlife movement corridors.	• Increase in existing ROW width • Number of intersections of PDA with known or potential wildlife movement corridors	The measurable parameters address the primary mechanism for disruption of movement patterns associated with the Project.

10.1.3 Boundaries

The spatial and temporal boundaries for the assessment of Project effects on Wildlife and Wildlife Habitat are described in the following sections.

10.1.3.1 Spatial Boundaries

Spatial boundaries used to assess Project and cumulative effects on Wildlife and Wildlife Habitat are described as follows:

- The PDA is the physical footprint of the Project, and includes an approximately 70 m wide pipeline ROW (consisting of a 20 to 35 m permanent ROW and 20 to 60 m intermittent temporary workspace). The PDA is 170.9 ha in size. For the assessment of potential Project effects on caribou, only the section of the PDA that is within current caribou habitat as defined by the Province (BC MOE 2013) and the federal recovery strategy (EC 2014a) is included; that is, 30.4 ha within the Moberly/Klinse-Za herd, 35.2 ha within the Burnt Pine herd, and 49.9 ha within Type 2 Matrix habitat (i.e., outside of herd ranges).
- The LAA is defined by a 1 km buffer around the entire PDA. The LAA encompasses the area within which Project-related effects on wildlife and wildlife habitat can be predicted or measured with a level of confidence that allows for assessment, and there is a reasonable expectation that those potential effects on wildlife and wildlife habitat will be of concern. The LAA is 6,180 ha in size. The caribou LAA is 6,179 ha and includes 993 ha within the Moberly/Klinse-Za caribou herd range, 1,821 ha within the Burnt Pine herd range, and 1,295 ha within Type 2 Matrix habitat.
- The RAA is defined by a 15 km buffer around the entire PDA. The RAA provides the context for determining the significance of Project-specific effects. It is also the area within which potential cumulative effects—the residual effects from the Project in combination with those of past, present and reasonably foreseeable projects—are assessed. The definition of the RAA is developed based on past experience and professional judgment, with consideration of the larger home ranges of species such as moose and grizzly bear. The RAA is 148,605 ha in size. The RAA within the Moberly/Klinse-Za caribou herd range is 40,527 ha and 33,146 ha within the Burnt Pine herd range.

The spatial boundaries for Wildlife and Wildlife Habitat are presented in Figure 10-1.

10.1.3.2 Temporal Boundaries

See Section 2.4 for the Project schedule and temporal boundaries for this VC.

10.1.4 Residual Environmental Effects Description Criteria

Each residual environmental effect is characterized using multiple descriptors: direction, magnitude, geographic extent, duration, frequency, reversibility, and ecological context (Assessment Methods, Section 4). The definitions for these descriptors as they relate to the Wildlife and Wildlife Habitat assessment are provided in Table 10-2.

Table 10-2 Characterization of Residual Environmental Effects on Wildlife and Wildlife Habitat

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories	
Direction	The long-term trend of the residual effect	Positive	Residual effect moves condition in a positive direction relative to baseline
		Adverse	Residual effect results in a deterioration of a condition relative to baseline
		Neutral	Residual effect is no change from baseline conditions and trends
Magnitude	The amount of change in a measurable parameter relative to its existing conditions	Change in Habitat: Expressed as percentage change in ha within the LAA	
		Change in Mortality Risk and Change in Movement Patterns: Low—Residual effect is detectable; however, has no measurable effect on the long-term persistence or viability of a wildlife species within the RAA Moderate— Residual effect is unlikely to pose a risk to the long-term persistence or viability of a wildlife species within the RAA High— Residual effect will likely affect the long-term persistence or viability of a wildlife species within the RAA	
Geographic Extent	The geographic area in which a residual effect occurs	PDA	Residual effect limited to the PDA (i.e., construction ROW and footprints associated with constructing the pipeline and facilities)
		LAA	Residual effect extends to the LAA (defined as a 1 km buffer on the PDA)
		RAA	Residual effect extends beyond the LAA to the RAA (defined as a 15 km buffer on the PDA)
Duration	The time until the Project residual effect on wildlife and wildlife habitat can no longer be measured or otherwise perceived	Short-term	Residual effect is restricted to the construction phase
		Medium-term	Residual effect occurs throughout the construction phase and up to 25 years during operation
		Long-term	Residual effect continues beyond the life of the Project
Frequency	How often during the Project does the residual effect occur	Single	Single event
		Multiple/ Irregular	Multiple irregular event (no set schedule)
		Multiple/ Regular	Multiple regular event (scheduled)
		Continuous	Residual effect occurs continuously
Reversibility	Whether or not the changes to a measurable parameter due to the Project can be reversed after Project activity ceases	Reversible	Residual effect expected to return to baseline conditions, through active management and mitigation or decommissioning
		Irreversible	Residual effects is permanent and will persist beyond the life of the Project

Table 10-2 Characterization of Residual Environmental Effects on Wildlife and Wildlife Habitat

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories	
Ecological Context	State of existing conditions and trends in relation to habitat in the area where effects occur	Undisturbed	Area is relatively undisturbed or not adversely affected by human activity
		Disturbed	Area has been altered or disturbed by human development or human development is still present

10.1.5 Significance Thresholds for Residual Environmental Effects

Most evidence supports a 30% habitat retention threshold (i.e., maximum 70% habitat loss) at the landscape level to avoid rapid population declines that could lead to regional extirpation (Andrén 1994, Fahrig 1997, Swift and Hannon 2010). For this assessment, a more conservative 80% habitat retention threshold (i.e., 20% loss) within the LAA was used as part of the determination of whether or not a residual effect is significant. The recovery strategy for southern mountain caribou (EC 2014a) indicates a threshold of 65% undisturbed habitat within caribou matrix habitat that provides low predation risk, defined as wolf population densities less than three wolves/1,000 km^2. However, EC does not provide data on how much habitat is already disturbed within southern mountain caribou range. Other residual effects characterization criteria, such as extent, duration, and reversibility, were also taken into consideration. There are no provincial or federal habitat thresholds identified for any other wildlife species potentially affected by the Project.

There are no prescribed thresholds for the qualitative assessment of Project effects on mortality risk and movement patterns; therefore, determination of significance is based on logical reasoning and professional judgment. In addition to magnitude and duration, considerations included status, size and range of the affected wildlife species, broad-scale habitat conditions, area-specific policies for land use and species management, and prediction confidence.

10.2 EXISTING CONDITIONS

Residual effects are measured and characterized relative to the existing (baseline) conditions. This section presents an overview of the existing conditions for Wildlife and Wildlife Habitat within the LAA and RAA. More details are provided in the Wildlife Technical Memorandum (Appendix B.4).

10.2.1 Methods

The description of the existing conditions is based on a review of existing information, the results of a baseline wildlife field program, and habitat mapping. These information sources are described in the following sections.

10.2.1.1 Review of Existing Information

A review of existing information, including provincial spatial data layers and databases (i.e., BC CDC's Species and Ecosystems Explorer), and scientific literature, was conducted to determine the presence of wildlife and wildlife habitat within the LAA and RAA (see Section 10.2.2.1). The review focused on species of management concern. Additional detail on the review of existing information is presented in Appendix B.4.

10.2.1.2 Field Program

The wildlife field program consisted of three components: a wildlife habitat features survey, a breeding bird survey, and a pond-breeding amphibian survey. The objectives of the field program were to:

- Document the presence of wildlife habitat features (e.g., dens, mineral licks) within and adjacent to the PDA
- Identify amphibian species and amphibian breeding sites, and migratory bird species present during the breeding season within the LAA, with particular focus on federally-listed species at risk

In addition, incidental observations of wildlife and wildlife sign (e.g., tracks, scat) made during the wildlife and other field program surveys were recorded. The wildlife habitat features surveys were conducted from September 23 to 27, 2015, October 16 to 18, 2015, and September 13, 2016. The breeding bird and amphibian surveys were conducted on June 14 and from June 28 to 30, 2016. Detailed methods of all surveys are presented in Appendix B.4.

10.2.1.3 Habitat Mapping

Habitat was mapped for 13 species selected as focus species for the assessment of Project effects on habitat availability. These focus species are known to occur within the RAA and meet one or more of the following criteria:

- Listed on Schedule 1 of SARA and likely to be vulnerable to Project effects on habitat[2]
- Identified by Aboriginal Groups and other stakeholders as being important species for hunting and trapping
- Can act as a surrogate for assessing Project effects on habitat availability for other species

[2] Two bat species that occur within the RAA, northern myotis (*Myotis septentrionalis*) and little brown myotis (*Myotis lucifugus*), are designated as endangered and are on Schedule 1 of SARA; however, the key concern for these species is white-nose syndrome rather than habitat loss (COSEWIC 2013). These species were not selected as focus species (although the potential effects of the Project on their roosting habitat can be inferred from focus species that require mature or old forest [e.g., fisher (*Pekania pennanti*)]). Project activities are not an effect pathway for white-nose syndrome.

Thirteen wildlife focus species were selected for the assessment of Project effects on habitat availability (Table 10-3). Four of the wildlife focus species included in Schedule 1 of SARA have associated recovery strategies released by EC: woodland caribou (*Rangifer tarandus*), common nighthawk (*Chordeiles minor*), olive-sided flycatcher (*Contopus cooperi*), and Canada warbler (*Cardellina canadensis*). Critical habitat has been defined for the southern mountain population of woodland caribou (EC 2014a) and is defined as:

- All of the area of high elevation winter and/or summer range
- Low elevation winter range and Type 1 Matrix range in a perpetual state of a minimum of 65% undisturbed habitat in order to provide an overall ecological condition that will allow for an ongoing recruitment and retirement cycle of habitat
- Type 2 Matrix range that provides connectivity between herds and an overall ecological condition that will allow for low predation risk, defined as wolf population densities less than 3 wolves/1,000 km^2

Baseline wildlife habitat availability within the LAA was mapped using Land Cover Circa 2000 Vector data (GeoBase 2011). These spatial data were supplemented with more detailed wetland mapping prepared using high-resolution multispectral two-dimensional imagery in conjunction with detailed topographic information (derived from remotely sensed LIDAR)[3].

A spatial data layer of existing disturbances within the LAA was also applied as described in Section 9.1.1.

Disturbance layers also included polygons such as: cutblocks, inactive industrial areas, primary industrial areas, rural residential areas, tertiary industrial areas, and active airstrips.

Table 10-3 Wildlife Focus Species for Assessment of Project Effects on Habitat Availability

Selected Focus Species		SARA Schedule 1[1]	Provincial Status[2]
Common Name	Scientific Name		
Woodland Caribou (southern mountain population)	*Rangifer tarandus caribou* pop. 15	T	Blue
Grizzly bear	*Ursus arctos*	-	Blue
Moose	*Alces*	-	Yellow
American marten	*Martes americana*	-	Yellow
Fisher	*Pekania pennanti*	-	Blue
Black bear	*Ursus americanus*	-	Yellow
Yellow rail	*Coturnicops noveboracensis*	SC	Red
Common nighthawk	*Chordeiles minor*	T	Yellow
Short-eared owl	*Asio flammeus*	SC	Blue

[3] This detailed wetlands mapping was an expansion of what was prepared for the smaller vegetation and wetlands LAA (see Section 9.2).

Table 10-3 Wildlife Focus Species for Assessment of Project Effects on Habitat Availability

Selected Focus Species		SARA Schedule 1[1]	Provincial Status[2]
Common Name	Scientific Name		
Olive-sided flycatcher	*Contopus cooperi*	T	Blue
Canada warbler	*Cardellina canadensis*	T	Blue
Rusty blackbird	*Euphagus carolinus*	SC	Blue
Western toad	*Anaxyrus boreas*	SC	Blue

NOTES:

1 SC = (special concern) a species of special concern because of characteristics that make it particularly sensitive to human activities or natural events. T = (threatened) a species that is likely to become endangered if limiting factors are not reversed (BC CDC 2015).

2 Yellow = species that are apparently secure and not at risk of extinction. Yellow-listed species may have red- or blue-listed subspecies (BC CDC 2015).

Blue = indigenous species or subspecies considered to be of Special Concern (formerly Vulnerable) in BC and are particularly sensitive or vulnerable to human activities or natural events. Blue-listed taxa are at risk, but are not Extirpated, Endangered or Threatened.

Red = indigenous species or subspecies that have, or are candidates for, Extirpated, Endangered, or Threatened status in BC.

Mapping the habitat availability of focus species was completed by selecting for the season and life requisite of interest in each species (e.g., spring/summer breeding) and identifying land cover classes present within the LAA that represent the specific required habitat attributes (Table 10-4). The maps were developed through a review of literature on species-habitat associations, knowledge of local environmental conditions, and habitat attributes identified in the land cover classes[4]. Table 10-5 provides a list of land cover classes that were identified as associated with habitat attributes for each focus species.

[4] Some species-specific attributes (e.g., coarse woody debris, snags, understory shrub and ground cover) could not be factored into the determination of available habitat due to the broad nature of the land cover class descriptions.

Table 10-4 Wildlife Focus Species Habitat Attributes Selected for Mapping Habitat Availability

Species	Season(s)/Life Requisite	Habitat Description	Source
Woodland Caribou (southern mountain population)	Year round living	• Wind-swept alpine slopes in winter and summer • Adjacent subalpine forest in winter and summer • Use of low elevation forest habitats in winter (pine, spruce, wetlands)	• EC 2014a • BC MOE 2014
Grizzly Bear	General living (non-winter)	• Mosaic of forested and open habitats • Meadows, forest openings, wetlands, floodplains, riparian areas • Abundance of berry-producing shrubs, grasses, sedges	• COSEWIC 2002a • BC MWLAP 2004 • Gyug et al. 2004
Black Bear	General living (non-winter)	• Mosaic of forested and open habitats • Meadows, forest openings, wetlands, riparian areas for feeding • Mature and old forest for cover • Abundance of berry-producing shrubs, grasses, sedges	• Blood and Paquet 2001 • Hatler et al. 2008
Moose	General living (year round)	• Mosaic of mature forest, shrubby openings, and riparian areas and wetlands • Willow-dominated wetlands with high shrub abundance • River valleys and floodplains	• Blood 2000 • Gillingham and Parker 2008a,b
American Marten	General living (year round)	• Mature and old coniferous forest • Spruce and fir dominated • Closed canopy • Abundant coarse woody debris	• Buskirk and Powell 1994 • Buskirk and Ruggiero 1994 • Hatler et al. 2008
Fisher	General living (year round)	• Mature and old forest with complex structure and dense canopy • Large, old cottonwood trees • Major riparian corridors	• Badry 2004 • Hatler et al. 2008 • Weir et al. 2011

Table 10-4 Wildlife Focus Species Habitat Attributes Selected for Mapping Habitat Availability

Species	Season(s)/Life Requisite	Habitat Description	Source
Short-eared Owl	Breeding (spring/summer)	• Open country with short vegetation • Grassland, rangeland, marshes, forest clearings, scrubland • Abundance of prey (voles)	• Cooper and Beauchesne 2004 • Wiggins et al. 2006 • COSEWIC 2008
Common Nighthawk	Breeding (spring/summer)	• Open, sparsely vegetated ground • Clearings, gravel habitat, grassland, rocky outcrops	• EC 2015a
Olive-sided Flycatcher	Breeding (spring/summer)	• Old coniferous or mixedwood forest • Snags or residual live trees • Canopy openings or edge habitat • Often close to water	• EC 2015b
Canada Warbler	Breeding (spring/summer)	• Moist forests with dense, deciduous shrub layer and complex understory • Young and mature aspen-dominated forest	• EC 2015c
Yellow Rail	Breeding (spring/summer)	• Small (20 ha), shallow wetlands • Meadows, fens, bogs, wet hayfields, floodplains • Emergent-dominated wetlands with sedges or grasses	• Bookhout 1995 • EC 2012 • Wilson 2005 • COSEWIC 2009
Rusty Blackbird	Breeding (spring/summer)	• Coniferous forest wetlands • Bogs, fens, muskegs, swamps, wet shrubby meadows, lake margins with trees or tall shrubs	• Campbell et al. 2001 • COSEWIC 2006 • Powell et al. 2010
Western Toad	Breeding (spring/summer)	• Natural or artificial wetlands with sandy bottom • Ponds, bogs, fens, slow-moving streams, lake margins, road ditches, road ruts • Shallow water (< 30 cm) • Submergent vegetation	• Matsuda et al. 2006 • COSEWIC 2002b

Table 10-5 Land Cover Class and Habitat Type Associations for Wildlife Focus Species

Land Cover Class	General Living Habitat (Non-Winter)		General Living Habitat (Year-Round)				Breeding Habitat						
	Grizzly bear	Black bear	Woodland caribou	Moose	American marten	Fisher	Short-eared owl	Common nighthawk	Olive-sided flycatcher	Canada warbler	Yellow rail	Rusty blackbird	Western toad
Exposed Land								✓					
Shrub Tall	✓	✓	✓	✓									
Shrub Low	✓	✓	✓	✓				✓					
Wetland-Treed	✓	✓	✓	✓	✓	✓			✓			✓	✓
Wetland-Shrub	✓	✓	✓	✓								✓	✓
Wetland-Herb	✓	✓	✓	✓							✓	✓	✓
Herb	✓	✓	✓	✓			✓	✓					
Coniferous Dense			✓	✓									
Coniferous Open	✓	✓	✓	✓	✓	✓			✓				
Coniferous Sparse	✓	✓	✓	✓		✓		✓	✓				
Broadleaf Dense	✓	✓		✓	✓	✓				✓			
Broadleaf Open	✓	✓		✓	✓	✓				✓			
Broadleaf Sparse	✓	✓		✓						✓			
Mixedwood Open	✓	✓	✓	✓	✓	✓			✓	✓			
Cropland							✓	✓					
Grassland	✓	✓	✓	✓			✓	✓					
Perennial Crop and Pasture							✓	✓					
Primary and Secondary Road													

Table 10-5 Land Cover Class and Habitat Type Associations for Wildlife Focus Species

Land Cover Class	General Living Habitat (Non-Winter)		General Living Habitat (Year-Round)				Breeding Habitat						
	Grizzly bear	Black bear	Woodland caribou	Moose	American marten	Fisher	Short-eared owl	Common nighthawk	Olive-sided flycatcher	Canada warbler	Yellow rail	Rusty blackbird	Western toad
Railway													
Runway													
Residential Area													
Building													
Oil and Gas Facility													
Oil and Gas Well													
Transmission Line	✓	✓		✓			✓	✓					
Pipeline active	✓	✓		✓			✓	✓					
Pipeline abandoned	✓	✓		✓			✓	✓					
Trail/Cutline	✓	✓		✓			✓	✓					
Cut block	✓	✓		✓			✓	✓					

10.2.2 Overview

10.2.2.1 Review of Existing Information

The review of existing information suggests that 27 species of conservation concern are known or likely to occur within the LAA (Appendix B.4). The Project does not overlap with any designated wildlife areas (e.g., UWRs or WHAs) or any parks or protected areas, but it does overlap with caribou critical habitat (see Appendix B.4). Approximately 43% of the PDA is on private property and 17% falls within range tenure.

The Project overlaps caribou habitat from KP 0 to KP 18+300. The Project intersects the Moberly/Klinse-Za caribou herd range for 5.2 km and the Burnt Pine caribou herd range for 6.3 km. Details on existing conditions for caribou are provided in the preliminary CHRP (Appendix I of the EPP). In summary, the Project overlaps matrix habitat delineated by BC MFLNRO. Areas within caribou range are identified as Type 1 matrix habitat and areas outside herd ranges is identified as Type 2 matrix habitat, which is consistent with critical habitat defined in the *Recovery Strategy for the Woodland Caribou, Southern Mountain population (*Rangifer tarandus caribou*) in Canada* (EC 2014a). Matrix habitat includes areas between winter and summer ranges, areas between herds that allow for movement between herds that contribute to the genetic diversity, and areas that allow for low predation risk (wolf population densities of less than three wolves/1,000 km^2) (EC 2014a).

The Project ROW is 100% parallel with an existing ROW for portions occurring within the Moberly/Klinse-Za herd range and 88% parallel with an existing ROW for portions occurring within the Burnt Pine herd range.

The Project intersects two Grizzly Bear Population Units (GBPUs): 18.3 km is within the Moberly GBPU (71 bears) and 9.3 km is within the Hart GBPU (244 bears) (BC MOE 2012).

Sources of wildlife mortality are generally only understood or quantified at broad scales (e.g., incidental take of birds) or for certain species groups (e.g., hunted and trapped species). Consequently, data are not available to quantify existing wildlife mortality risk within the LAA and RAA. However, existing sources of mortality within the LAA include road networks, ongoing forest harvesting (i.e., incidental take), and hunting and trapping[5].

Wildlife movement patterns within the LAA and RAA have already been disrupted and adjusted to some extent due to the presence of the existing ROW and other linear developments (e.g., seismic lines, provincial highway) and patch disturbances (e.g., cutblocks). Numerous wildlife trails were observed within the LAA during the field program (e.g., a moose trail through a grassy area); however these trails did not appear to be primary or fixed travel routes exhibiting repeated use (Appendix B.4).

[5] See Section 13 (Land and Resource Use) for a description of existing conditions for hunting and trapping.

10.2.2.2 Field Program

Appendix B.4 provides details on the results of the field program. In summary, 30 wildlife habitat features were identified during the surveys:

- Two bear dens near KP 2 and KP 17
- three potential fisher dens (one near KP 13.5 and two near KP 25)
- swallow colonies near KP 3 and KP 21
- two potential raptor nests near KP 21 and KP 25
- 17 potential western toad breeding sites
- Two trumpeter swan breeding sites near KP 3 and KP 13, and two small mineral licks near KP 25 and KP 26.

Based on their proximity to the PDA, only 16 of these habitat features have been identified as potentially requiring specific mitigation: the two black bear dens, eight of the potential western toad breeding sites, one raptor stick nest (likely red-tailed hawk), one mineral lick, two potential fisher dens, and two trumpeter swan nesting sites.

10.2.2.3 Habitat Mapping

Based on Land Cover Circa 2000 Vector data, the dominant land cover classes within the LAA are herb, broadleaf open forest and coniferous open forest, comprising 71% of the total area of the LAA. The PDA is highly disturbed, with 49% currently used for industrial purposes (e.g., oil and gas, transportation, or forestry).

Table 10-5 summarizes the habitat identified within the LAA. Among the focus species considered, general living habitat conditions for moose, grizzly bear and black bear was the most common habitat present. This was followed by general living habitat suitable for fisher and marten.

10.3 PROJECT INTERACTIONS

Table 10-6 identifies Project activities that may interact with Wildlife and Wildlife Habitat. These interactions are discussed in Section 10.5 as they relate to residual effect predictions. Those project activities not expected to interact with the VC (e.g., "-") are not carried through the effects assessment.

Table 10-6 Potential Project Environmental Effects on Wildlife and Wildlife Habitat

Associated Activities and Equipment	Potential Effect On Change in Habitat Availability	Potential Effect On Change in Mortality Risk	Potential Effect On Change in Movement Patterns
Pre-Construction and Pipeline Construction (Pipeline construction)			
Engineering	-	-	-
Surveying	✓	✓	✓
Clearing	✓	✓	✓
Grubbing	✓	✓	✓
Topsoil Salvage	✓	✓	✓
Grading	✓	✓	✓
Vehicle Stream Crossings	-	✓	✓
Blasting	-	✓	✓
Trenching*	-	✓	✓
Stringing (i.e., pipe is lined up along the ROW)	-	-	✓
Pipeline Stream Crossings	-	-	✓
Lowering-in and Tie-In	-	-	✓
Hydrostatic Testing	-	-	-
Backfilling	-	-	✓
Clean-up and Reclamation	✓	-	-
Operation Activities (from Table 2-5)			
ROW Inspection	-	-	✓
Vegetation Maintenance	✓	✓	✓
Pipeline Cleaning, Maintenance, and Testing	-	-	-
Site Inspections	-	-	-

NOTES:
✓ Indicates the activity is likely to contribute to the potential effect.
- Indicates that an activity is unlikely to contribute to the potential effect.

Interactions between the Project and Wildlife and Wildlife Habitat would not be expected in situations where the activity does not occur on site (e.g., engineering) or where there is no physical disturbance (e.g., testing). There are also activities that may not interact with all three potential effects based upon the characteristics of that activity. For example, pipe stringing creates a potential physical barrier to wildlife movement, however does not affect mortality risk or habitat availability.

Changes in habitat availability, mortality risk, and movement patterns are assessed further in Sections 10.5.2, 10.5.3, and 10.5.4, respectively.

10.4 MITIGATION

Standard industry practices and avoidance measures, and specific mitigation measures provided within the Spectra EMCPC (Spectra 2014) will be implemented, where practical, during all phases of the Project. Additional mitigation measures are described within the Project EPP (Appendix A)[6] and the Caribou Habitat Restoration Plan (CHRP) (Appendix I of EPP). Key mitigation measures are summarized in Table 10-7.

[6] Results of the wildlife field program (Section 10.2.1.2 provide information on species presence, distribution, and habitat use, and the location of specific wildlife habitat features. These results were considered in the development of the Project EPP.

Table 10-7 Mitigation Measures for Wildlife and Wildlife Habitat

Potential Effect	Mitigation Measures
Change in habitat availability	• ROW has been designed to follow and share space with existing disturbances as much as possible. Construction activities will be restricted to the designated ROW and approved intermittent TWS and access roads. • The extent of clearing will be limited and existing habitat conditions preserved where practical. • Environmentally sensitive features (e.g., nests, mineral licks, dens, wetlands) will be flagged or fenced off in the field before clearing and construction. Buffer distances will be based on direction from provincial and federal best management practices. Major game trails will be cleared of brush piles and felled trees where practical. • To avoid effects to mineral licks, maintain 100 m buffer, where feasible, from April to October (BC OGC 2016b). If it is not possible to maintain 100 m buffer during this period, additional mitigation measures, such as maintaining trees to provide a buffer, or snow fencing erected between ROW and mineral lick to prevent encroachment by construction crews. • Any previously unidentified sensitive habitat features will be reported, and appropriate mitigation implemented. • Equipment used for construction and operation activities will be maintained in good working order and properly muffled to reduce air pollution and unnecessary noise. • The intermittent TWS will be allowed to regenerate naturally. • Westcoast has developed a CHRP (Appendix I of EPP) that will include construction and post-construction mitigation measures to avoid and limit habitat loss, and restore on-site conditions when working within caribou herd range. Westcoast will develop a monitoring program using an adaptive management framework to monitor the implementation and effectiveness of the mitigation measures. • Blasting will not occur when caribou, or any other larger mammals (e.g., grizzly bear), are seen in the immediate blast area. Blast areas will be monitored and if any large mammals are present, blasting will be delayed. • A phased construction schedule approach will be implemented to limit construction activities during the late winter and calving critical period identified for caribou (January 15 to July 15, BC MFLNRO 2014) in caribou habitat. • An EI will be on-site during construction. • Periodic reviews of the caribou telemetry locations provided by BC MFLNRO will occur prior to and during Project activities to avoid conducting activities when and where caribou are present. Where telemetry data suggest caribou are within 1 km of planned Project activities, the activities will be rescheduled to avoid disturbing caribou during the identified critical period. • Avoid routing and disturbance within 250 m of a caribou mineral lick and wildlife trails connecting to mineral licks where practical (BC MFLNRO 2014).

Table 10-7 Mitigation Measures for Wildlife and Wildlife Habitat

Potential Effect	Mitigation Measures
Change in habitat availability (cont'd)	• Avoid routing and disturbance, including aerial activities, within 500 m of designated caribou habitat areas (e.g., HEWR). • Provide gaps and breaks along the ROW facilitating caribou movement. • Shrubs (non-preferred browse for moose and deer) and trees at least 1.2 m tall will be planted in strategic locations where the Project creates line-of-sight >500 m (Appendix I of EPP). • Cement (jersey) barriers will be used to enhance access control at locations because rollback or berm material (e.g., rock) is not available. • If caribou are encountered, staff will follow best practices for avoiding disturbance to caribou (Appendix I of EPP) (BC MOE 2013; BC MFLNRO 2014).
Change in mortality risk	• Clearing activities, if possible should be conducted outside the primary breeding bird window (April 25 to August 8 in the Peace Region) (EC 2014b), where feasible. For any clearing required during the breeding bird window, a nest survey will be done prior to clearing to identify and apply a buffer (setback) to any active nests until chicks have fledged. If nest searches are required, any active nests identified prior to clearing will be flagged and/or fenced off in the field and a buffer will be maintained until the nest is no longer active. Buffer distances will be based on direction from provincial and federal best management practices. • Construction will be avoided, where feasible, during the critical period identified for trumpeter swan (April 1 to August 31, BC MFLNRO 2014) within 200 m from the high water mark of active trumpeter swan breeding sites (BC OGC 2016b). If not feasible, the duration of work in within the buffer will be reduced to the greatest extent possible. • Where feasible, construction will be avoided in wetlands containing western toad egg masses and tadpoles during the breeding period for western toad (early May to mid-August in the Peace Region). • If construction cannot be avoided during the breeding period for western toad, an amphibian survey will be conducted prior to construction within previously identified breeding wetlands to identify the presence of western toad individuals, eggs, or tadpoles. • During the pre-construction survey if western toad breeding habitat is identified within 30 m of the Project footprint, Project activities are likely to affect western toad juvenile dispersal. Silt fencing will be used to prevent dispersing juvenile toads from moving into Project clearing or construction areas from nearby wetlands. • During the pre-construction survey, if avoidance of western toad breeding habitat is identified as not feasible, western toad egg, tadpole, juvenile, and/or adult salvage will be implemented to mitigate mortality risk. Westcoast will contact the appropriate regulator, acquire the necessary permits, and use best practices for salvage and relocation. • The intermittent TWS will be located to avoid the identified wetlands. • Maintain a 60 m buffer on active bear dens during construction (between November 15 and May 1, depending on the season)

Table 10-7 Mitigation Measures for Wildlife and Wildlife Habitat

Potential Effect	Mitigation Measures
Change in mortality risk (cont'd)	• Clearing of trees identified as potentially supporting a fisher den will be avoided during the critical period identified for fisher natal denning and early rearing (March 15 to June 30; BC MFLNRO 2014). If clearing of identified potential fisher den trees cannot be avoided during the critical period, a qualified biologist will conduct an assessment of the potential fisher dens prior to clearing, early on in the denning season to determine if the dens identified within the PDA are active and whether or not they are confirmed as used by fisher. If the dens are determined to be fisher dens and they are active (i.e., in use), a setback will be established in consultation with the appropriate regulatory agency (MFLNRO) where clearing will be avoided until the young and adults have left the den site. • Feeding or harassment of wildlife will be prohibited. • No waste will be disposed of on-site. Waste will be taken to the main office yard at night. It will be stored on-site in a bear-proof container until taken to an approved facility. • Low vehicle speeds on roads will be enforced. • Recreational use of all-terrain vehicles along ROW and other construction areas will be prohibited. • Unauthorized entry will be discouraged using signs and gates at appropriate locations. • Project-related wildlife deaths and nuisance animals will be immediately reported to appropriate authorities. • As described above, Westcoast will develop and implement a CHRP that will include construction and post-construction mitigation measures to avoid and limit mortality risk to caribou when working within caribou herd range. Westcoast will develop a monitoring program using an adaptive management framework to monitor the implementation and effectiveness of the mitigation measures.
Change in movement patterns	• ROW will be aligned to follow and share space with existing disturbances as much as possible. Construction activities will be restricted to the designated ROW and approved work space and access roads. • The extent of clearing will be limited and existing habitat conditions preserved to the extent practical. • To facilitate the movement of wildlife, trenching operations will be followed as closely as practical by backfill operations. Gaps will be created in windrows, strung pipe and open trenches to allow for the potential movement of wildlife across the ROW at well-defined wildlife trails.

10.5 RESIDUAL EFFECTS

Project effects on Wildlife and Wildlife Habitat are evaluated based on changes in wildlife habitat availability, mortality risk, and movement patterns. The analytical methods used to assess the potential effects are described and, for each effect, effect pathways and the residual effects characterization are provided.

10.5.1 Methods

The direct effects of the Project on habitat availability for focus species (i.e., habitat loss) are determined quantitatively using Geographic Information Systems (GIS) to overlay the PDA on the land cover class mapping product (see Section 10.2.2.3). The results of this analysis are compared to the total area of habitat available within the LAA at baseline. The indirect effects of the Project on habitat availability resulting from sensory disturbance (i.e., noise) are assessed qualitatively relative to existing (baseline) conditions, based on professional judgment, available literature, and the characteristics of the sources of disturbance in each Project phase.

The effects of the Project on mortality risk are assessed qualitatively for most focus species and quantitatively for caribou relative to the existing (baseline) conditions, based on professional judgment, available literature, and consideration of Project design parameters (e.g., the Project parallels an existing ROW for 86% of its length). The assessment includes a discussion of the potential sources of mortality risk—direct mortality from clearing and other hazards (e.g., trenching), wildlife-vehicle collisions, adverse wildlife-human interactions, and indirect mortality through increased access for humans and predators. For caribou, the assessment of change in mortality risk was assessed quantitatively using the identified areas of disturbance as guided by the methods outlined within the caribou recovery strategy (EC 2014). Baseline disturbance was calculated using human-caused disturbance visible on Landsat imagery at a scale of 1:50,000, including habitat within a 500 m buffer of the human-caused disturbances; and fire disturbance documented in the last 40 years. The Project footprint, buffered by 500 m, was then overlaid onto this disturbance layer to determine the direct and indirect effects of the Project on caribou mortality. Due to the large home range of caribou, and the regional contribution of the Project to disturbance, the analysis of mortality risk to caribou was extended beyond the LAA to also address the larger RAA. Only sections of the RAA that intersect low elevation and Type 1 Matrix range (i.e., within caribou herd range) for Moberly/Klinse-Za and Burnt Pine herds were assessed, as per methods described in the recovery strategy.

The effects of the Project on movement patterns are assessed qualitatively relative to the existing (baseline) conditions, based on professional judgment, available literature, the predicted increase in ROW width, and consideration of Project design parameters (e.g., the Project parallels an existing ROW for 86% of its length). The assessment includes a discussion of the potential effects of the Project on the integrity of any known or potential movement corridors identified by specific topographic features (e.g., riparian corridors, ridges) or areas of contiguous high quality habitat.

10.5.2 Change in Habitat Availability

Site clearing and sensory disturbance from construction activities are the primary effect mechanisms for change in habitat availability. The effect of site clearing will be evident throughout the operation phase, however, activities resulting in sensory disturbance are expected to be low magnitude, short duration and intermittent (e.g., ROW inspection) once construction is completed.

The Project will result in the direct loss of habitat ranging from 1 to 148 ha, depending on the focus species (Table 10-8). This direct loss of habitat is no greater than 5.4% of what is available within the LAA for any focus species (range 0.2 to 5.4%, Table 10-8). There will be some recovery of habitat value within the PDA over time as the intermittent TWS, log deck space and laydown areas are allowed to regenerate during the operation phase. The area of permanent ROW that will be cleared on a regular basis to shrub height maintained throughout the operation phase is 63.6 ha (see Table 2-1, Section 2.3), which represents 37% of the total area of the PDA.

The Project will result in the loss of 44.5 ha of available caribou habitat within Matrix Type 1 and Type 2 range (Table 10-8). Based on land cover types associated with caribou, there is predicted to be a loss of 6.0 ha of habitat within the Moberly/Klinse-Za herd, 24.6 ha within the Burnt Pine herd, and 13.9 ha outside of herd range (i.e., Type 2 Matrix habitat). Habitat types directly affected by the Project include coniferous open and low shrubs within the Moberly/Klinse-Za herd range, herbs and wetland within the Burnt Pine herd range, and herbs and low shrubs outside herd range.

Table 10-8 Change in Habitat Availability for Selected Focus Species within the LAA

Species	Habitat Type	Habitat in the LAA at Baseline (ha)	Habitat Affected by Construction (ha)	Change in Habitat Availability in the LAA (%)
Woodland caribou	Matrix - Total	2,119.8	44.5	-2.1
	Moberly/Klinse-Za Matrix Type 1	537.0	6.0	-1.1
	Burnt Pine Matrix Type 1	1,127.2	24.6	-2.2
	Matrix Type 2 (outside herd range)	455.6	13.9	-3.1
Grizzly bear	General living	5,419	148	-2.7
Black bear	General living	5,419	148	-2.7
Moose	General living	5,425	148	-2.7
American marten	General living	3,133	46	-1.5
Fisher	General living	3,214	46	-1.4
Short-eared owl	Breeding	1,762	96	-5.4
Common nighthawk	Breeding	2,334	56	-2.4
Olive-sided flycatcher	Breeding	921	1	-0.1
Canada warbler	Breeding	2,339	45	-2.0
Yellow rail	Breeding	84	1	-1.2
Rusty blackbird	Breeding	99	1	-1.0
Western toad	Breeding	99	1	-1.0

Noise and human activity may cause wildlife to avoid or underutilize otherwise suitable habitat adjacent to the PDA. This indirect effect on habitat availability will be greatest during construction and applicable for the most sensitive species (e.g., caribou, grizzly bear, and fisher). With the marked reduction in indirect effects during the operation phase, certain wildlife species (e.g., moose, black bear, birds associated with early seral habitats) are predicted to use the Project ROW for travel, foraging and nesting, as has been observed along the existing parallel ROW. Long-term effects are associated with the operation phase and are primarily related to habitat alteration; however, for many species, including caribou, these also include indirect effects on habitat availability due to avoidance based on potential human and predator use of the ROW (i.e., travel corridor).

In summary, with the implementation of the mitigation measures described in Section 10.4, the residual effect on habitat availability is characterized as adverse, low magnitude (direct and indirect effects), limited to the LAA, short term (construction) to long term (operation), and considered reversible. The residual effect occurs in a disturbed ecological context.

10.5.3 Change in Mortality Risk

Pre-construction activities (e.g., site clearing, grubbing, topsoil moving, grading) and trenching during construction are the primary effect mechanisms for increased wildlife mortality risk. Increased mortality risk from site clearing will be greatest for small species (e.g., amphibians, small mammals) with limited avoidance capability (e.g., from machinery), wildlife with strong site fidelity (e.g., nesting birds), and wildlife that require and occupy specialized habitat features such as nests, dens, cavities, and burrows at specific times of the year. This effect will be limited for adult birds and medium to large-size mammals (e.g., moose, deer, black bear, marten) due to their ability to move away from the activity.

Project-related traffic, site hazards (e.g., trenches), increased human and predator access, vegetation maintenance during operation, and adverse human-wildlife encounters are less likely to result in a measurable increase in mortality risk for the following reasons:

- Implementation of specific mitigation measures (e.g., temporary fencing around trenches, waste handling)
- Access management mitigation measures will be included within the CHRP and will not only mitigate mortality risk to caribou, but also other species such as bears and moose within caribou habitat
- Adhering to species specific timing windows
- Adjacency of PDA to an existing ROW
- Absence of worker camps
- Reduced wildlife activity in and around the PDA during construction, when Project-related traffic and on-site human activity will be highest

Locations within the PDA where Project-related traffic intersects amphibian migration and dispersal routes are a potential concern; however, to date, no such migration and dispersal routes have been identified within the LAA (see Section 10.2.2; Appendix B.4).

For caribou, increased disturbance within the RAA may contribute to mortality risk through increased access for hunters and predators. Using the methods for calculating disturbance described in the recovery strategy, current disturbance is 61.1% of the Moberly/Klinse-Za herd RAA and 61.8% of the Burnt Pine herd RAA. The Project will result in a 0.4% increase in direct disturbance and a 1.3% increase in indirect disturbance for the Moberly/Klinse-Za RAA, for a total increase of 1.7% (Table 10-9). The Project will result in a 0.2% increase in direct disturbance and a 1.3% increase in indirect disturbance for the Burnt Pine RAA, for a total increase of 1.5% (Table 10-9).

Table 10-9 Change in Mortality Risk for Caribou

Caribou Herd	Disturbance[1]	Disturbance within the RAA at Baseline (ha)	Increase in Disturbance from the Project (ha)	Change in Disturbance within the RAA (%)
Moberly/Klinse-Za	Direct	8,057	29	0.4
Moberly/Klinse-Za	Indirect	16,719	223	1.3
Burnt Pine	Direct	10,183	20	0.2
Burnt Pine	Indirect	10,302	131	1.3

NOTE:

[1] Direct disturbance calculated as anthropogenic disturbances delineated on 1:50,000 LandSat and fire disturbance less than or equal to 40 years old within low elevation and Type 1 Matrix range within the caribou herd RAA; Indirect disturbance calculated as 500 m buffer applied to anthropogenic disturbances delineated on 1:50,000 LandSat within low elevation and Type 1 Matrix range within the caribou herd RAA.

In summary, with the implementation of the mitigation measures described in Section 10.4, the residual effect on mortality risk is characterized as adverse, low magnitude, limited to the LAA for all species (except caribou which uses the RAA), short term (construction) to long term (operation), and is considered reversible. Construction will be a single event and operations will consist of multiple irregular events associated with maintenance. The residual effect occurs within a disturbed ecological context.

10.5.4 Change in Movement Patterns

The primary mechanism for change in wildlife movement patterns is associated with the presence of the ROW, which may act as a barrier to wildlife movement. Wildlife may avoid crossing a ROW for a number of reasons including the width of the opening, lack of security cover, and deep snow (Gilbert et al. 1970, Wallmo and Gill 1971, Lima and Dill 1990, Bélisle and St. Clair 2001, Bayne et al. 2005). In addition, sensory disturbance from pre-construction, construction, inspection, and maintenance activities may deter wildlife movement across the ROW (as a function of avoidance, see Section 10.5.2). Trenching and stockpiling may also provide a temporary barrier to the movements of some species (e.g., ungulates).

As the PDA parallels an existing ROW for 86% of its length, there will be an overall increase in permanent ROW width (from approximately 20 m to 40 m). This ROW will maintain and may increase any existing barrier effect for small mammals, amphibians, and some birds; however, is unlikely to be a concern for large animals (e.g., moose, bears, and caribou). No known movement corridors were identified within the LAA (see Section 10.2.2; Appendix B.4); however, certain topographic features, such as riparian corridors, may act as potential wildlife movement corridors. There are several riparian corridors that will be intersected by the PDA; however the majority of these riparian corridors are currently intersected by the existing ROW (Section 9.2.2). Therefore, any wildlife movement along these corridors is already presumed to have been disrupted or altered to an extent in response to earlier development.

In summary, with the implementation of the mitigation measures described in Section 10.4, the residual effect on movement patterns is characterized as adverse, low magnitude, limited to the LAA, short term (construction) to long term (operation), and considered reversible. It will be a single event for construction and continuous event for operation. The residual effect occurs within a disturbed ecological context.

10.5.5 Summary of Residual Effects

Project residual effects on Wildlife and Wildlife Habitat are summarized in Table 10-10.

Table 10-10 Summary of Residual Environmental Effects on Wildlife and Wildlife Habitat

Project Phase	Residual Environmental Effects Characterization						
	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological Context
Change in Habitat Availability							
Construction	Adverse	Low	LAA	Short Term	Single Event	Reversible	Disturbed
Operation	Adverse	Low	LAA	Long Term	Multiple/Irregular	Reversible	Disturbed
Change in Mortality Risk							
Construction	Adverse	Low	RAA	Short Term	Single Event	Reversible	Disturbed
Operation	Adverse	Low	RAA	Long Term	Multiple/Irregular	Reversible	Disturbed
Change in Movement Patterns							
Construction	Adverse	Low	LAA	Short Term	Single Event	Reversible	Disturbed
Operation	Adverse	Low	LAA	Long Term	Continuous	Reversible	Disturbed

10.6 CUMULATIVE EFFECTS

As discussed in Section 4.3, in addition to assessing Project-related residual effects, section A.2.7 of NEB Filing Manual (NEB 2016) requires that the assessment consider the cumulative effects predicted to result from the Project's residual effects in combination with the potential residual effects of other past, present, or foreseeable future activities. The following sections present the cumulative effects assessment for Wildlife and Wildlife Habitat.

The identification of the residual effects on Wildlife and Wildlife Habitat that are likely to interact cumulatively with past, existing, and foreseeable future activities, and the rationale for their identification, is presented in Table 10-11.

The Project does result in residual effects on Wildlife and Wildlife Habitat, related to changes in habitat availability, mortality risk, and movement patterns (Section 10.5). As indicated in Table 10-11, these residual effects have the potential to act cumulatively with the effects of other projects and activities within the RAA. Oil and gas development and forestry are the primary activities that have the potential to act cumulatively with the identified Project-residual effects on wildlife and wildlife habitat; the primary mechanism for the interaction is associated with clearing and habitat alteration (Table 10-11). However, there is no reasonable expectation that the Project's incremental contribution to cumulative effects will affect the long term persistence or viability of any wildlife species within the RAA for the following reasons:

- The PDA affects an area that is less than 1% of the RAA
- The PDA is highly disturbed at baseline with a minimum of 49% of the PDA currently used for industrial purposes (e.g., oil and gas, forestry, transportation)
- The loss of focus species habitat ranges from 1 to 148 ha, depending on the species, and this represents no more than 5.4% of the habitat available within the LAA for any one focus species
- The residual loss of habitat will decrease during the operation phase as the intermittent TWS, log deck space, and laydowns areas are allowed to regenerate
- Although habitat is altered within the PDA, the new ROW will serve as a functional habitat for a variety of species (nesting, travel, foraging)
- The indirect effect of the Project on habitat availability is primarily due to sensory disturbance associated with construction activities, which will be short term (approximately 13 months)
- The residual increase in mortality risk for most focus species will be primarily confined to the construction phase, which will be short term (approximately 13 months)
- No permanent residual effects are predicted
- The PDA is low elevation and is unlikely to interact with the same suite of species and habitat as higher elevation projects (e.g., Dokie Wind Project). High elevation areas can contain important habitat for sensitive species such as grizzly bear and caribou

Table 10-11 Potential Cumulative Effects on Wildlife and Wildlife Habitat

Other Physical Activities with Potential for Cumulative Effects	Potential Cumulative Effects			Rationale
	Change in Habitat Availability	Change in Mortality Risk	Change in Movement Patterns	
Past or Existing Physical Activities				
Existing cutblocks for companies such as Louisiana-Pacific Canada Ltd., Chetwynd Mechanical Pulp, Sawchuck Contracting, West Fraser Mills, and Canadian Forest Products	✓	✓	-	Forestry activities within the RAA have potential to affect habitat quantity and quality and to contribute to fragmentation (reduced connectivity) as well as increased mortality risk within the RAA. Residual effects of the Project have the potential to act cumulatively with the forestry activities by further reducing habitat availability and increasing wildlife mortality risk.
Well sites and small facilities such as gathering points, test facilities, seismic lines and sales meters	✓	✓	-	Other small facilities occur within the RAA and have affected habitat quantity and quality and contributed to fragmentation (reduced connectivity) as well as increasing mortality risk within the RAA. Residual effects of the Project occur within the context of these existing conditions.
Agricultural operations, residential and commercial developments	✓	✓	-	Agricultural, residential and commercial activities within the RAA have potential to affect habitat quantity and quality and to contribute to fragmentation (reduced connectivity) as well as increased mortality risk within the RAA. Residual effects of the Project have the potential to act cumulatively with agricultural, residential and commercial activities by further reducing habitat availability and increasing wildlife mortality risk.
Highways (29 and 97), resource roads and access roads	✓	✓	✓	Existing linear features affect habitat quantity and quality and contribute to fragmentation (reduced connectivity) as well as increased mortality risk and effects on movement patterns within the RAA. Residual effects of the Project occur within the context of these existing conditions.

Table 10-11 Potential Cumulative Effects on Wildlife and Wildlife Habitat

Other Physical Activities with Potential for Cumulative Effects	Potential Cumulative Effects			Rationale
	Change in Habitat Availability	Change in Mortality Risk	Change in Movement Patterns	
Hydro lines	✓	✓	✓	Transmission lines occur in the RAA and have affected habitat quantity and quality and contributed to fragmentation (reduced connectivity) as well as increasing mortality risk and affecting wildlife movement within the RAA. Residual effects of the Project occur within the context of these existing conditions.
Existing pipeline ROWs (FSJ Mainline, T-North System)	✓	✓	✓	Pipeline ROWs occur in the RAA and have affected habitat quantity and quality and contributed to fragmentation (reduced connectivity) as well as increasing mortality risk and affecting wildlife movement within the RAA. Residual effects of the Project occur within the context of these existing conditions.
Willow Creek Mine	✓	✓	-	The Willow Creek mine occurs within the RAA and has affected habitat quantity and quality and contributed to fragmentation (reduced connectivity) as well as increasing mortality risk within the RAA. Residual effects of the Project occur within the context of these existing conditions.
Dokie Wind Project	✓	✓	-	The Dokie Wind Project occurs within the RAA and has affected habitat quantity and quality and contributed to fragmentation (reduced connectivity) as well as increasing mortality risk within the RAA. Residual effects of the Project occur within the context of these existing conditions.

Table 10-11 Potential Cumulative Effects on Wildlife and Wildlife Habitat

Other Physical Activities with Potential for Cumulative Effects	Potential Cumulative Effects			Rationale
	Change in Habitat Availability	Change in Mortality Risk	Change in Movement Patterns	
Foreseeable Future Activities				
Liquefied Natural Gas-related pipelines (including Coastal GasLink, Westcoast Connector, and Prince Rupert Gas Transmission, and the FSJ Mainline)	✓	✓	✓	Future linear features could affect habitat quantity and quality and contribute to fragmentation (reduced connectivity) as well as increasing mortality risk and effects on movement patterns within the RAA. Residual effects of the Project occur within the context of these future conditions.
Other proposed pipelines and looping projects including the High Pine Expansion Project, Merrick Mainline and N5 to CS2	✓	✓	✓	Future linear features could affect habitat quantity and quality and contribute to fragmentation (reduced connectivity) as well as increasing mortality risk and effects on movement patterns within the RAA. Residual effects of the Project occur within the context of these future conditions.

NOTE:
✓ Indicates that potential effects are likely to act cumulatively with those of other physical activities.

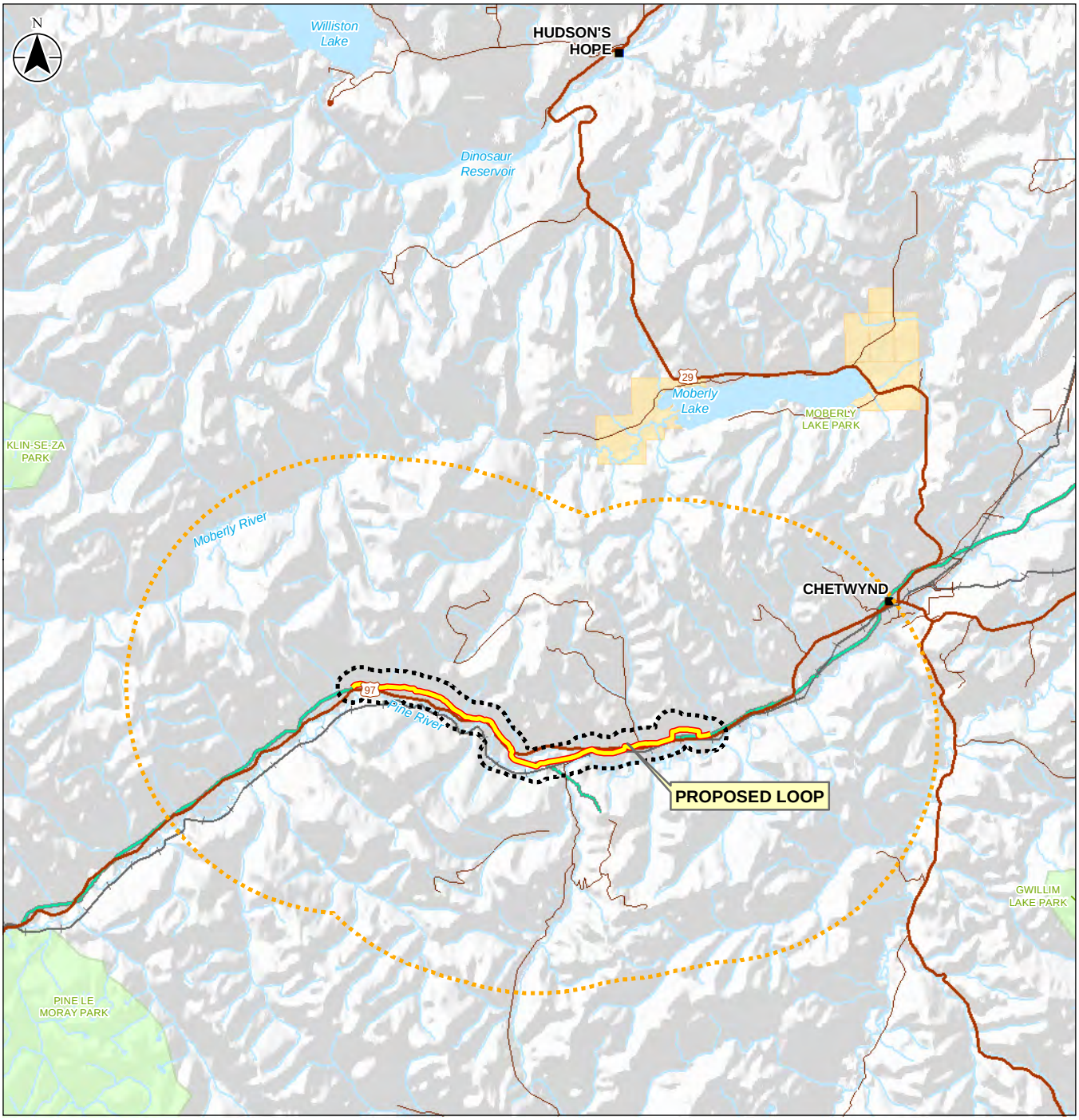
10.7 DETERMINATION OF SIGNIFICANCE

The effect of the Project on habitat availability within the LAA for all focus species is below the 20% habitat threshold identified in Section 10.1.5, with losses ranging from 1 to 5.4%, depending on the individual focus species. As described in Section 10.2.1.3, the focus species serve as surrogates for evaluating the potential effects of the Project on the habitat of other species. Given this, the effect of the Project on wildlife habitat availability in general is also expected to be below the 20% threshold. Thus, the overall residual effect of the Project on wildlife habitat availability is predicted to be not significant. With respect to caribou, the Project is making a small contribution (2.1% reduction in habitat availability within the caribou LAA, and 0.7% and 1.0% increase in disturbance within Moberly/Klinse-Za and Burnt Pine herds, respectively, within the caribou RAA) to an already significant scenario for caribou habitat availability and mortality risk. Therefore, given the existing scenario for caribou, the effect of the Project on caribou is considered significant. Any change to the existing significant scenario, regardless of scale, is considered significant. The commitment of Westcoast to develop a comprehensive CHRP, which includes a commitment for developing on Offset Measures Plan, demonstrates Westcoast's commitment to reducing Project effects on caribou.

There are multiple interactions that may result in increased mortality risk however they are primarily associated with specific, finite activities occurring during the construction phase, which facilitates the application of numerous mitigation measures. Successful implementation of the mitigation measures described in Section 10.4 is essential to limiting the magnitude and duration of Project effects on wildlife mortality risk, in particular the measure aimed at avoiding incidental take of migratory birds. On this basis, the increase in mortality risk as a result of the Project is expected to be small relative to the existing level of mortality risk within the LAA and RAA; therefore, the residual effect of the Project on mortality risk is predicted to be not significant.

The Project does not result in any new intersections of known or potential movement corridors (e.g., riparian corridors) within the LAA, and the increase in overall ROW width is not expected to create any new impermeable barriers to movement within the LAA. The residual effect of the Project on movement patterns is predicted to be not significant.

Based on the discussion presented in Section 10.6, the incremental contribution of the Project to cumulative effects on Wildlife and Wildlife Habitat within the RAA is predicted to be not significant.



- City or Town
- Highway
- Road
- Railway
- Watercourse
- Existing Right of Way
- Waterbody
- Indian Reserve
- Parks, Protected Area, Ecological Reserve and Conservancy
- Proposed Loop
- Local Assessment Area
- Regional Assessment Area

0 5 10 15 km

1:400,000 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 10N
2. Data Sources: DataBC, Government of British Columbia (GovBC); Terrain Resource Information Management, GovBC; National Topographic System, GovBC; BC Stats, GovBC; BC Oil & Gas Commission, GovBC; CanVec v12, Government of Canada (GC); National Hydrology Network, GC; Atlas of Canada National Framework, GC; Fisheries and Oceans Canada, GC; Environment Canada, GC; Natural Resources Canada, GC;

Stantec

Spectra Energy

Project Location
North-Eastern British Columbia

123220406
Prepared by S.Sun on 2016-09-23
Technical Review by T.Dinneen
Independent Review by K.Hewgill

Client/Project
Spectra Energy Transmission
Wyndwood Expansion Project
Environmental and Socio-Economic Assessment

Figure No.
10-1

Title
WYNDWOOD EXPANSION PROJECT
WILDLIFE AND WILDLIFE
HABITAT ASSESSMENT AREAS

11 HERITAGE RESOURCES

Landsong Heritage Consulting Ltd. (Landsong) prepared four Archaeological Impact Assessment (AIA) Interim Reports of the pipeline component of the Project between September 21 - 26, September 28 - 30, October 1 - 3, October 5 - 10, October 13 - 18, November 10 - 13, 2015 and July 4 – 8, September 12 – 13 and 28, 2016. The complete interim AIA reports and site specific mitigation measures are included in Appendix C and key findings are summarized below:

- The pipeline component of the Project is located on Private and Crown land within Treaty No.8 (1899), British Columbia.
- An archaeological site file search was conducted prior to the field assessment utilizing Remote Access to Archaeological Data (RAAD). The search identified five previously recorded archaeological sites, GjRl-1, GjRl-3, GjRn-1, GjRn-3 and GkRn-7, within 2000 m of the Project. GjRl-1 is the closest identified site located approximately 299 m to the northwest. The sites are located a sufficient distance from the Project to avoid inadvertent impact during construction.
- A Pre-Field Archaeological Potential Assessment was conducted, and included a review of available Project area mapping including draft Project plans, topographic maps and orthophotography, and analysis of the Archaeological Overview Assessment Potential Model in RAAD and the Peace District Potential Model. A review of available Project area mapping indicated a number of areas of moderate to high archaeological potential. Analysis of potential modelling indicated that the Project was located within areas exhibiting moderate to high archaeological potential.
- Ground reconnaissance consisted of pedestrian traverse within and adjacent to the development area. A total of 2,628 subsurface tests and four 1 m x 1 m evaluative units were conducted at 70 areas of moderate to high archaeological potential.
- There were ten previously unrecorded archaeological sites identified during the AIA: GjRl-5, GjRl-6, GjRm-1, GjRm-2, GjRm-3, GjRm-4, GjRm-5, GjRn-4, GjRn-5 and GjRn-6. Archaeological Site GjRm-3 cannot be avoided to the south due to Rocket Creek and rerouting to the north would result in undesirable parallel routing and involve additional grading over an unnamed drainage and slopes above Rocket Creek. Owing to these environmental and engineering constraints, Westcoast cannot avoid GjRm-3 and will apply for a section 12 Site Alteration Permit. Archaeological Site GjRn-5 is located approximately 6 m south of the pipeline ROW, as per the Revision 7 development plans. Installation of pre-construction temporary fencing is required to avoid inadvertent impacts during construction. Post-construction, the fencing should be removed and the site reflagged as required. A qualified archaeologist will oversee the installation and removal of the temporary fencing. Archaeological Site GjRn-6 is located approximately 4 m north of a temporary workspace, as per the Revision 7 development plans. Installation of pre-construction temporary fencing is required to avoid inadvertent impacts during construction. Post-construction, the fencing should be removed and the site reflagged as required. A qualified archaeologist will oversee installation and removal of the temporary fencing. Archaeological Site GjRm-1 is located approximately 1 m north of a temporary workspace, as per the Revision 7 development plans. Installation of pre-construction temporary fencing is required to avoid inadvertent impacts during construction. Post-construction, the fencing should be removed and the site reflagged as

required. A qualified archaeologist will oversee installation and removal of the temporary fencing.

- The other six previously unrecorded archaeological sites were identified and marked as a "no work zone" and marked for avoidance. The current Revision 7 plans have avoided these sites through re-design. The sites are located a sufficient distance from the Project to avoid inadvertent impact during construction.
- No culturally modified trees (CMTs) were identified during the AIA.

11.1 TRADITIONAL LAND USE

Traditional land use (TLU) site assessments were carried out on the Crown land portion of the Project which includes the pipeline components only and excludes the compressor station Project components.

Key findings are summarized below:

- The loop occupies Crown land within Treaty No.8 (1899) of British Columbia.
- The primary objectives of the study were to identify and document past and current TLU sites information at both a site specific and landscape level within the PDA, document proposed Project-related concerns, develop mitigation measures, maintain a community based approach with local Aboriginal Groups, and provide information to the proponent to respond to specific Aboriginal community concerns and to manage TLU impacts during the life of the Project.
- A total of 15 specific Traditional Use sites were recorded during the study. Currently all of these sites are being reviewed for mitigation measures. Eighty one environmental biophysical features and observations were recorded during the TLU site assessment. Nine of these sites had requests for mitigations to Westcoast. Westcoast has reviewed these mitigations and will incorporate them where practical into the design of the Project.

Westcoast has not received any other requests or concerns related to TLU on this Project.

12 LAND AND RESOURCE USE

12.1 SCOPE OF ASSESSMENT

This section defines and describes the scope of the assessment of potential effects on land and resource use. Land and Resource Use was selected as a VC because Project construction and operation have the potential to remove lands used for agriculture, forestry, oil and gas and other industrial uses, and affect fishing, hunting, trapping, and recreational activities, either temporarily or for an extended period of time.

The following sections of the Application address effects that influence or are influenced by effects on Land and Resource Use:

- Acoustic Environment (Section 6)
- Soil and Soil Productivity (Section 7)
- Fish and Fish Habitat (Section 8)
- Vegetation and Wetlands (Section 9)
- Wildlife and Wildlife Habitat (Section 10)
- Employment and Economy (Section 15)

12.1.1 Regulatory Setting

The scope of this section takes into consideration guidance provided by the NEB Filing Manual (NEB 2016), specifically Table A-3 which includes details on assessing socio-economic elements such as human occupancy and resource use.

In BC management of provincial Crown Land and resources is guided by the *Agricultural Land Commission Act*, the *Land Act*, the OGAA, the *Wildlife Act*, the *Forest Act*, the FRPA, the *Mineral Tenure Act* and the *Park Act*.

At the municipal government level land use policies are enacted through the *Community Charter Act* and the *Local Government Act* (Province of British Columbia 2015a). These Acts give municipalities, regional governments, and improvement districts powers to create Official Community Plans (OCPs) or bylaws that are developed in consideration of regional land use planning objectives.

12.1.2 Selection of Potential Environmental Effects and Measurable Parameters

Potential effects of the Project were identified through public and regulatory consultations with stakeholders, past experience, and professional judgment (Consultation and Engagement, Section 3). During the preparation of this assessment, Westcoast notified the Aboriginal Groups listed in Section 3 regarding areas that could be affected by the Project.

Table 12-1 summarizes the potential effects, measurable parameters, and rationale for selection of the Land and Resource Use VC. Measurable parameters were selected to provide a means of qualitatively assessing the expected change to existing socio-economic conditions.

Table 12-1 Potential Effects and Measurable Parameters for Land and Resource Use

Potential Effect	Rationale for Inclusion of the Potential Project Effect in the Assessment	Measurable Parameter(s) for the Effect	Rationale for Selection of the Measurable Parameter
Change in park or protected area	• Parks and protected areas provide recreation and natural heritage conservation value, and may be protected from development. • Map reserves, a form of Crown land allocation used to withdraw or withhold Crown lands for a specific purpose, may be protected from development.	• Area of park affected (ha) • Proximity to park features (e.g., campgrounds, picnic sites, recreation areas) • Valued natural attributes (e.g., old growth forests, heritage rivers, karst formations)[7]	• Overlapping use of lands within parks or protected areas may not be compatible within parks and protected areas • Project use of adjacent land may disrupt existing uses of parks and protected areas.
Change in tenured land use and Private Property	• Project activities may not be compatible with tenured land use or the use of private property. • The Project may affect the quantity and quality of land and resource use activities through such means as limiting access to areas within the Project footprint or affecting the aesthetic quality of areas used for land and resource use activities.	• Area of overlapping land-use affected (ha) • Attribute data on overlapping land-uses (e.g., ALR[1], forestry, hunting, trapping, etc.) within area affected (ha/km^2) • Number of private properties affected by the Project • Qualitative description of property development potential based on zoning	• The Project may disrupt existing industrial land use through a reduction in land base and/or change in access. • Tenure areas and the PDA can be represented spatially using GIS to illustrate proximity and potential interaction with the Project. • The area (ha) of tenured areas potentially affected by the Project can be quantified.
Change in non-tenured land use	• Non-tenured land uses such as recreation, tourism, fishing, and hunting may be affected by the presence of the Project and Project-related activities through a change in land base, quality of experience, or access.	• Overlapped area (ha) of Wildlife Management Units (WMUs) where hunting occurs • Total length (m) of and overlap (ha) with trails in the LAA • Number and overlap (ha) of recreation sites in the LAA • Recreation features inventory significance and sensitivity	• The number and spatial extent of trails and/or recreational sites that overlap with the LAA can be used to assess the potential effects of the Project on non-tenured land-use • WMUs and the PDA can be represented spatially using GIS to illustrate proximity and potential interaction with the Project affecting hunting activities.
NOTE: Only applies to Crown land designated as ALR. Crown land and private property occur within areas designated as ALR.			

[7] The assessment of biophysical-related land-use attributes needs to consider and be compatible with their assessment in the relevant biophysical sections of the ESA.

12.1.3 Boundaries

12.1.3.1 Spatial Boundaries

The spatial boundaries for the assessment of Land and Resource Use include areas that might interact directly or indirectly with the Project. The following spatial boundaries were used to assess Project and cumulative effects on land and resource use. The PDA includes all lands subject to direct disturbance from the footprint of the Project (approximately 171 ha). Areas occupied by the PDA are broken down as follows:

- Proposed ROW (permanent) – approximately 64 ha
- Proposed workspace (temporary) – approximately 96 ha
- Proposed shoofly (temporary) – 1 ha
- Existing cleared – approximately 10 ha

The LAA encompasses the physical area in which Project activities and facilities could have direct or indirect effects on land and resource use. The LAA includes the PDA and a 1 km buffer either side of the ROW (approximately 6, 599 ha).

The RAA is used as context to determine the significance of Project-specific effects on land and resource use as well as assess where Project-specific residual effects overlap with the residual effects of past, present, and reasonably foreseeable future activities (i.e., cumulative effects; see Section 4.3.1). The RAA includes the PDA and a 15 km buffer either side of the ROW (approximately 148, 979 ha).

12.1.3.2 Temporal Boundaries

See Section 2.4 for the Project schedule and temporal boundaries for this VC.

12.1.3.3 Administrative Boundaries

Administrative and technical boundaries define various aspects of land use, as determined by political, social, cultural and economic factors. Various levels of government administer land use in the RAA. The province manages oil and gas and industrial dispositions, wildlife exploitation (e.g., hunting and fishing restrictions, and fur trapping Licenses) and uses of Crown lands (e.g., grazing leases). Within provincially designated ALR, as regulated through the Agricultural Land Reserve, Use, Subdivision and Procedure Regulation BC. Reg. 171/2002 pursuant to the *Agricultural Land Commission Act* SBC 2002, C. 36, farming and other agricultural activities take precedence over other land uses. Both Crown land and private property can occur within areas designated as ALR.

12.1.4 Residual Environmental Effects Description Criteria

Table 12-2 presents the criteria that are applied to characterize Project residual effects on Land and Resource Use.

Table 12-2 Characterization of Residual Effects on Land and Resource Use

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories	
Direction	The long-term trend of the residual effect	Positive	Residual effect is positive compared to baseline condition
		Adverse	Residual effect is negative relative to baseline condition
		Mixed	Residual effect can be both positive and negative compared to baseline conditions
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	Negligible	No measurable change from baseline conditions
		Low	A measurable change but residual effect cannot be distinguished from baseline conditions within normal range of variability
		Moderate	Measurable change but unlikely to pose a serious risk or benefit to the VC or to represent a management challenge
		High	Measurable change that is likely to pose a serious risk or benefit to the VC and, if negative, represents a management challenge
Geographic Extent	The geographic area in which an environmental effect occurs	PDA	Residual effect is limited to the PDA
		LAA	Residual effect is limited to the LAA
		RAA	Residual effect is limited to the RAA
Duration	The period of time required until the measurable parameter or the VC returns to its existing condition, or the effect can no longer be measured or otherwise perceived	Short-term	Residual effect will last no longer than the construction phase
		Long-term	Residual effect extends through the operations phase
		Permanent	VC or sub-component unlikely to recover to baseline conditions
Frequency	Identifies when the residual effect occurs and how often during the Project or in a specific phase	Single	Residual effect (or event) occurs once
		Multiple/Irregular	Residual effect occurs sporadically throughout assessment period
		Multiple/Regular	Residual effect occurs repeatedly and regularly throughout assessment period
		Continuous	Residual effect occurs continuously

Table 12-2 Characterization of Residual Effects on Land and Resource Use

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories	
Reversibility	Pertains to whether a measurable parameter or the VC will return to its existing condition after the Project activity ceases	Reversible	Residual effect will no longer occur after Project closure and reclamation (or sooner)
		Irreversible	Residual effect is irreversible after closure of the Project (i.e., permanent)
Ecological and Socio-economic Context	Existing condition and trends in the area where environmental effects occur	Undisturbed	Area is relatively undisturbed or not adversely affected by human activity
		Disturbed	Area has been previously disturbed by human development or human development is still present

12.1.5 Significance Thresholds for Residual Environmental Effects

A significant adverse residual effect to Land and Resource Use is defined as one where:

- The Project does not comply with established land use plans, policies, or by-laws
- The Project will create a change or disruption that restricts or degrades present land use capability to a point where the activities cannot continue at or near current levels and where compensation is not possible

The residual effects assessment considers adverse effects after mitigation and other management measures are implemented.

12.2 EXISTING CONDITIONS FOR LAND AND RESOURCE USE

12.2.1 Methods

12.2.1.1 Use of Existing Data

Spatial information on land use was primarily obtained from the Province of BC's data warehouse (DataBC), ILMB's Land and Resource Use Data Warehouse, and the Agricultural Land Commission (ALC). Metrics for geospatial information within the LAA and RAA were generated using ArcGIS. Additional information on land and resource use was obtained from other publicly available secondary sources.

12.2.2 Overview

12.2.2.1 Land Use Planning

Sustainable management of Crown land within BC is guided by legislation (see Section 12.1.1) as well as through a policy framework established through land use plans and leave orders (Province of BC 2015b). Within the PRRD the Project occurs within the Dawson Creek Land and Resource Management Plan (LRMP) planning area (BC MFLNRO 1999) and the Peace Northern Caribou Plan. The entire PDA occurs within the Dawson Creek LRMP of which 13 ha falls within the Burnt Pine Caribou Augmentation Plan (see Section 10 Wildlife and Wildlife Habitat).

The Dawson Creek LRMP is subdivided into smaller planning units called resource management zones (RMZs). Each RMZ outlines permissible land uses. Overlapped RMZs under the Dawson Creek LRMP include Hulcross Creek, Pine-Hasler, West Pine River and miscellaneous (settlements). Of the total PDA area (approximately 171 ha), 11 ha fall within Hulcross Creek RMZ, 82 ha within the Pine-Hasler RMZ and 77 ha within the miscellaneous (settlement) RMZ. Use of lands within these RMZs for the purpose of pipeline construction and operation are compatible with planning objectives. Land overlapped by the PDA within the Hulcross Creek and the miscellaneous (settlement) RMZs represent less than 1 percent (%) of total land area designated under these RMZs while land overlapped by the PDA within the Pine-Hasler RMZ represents just over 1% of total land designated by that RMZ.

12.2.2.2 Private Property

Approximately 40% of the Project is located on private property. In total the Project PDA overlaps 28 private properties equaling approximately 62 ha of overlap with the PDA. Overlapped private property by premises identification number (PID) is provided in Table 12-3.

Table 12-3 Private Property Overlapped by PDA

PID	Legal Location
014-773-287	Block C of District Lot 373 Peace River District
015-144-828	North west 1/4 of District Lot 1138 Peace River District except plans H304, 16965 and 17398
014-865-793	Block A of the West 1/2 District Lot 363 Peace River District
007-577-133	Block A of District Lot 1132 Peace River District except plan 16964
004-522-273	The fractional north west 1/4 of District Lot 1131 Peace River District, except plan A1805
014-903-121	Block A District Lot 357 Peace River District except plans 28110, A1805 and BCP42772
016-988-353	Block A of the south west 1/4 of District Lot 1129 Peace River District except plan 26709
014-913-569	The north east 1/4 of District Lot 1131 Peace River District, except plans A2033 and BCP42772
028-084-322	Lot 1 District Lot 357 and 1131 Peace River District Plan BCP42772
004-615-158	Lot 1 District Lot 1129 Peace River District Plan 20066 except plan 33459
014-682-532	Block B District Lot 357 Peace River District except plans CG 570 and BCP42772

Table 12-3 Private Property Overlapped by PDA

PID	Legal Location
028-084-331	Lot 2 District Lot 357 Peace River District Plan BCP42772
012-651-591	Lot A District Lot 1129 Peace River District Plan 33459
008-448-663	Lot 1 District Lot 1126 and 1129 Peace River District Plan 23834, except plan 29536
014-800-055	Block F of The south west 1/4 of District Lot 1126 Peace River District
007-741-014	That part of block A of the south east 1/4 of District Lot 1126 Peace River District lying south of plan H305, except plans CG 570 and 16964
007-741-031	The south west 1/4 of District Lot 1125 Peace River District, except that part lying to the north of plan H305 and except plans A1805 and H305
015-018-075	The south east 1/4 of District Lot 1125 Peace River District except plans A1805 18036 H305 16964 and 30842
007-572-077	That part of the north 1/2 of the south west 1/4 of District Lot 1122 Peace River District lying south of plan CG 571
014-800-284	Block A of the south west 1/4 of District Lot 1122 Peace River District
003-922-707	That part of District Lot 1122 lying north of plan H305 Peace River District except plans 15172, 16964 and PGP35538
014-761-122	The West 1/2 of the south 1/2 of the south 1/2 of the north 1/2 of District Lot 1121 Peace River District, except plans A1856 and PGP37820
014-822-211	Parcel A (P18704) of the north 1/2 of District Lot 1121 Peace River District
005-635-349	Lot 1 District Lot 351 Peace River District Plan 24993
008-047-235	Lot 2 District Lot 351 Peace River District Plan 24993
014-900-904	That Part of Block B lying to the north of plan H306 District Lot 351 Peace River District except a strip of land 50 feet in parallel width adjoining plan H306
014-926-580	District Lot 2252 Peace River District, except plans 17053, PGP39640 PGP41755, BCP1349, BCP2182 and BCP9586
014-741-814	That Part of Block B Lying North of Plan H306 District Lot 355 Peace River District, Except Plan 17053

12.2.2.3 ALR, Parks and Protected Areas and Tenured Land Use

Use of Crown land (land and land covered by water owned by the provincial government) is subject to a rental agreement, known as tenure, between an individual or organization for a certain purpose over a set period of time with the Crown (Province of BC 2015c). Information on overlapped ALR, parks and protected areas and tenured land use within the Project PDA, LAA and RAA is provided in Table 12-4.

Table 12-4 Overlaped ALR, Parks and Protected Areas and Tenured Land Uses – PDA, LAA, RAA

Land Use	PDA		LAA	RAA	Notes
	Ha[1]	Additional Information	ha[1]	ha[1]	
ALR	67	The PDA intersects two areas (ALR polygons) designated as ALR. ALR Polygon IDs: • 29 ha - 1.9% of ALR polygon ID 57883 • 38 ha – 1.5% of ALR polygon ID 58123 Combined, the total area of these ALR polygons is 4,092 ha. Overlap with the PDA and these two ALR polygons represent 1.6% of this total area.	2,701	8,764	Farming activities take precedence over other land uses in areas designated as ALR in BC. The Provincial ALC is responsible for administering the ALR and is mandated pursuant to the *Agricultural Land Commission Act*. • Within the LAA there are three intersected ALR polygons (IDs 57883, 57890 and 58123). These polygons have a total area of 6,331 ha (extend outside the LAA). • Within the RAA 10 ALR polygons are intersected (IDs 57874, 57879, 57883, 57886, 57890, 57893, 57897, 58123, 58139, 58144). These polygons have a total area of 12,865 ha (extend outside the RAA).
Range Tenure	25	Represents 6% of range tenure under file ID RAN073716 held by D. Ball	389	389	The BC MFLNRO manages range programs for the province. Range tenures are licensed to use range unit, typically comprised for one or more pastures. Only one active range tenure (RAN073716 (Daniel Ball) is overlapped by the LAA and RAA. Total area associated with this range tenure is 389 ha.

Table 12-4 Overlaped ALR, Parks and Protected Areas and Tenured Land Uses – PDA, LAA, RAA

Land Use	PDA		LAA	RAA	Notes
	Ha[1]	Additional Information	ha[1]	ha[1]	
Forest Tenure Cutblocks	25	Cutblock and tree farm licenses are held by the same licensees for the same areas within the PDA, LAA and RAA. The PDA intersects four timber blocks. Within the PDA license holders include: • Tembec Industries (5 ha – 23% of license A77933 7793 UM-4; 8 ha – 65% of license A78229 78229 UM-8) • Chetwynd Mechanical Pulp Inc. (8 ha – 12% of license A70730 201 AU1201 UM-5; 4 ha – 10% of license A70730 201 AU1201 UM-6)	322	24,515	The proposed Project occurs within the Dawson Creek TSA (part of the Peace River Forest District). The Dawson Creek TSA encompasses an area of approximately 2.28 million ha with a current annual allowable cut (AAC) of 1.86 million m^3 (BC MFLNRO 2015a, b). Seven harvesting licenses have been issued for the Dawson Creek TSA. Other licenses that do not contribute to AAC are also issued. Intersected timber supply blocks within the PDA, LAA and RAA are: PDA – 41D (total area 1,084,798 ha) LAA – 41D (total area 1,084,798 ha) RAA – 41C (total area 109,228), 41D (total area 1,084,798 ha)
Tree Farm License	25		322	24,516	
Forest Tenure Managed License[2]	5	Banyon Consulting Ltd. (5 ha – 3% of license W1190 C Schedule B)	182	4,374	
Old Growth Management Area	<1	Two legal old growth management areas (OGMA) are overlapped by the PDA totaling 0.82 ha: • Feature code AD19625200 (Internal ID 8735) – 0.8 ha or 0.8% overlap (total area of OGMA is 97.4 ha) • Feature code AD19625200 (internal ID 8741) – 0.02 ha or <0.01% (total area of OGMA is 1,880.7 ha) Of the 0.82 ha of OGMA overlapped by the PDA 0.63 ha are already cleared (76.8%). The PDA does not overlap any non-legal OGMAs.	583	14,327	The Ministry of Agriculture and Lands' Ministerial Order, Land Use Objectives for the Dawson Creek TSA (May 29, 2009) Part 2.3 (Objectives) states "minor intrusions into the OGMAs is permitted provided the disturbance to the gross OGMA area does not exceed: (a) 10% in OGMAs less than 50 hectares; or, (b) 5% or 40 ha, whichever is less, in OGMAs of 50 hectares or greater. The LAA overlaps two legal OGMAs: AD1962500-8735 and AD1962500-8741. The RAA overlaps 18 legal OGMAs. There are no non-legal OGMAs overlapped by the LAA or RAA.

Table 12-4 Overlaped ALR, Parks and Protected Areas and Tenured Land Uses – PDA, LAA, RAA

Land Use	PDA		LAA	RAA	Notes
	Ha[1]	Additional Information	ha[1]	ha[1]	
Mineral Tenure	171	Overlapped tenure number IDs: • 6 ha–0.5% of 417901 • 1 ha–0.1% of 417902 • 24 ha–1.6% of 417960 • 53 ha–1.3% of 418113 • 87 ha–1.7% of 418114 All overlapped tenures are related to coal exploration and extraction.	6,571	139,582	Located south of Tumbler Ridge, the Peace River coal fields have over one billion tonnes of medium-volatile bituminous coal (South Peace Economic Development Corporation no date [n.d.]). Coal mining in the PRRD accounts for one third ($2 billion) of the PRRDs gross domestic product (GDP) (South Peace Economic Development Corporation n.d.). There are currently nine coal mines either proposed or operating in the south peace region (South Peace Economic Development Corporation n.d.). The LAA overlaps 10 mineral tenures and the RAA 122.
Oil and Gas tenure	13	The PDA only overlaps with 13 ha of oil and gas tenure (pipeline) and parallels existing pipeline infrastructure. The PDA overlaps no active drill site or wellsite tenures.	68	778	The total surface land area used for oil and gas activities for the Dawson Creek LRPMP area was 69,980 ha (2.3%) of the total LRMP area (2,989,837 ha) (BC OGC 2013). The total disturbed land area reflects the area shared by overlapping permits and includes: wells, roads, facilities, pipelines, other oil and gas activities, and geophysical exploration (seismic lines) (BC OGC 2013). The LAA does not overlap any active drill sites or wellsite tenures. The RAA overlaps 23 drill/well sites (11 statutory ROW or easements and 12 interim licenses) totaling 45 ha.

Table 12-4 Overlaped ALR, Parks and Protected Areas and Tenured Land Uses – PDA, LAA, RAA

Land Use	PDA		LAA	RAA	Notes
	Ha[1]	Additional Information	ha[1]	ha[1]	
Energy Generation and Transmission	<1	There are no active energy generation tenures within the PDA. Electric Power line (tenure document 814454 – statutory ROW or easement))	1	4,335	Within the PRRD hydroelectricity and wind power are the primary forms of energy generation. BC Hydro is the primary provider of hydroelectricity while wind power is provided through a series of privately and publicly held companies (BC Hydro 2015). The LAA does not overlap any active energy generation tenures. The LAA overlaps three electric power line tenures (three statutory ROWs or easements – tenure documents 804321, 814454, 2122). The RAA overlaps 12 electric power line tenures (10 statutory ROWs or easements [tenure documents 1099, 1648, 2112, 2256, 800348, 802369, 802694, 804321, 814454, 815336 and two licenses of occupation [tenure documents 813879, 813985]) totaling 875 ha. The RAA also overlaps two wind power tenures (one license of occupation and one standard lease) totaling 3,460 ha.
WMU	171	Overlaps the following WMU: • 55 ha – 7-22 (<0.01%) • 116 ha – 7-31(<0.01%)	6,599	148,979	BC is divided into nine wildlife administration areas named Wildlife Management Regions (WMR). WMRs are divided into six regions and subsequently into zones and subzones (WMUs). These administrative areas are managed by BC MFLNRO. All hunting and trapping in BC occurs within these administrative areas. Zones 7A and 7B fall within the PRRD (BC MFLNRO 2015c). WMUs 7-22 and 7-31 are overlapped by the PDA and LAA. WMUs 7-21, 7-22 and 7-31 are overlapped by the RAA.
Trapline Tenure	171	Trapline area identifiers: • 49 ha – 0.1% of TR0731T010 • 77 ha – 0.2% of TR0722T007 • 43 ha – 0.1% of TR0722T006	6,599	148,979	Trapline tenures are "delineated areas of which registration is granted to one or more licensed trappers for the trapping of fur bearing animals under the *BC Wildlife Act*" (Province of BC 2015d). Three trapline tenures are overlapped by the PDA and LAA, nine by the RAA.

Table 12-4 Overlaped ALR, Parks and Protected Areas and Tenured Land Uses – PDA, LAA, RAA

Land Use	PDA		LAA	RAA	Notes
	Ha[1]	Additional Information	ha[1]	ha[1]	
Guide Outfitting Tenure	171	Guide Outfitter names and certificates: • 18 ha – <0.01% of certificate number 701245 (registered to G. Drinkall) • 153 ha – 0.03% of certificate number 701222 (registered to H. Mindermann)	6,599	148,979	Issued annually by BC MFLNRO, guide outfitting tenures license individuals to guide resident and non-resident hunters within exclusive guide areas (clearly defined and legally described boundaries). Non-resident hunters visiting BC who wish to hunt big game must be accompanied by a registered guide outfitter or accompanied by a resident who holds a 'permit to accompany' (BC MFLNRO 2015d). Two guide outfitters operate within the LAA and RAA (certificate numbers 701245 and 701222)
Parks and Protected areas	0	N/A	38	14,135	There are 39 Provincial Parks and five Regional Parks within the PRRD. There are no National Parks in the PRRD. The Project does not overlap with any provincial or regional parks. The PDA does not overlap with any fish and wildlife management map reserves or ecological areas. The LAA overlaps with one active fish and wildlife management tenure (R888019 – Section 16 Map Reserve) and two active recreation reserve tenures (tenure documents 72089 and 68147 – both Section 16 Map Reserves). The RAA overlaps five active fish and wildlife management tenures (R138031 – Notation of Interest [NOI], R888019 – Section 16 Map Reserve, R138010 – Section 17 Designated Use Area, R138032 – NOI, and R138006 – Section 17 Designated Use Area) one buffer zone (888006 – NOI), one Greenbelt (998002 – NOI) and six recreation reserve tenures (72089 – Section 16 Map Reserve, 55061 – Section 15 Order-In-Council Reserve [OIC], 70345 – Section 16 Map Reserve, 52057 – Section 16 Map Reserve, 68102 – Section 16 Map Reserve, 68147 - Section 16 Map Reserve).

Table 12-4 Overlaped ALR, Parks and Protected Areas and Tenured Land Uses – PDA, LAA, RAA

Land Use	PDA		LAA	RAA	Notes
	Ha[1]	Additional Information	ha[1]	ha[1]	
Other Crown Tenures	35	• Transportation – roadways/railways (tenure document 9634900 – temporary permit [< 1 ha] and 908011 – NOI [< 1 ha]) • Commercial Recreation – multiple use (one application for a license of occupation [< 1 ha]) • Quarrying – Sand and Gravel (tenure document 64367 – Section 16 Map Reserve [31 ha], 62282 – Section 16 Map Reserve [3 ha]). Overlap represents 8.7% of tenure 64367 and 8.2% of tenure 62282.	739	4,828	Other crown tenures (e.g., inventory, lease, license, permit, reserve/notation, ROW) for the purpose of commercial uses, commercial recreation, communication, environment, conservation and recreation, industrial, institutional, miscellaneous land uses, quarrying, residential, transportation and utility.

NOTES:

N/A Not applicable.

[1] provided as an approximate measure

[2] Forest tenure managed licenses consist of Community Forest Schedule A and B and Woodlot License Schedule A and B licenses.

SOURCE:

DataBC 2015.

12.2.2.4 Non-Tenured Land Use

12.2.2.4.1 Hunting

All hunting activities occurring within BC are managed by the BC MFLNRO (BC MFLNRO 2015e, f). Residents wishing to engage in hunting activities for recreational purposes must have a valid firearm license, obtain a BC hunter number and are subject to federal, provincial and area-specific hunting regulations (BC MFLNRO 2015e, 2015f). As of December 2014 there were 252,177 valid firearm licenses issued to residents of BC representing 5,731 licenses per 100,000 population (RCMP 2015). More detail can be found in the Wildlife and Wildlife Habitat assessment (Section 10). It is conservatively assumed that where not posted otherwise and where minimum distances are maintained, the entirety of the LAA may be used for hunting activities.

12.2.2.4.2 Fishing

The activities of individuals wishing to engage in non-tidal fishing in BC are governed by provincial regulations, regional regulations, water-specific regulations and in season regulation changes (BC MFLNRO 2015g, h). Individuals subject to the *Indian Act* and of who are residents of BC do not need to obtain any type of license or stamp (BC MFLNRO 2015g, h). Information on overlapped waterbodies is provided in the Fish and Fish Habitat assessment (Section 8); the PDA intersects 31 confirmed watercourses, of which 12 are fish bearing (11 streams and one wetland). It is conservatively assumed that all fish bearing watercourses are used for recreational fishing.

12.2.2.4.3 Recreational Trails and Sites

Within the PRRD there are numerous Recreation Sites and Trails (public campgrounds and trails located on Crown land outside of national, provincial and regional parks and settled areas). These sites and trails are managed by Recreation Sites and Trails BC (RST BC) under BC MFLNRO (RST BC 2015). Recreation Sites and Trails are designated under two acts, the *Forests Act,* and the *Range Act* as map reserves (either recreational reserves or public access/public trials reserves) (RST BC 2015). The PDA does not overlap with any RST BC map reserves or recreation reserves. The LAA and RAA overlap approximately 20 ha and 3,300 ha of RST BC Map Reserves respectively.

In addition to hiking and backcountry recreation afforded through the use of designated parks, recreational areas, and RST BC map reserves and recreation reserves, residents and visitors to the LAA may choose to use non-designated areas, trails and stand-alone outdoor recreation features. Within the PRRD there are numerous non-designated trails used for hiking, mountain biking, snowshoeing, cross-country skiing and dog sledding, snowmobiling and all-terrain vehicle (ATV) and utility task vehicle (UTV) use (PRRD 2014). Trails often lead to recreational features of interest such as waterfalls, caves, alpine vista, lakes and other geological formations (PRRD 2014). Trails not within designated areas are often managed by individuals, societies and recreational groups (PRRD 2014). Westcoast is unaware that users of recreational vehicles (e.g., ATVs, dirt bikes, and snowmobiles) use existing pipeline ROWs that parallel the proposed Project. In addition to the use of these ROWs, it is conservatively assumed that a variety of

recreational sites and trails exist within the LAA that, at the time of writing are unknown to Westcoast.

12.2.2.4.4 Visual Sensitivity

In the BC Visual Landscape Inventory (VLI) viewpoints are ranked according to their likely importance to viewers, and characterized according to their sensitivity to change (BC MFLNRO 1997). The VLI is comprised of visually sensitive units (VSUs), which are the view an observer would see from a given viewpoint (BC MFLNRO 1997). VSUs are rated according to existing visual condition (EVC), and are expressed as visual quality class (VQC), which rates the degree of disturbance to visual quality.[8] As well, they are ranked according to visual sensitivity classification (VSC) from 5 (very low sensitivity) to 1 (very high sensitivity) (BC MFLNRO 1997). Visual absorption capability (VAC), a measure of a landscape's ability to absorb alteration and maintain its visual integrity is rated having a high ability, moderate ability, or low ability.

The PDA overlaps with 12 VLI polygons totaling 128 ha, the LAA 29 VLIs totaling 3,997 ha, and the RAA 125 VLIs totaling 32,601 ha.

Table 12-5 Detailed Information on VLIs – PDA

VLI Polygon Number	VSU	VSC	EVC/VQC	VAC	Area Overlapped (ha)	Proportion of VLI Polygon Overlapped (%)
525	-	2	PR	H	8	1
539	-	3	P	M	15	7
554	-	2	P	M	3	3
555	-	2	PR	M	3	4
556	-	2	R	H	36	3
557	-	2	PR	M	9	4
562	-	2	M	L	1	<1
563	-	4	R	H	6	6
574	-	2	R	M	25	8
581	-	2	PR	L	<0.1	<1
603	-	2	PR	H	17	4
2347	-	2	-	-	5	1

NOTE:
- Not applicable.

8 EVC/VQC ratings are: preservation (0% disturbance), retention (0% - 1.5%), partial retention (1.5% to 7%), modification (1.5% to 7%), modification (7% to 20%), and maximum modification (over 20% disturbance).

12.3 PROJECT INTERACTIONS

Potential interactions between the Project and Land and Resource Use are summarized in Table 12-6. Those project activities not expected to interact with the Valued Component (e.g., "-") are not carried through the effects assessment.

Table 12-6 Potential Project Effects on Land and Resource Use

Project Activities and Physical Works	Potential Effects		
	Change in Parks or Protected Areas	Change in Tenured Land Use and Private Property	Change in Non-tenured Land Use
Construction	✓	✓	✓
Operation	✓	✓	✓

NOTES:
✓ Indicates that an activity is likely to contribute to the potential effect.
N/A Not applicable.

Project construction and operation have the potential to adversely affect parks or protected areas, tenured land use and private property and non-tenured land use; however, the effects are likely to be restricted to the PDA with some potential for effects extending to the LAA. During construction the Project has the potential to affect both tenured and non-tenured land use through the physical modification of existing lands (e.g., clearing of the PDA) and through changes in access to the PDA (i.e., restricted access during construction due to safety considerations). The physical modification of existing lands also has the potential to adversely affect fishing, hunting and other forms of recreation (non-tenured land use) and visual quality (non-tenured land use) within the LAA. Project-related changes in the acoustic environment (see Section 6) can also affect existing land uses within the RAA.

Project operation has the potential to affect tenured and non-tenured land use through continual physical maintenance of the PDA (e.g., ROW maintenance) and through restricted access. Westcoast will discourage use of the PDA outside of private lands as a means to limit adverse effects associated with increased access to private lands, increased access to hunting locations and wildlife, and to limit erosion effects on pipeline cover. Adverse effects on some non-tenured land-uses, such as visual quality may extend into the LAA, and may occur throughout Project operations.

12.4 MITIGATION

Table 12-7 describes the mitigation measures that will be used to manage Project effects, where practical, on Land and Resource Use.

Table 12-7 Mitigation Measures for Land and Resource Use

Potential Effect	Project Mitigation and Other Management Measures
Change in park or protected area	• Westcoast will develop a Stakeholder Engagement Plan. The plan will facilitate communication channels with affected stakeholders over the operational life of the Project to resolve issues that may arise.
Change in tenured land use and private property	• Westcoast will establish land use agreements and where appropriate compensate private property holders. • Westcoast will work with overlapping tenure holders to limit interference with existing uses. • Westcoast will develop a Stakeholder Engagement Plan (see above for details). • A Traffic and Access Management Plan will be developed to support safe driving practices and reduce impacts to landowners, residents, and local communities and to communicate and manage changes in access. The Plan will require that appropriate signage be posted in advance and during construction, indicating access restrictions. • A Worker Management Strategy (inclusive of a Project-specific orientation) will be developed to establish guidelines for Project workers to follow while on-site. During working hours, and while housed in Project sponsored accommodations (including existing camps and commercial accommodations), Project personnel will be prohibited from hunting, fishing, and using recreational vehicles within a buffer zone to be determined prior to construction. • A Timber Salvage Plan will be developed. • Scheduling of construction activities will consider appropriate timing to limit disruption of wildlife during sensitive periods. • Registered outfitters and trapline holders will be notified prior to construction. • Trapline holders will be compensated, where appropriate, in accordance with the BC Registered Trapper and Petroleum Industry Agreement on Notification and Compensation. • Waste and debris will be removed from the PDA following Project construction.
Change in non-tenured land use	• A Stakeholder Engagement Plan will be developed (see above for details) • A Traffic and Access Management Plan will be developed (see above for details) • A Worker Management Strategy will be developed (see above for details) • Scheduling of construction activities will consider appropriate timing to limit disruption of wildlife during sensitive periods • Existing disturbed areas (e.g., roads, logged areas) will be used to the extent practical to reduce the area of new clearing required • Natural regeneration, to the extent practical, will be allowed to occur within the PDA following Project construction.

Mitigation measures presented in the assessment of the Acoustic Environment (Section 5), Soil and Soil Productivity (Section 7), Fish and Fish Habitat (Section 8), Vegetation and Wetlands (Section 9) and Wildlife and Wildlife Habitat (Section 10) also apply to mitigate effects on tenured and non-tenured land use.

Westcoast is committed to regular communication with stakeholders, providing advance notice regarding Project plans, and the continuous monitoring of mitigation and other management measures via engagement with local infrastructure and service providers (see Section 3 for details of consultation activities).

12.5 RESIDUAL EFFECTS

12.5.1 Adherence with Land Use Planning

Project activities and physical works within the Hulcross Creek, Pine-Hasler, West Pine River and miscellaneous (settlements) RMZs adhere with uses designated by the Dawson Creek LRMP. With the application of best management practices, as referenced in the Burnt Pine Caribou Augmentation Plan, the Project adheres with allowable land uses within Zone C, matrix habitat. No further assessment on adherence with land use planning is required.

12.5.2 Change in Parks or Protected Areas

There is no overlap between the PDA and national, provincial or regional parks or protected areas and therefore no adverse residual effects are assessed at the PDA level. The LAA overlaps with 38 ha of Map Reserve designated under the *Land Act* for the purpose of fish and wildlife management and recreation. Because the Project PDA does not overlap with the map reserve, changes in access during construction and operation are not anticipated; however, changes in existing uses of the area could occur as a result of changes in the acoustic environment during construction (see Section 6). Since Section 6 concludes that with the application of mitigation measures changes in the acoustic environment are at or below the noise level recommendation at any receptor location outside the minimum buffer zone (350 m for land-based pipeline construction and 500 m for water crossings with trenchless construction methods), adverse effects on the use of parks or protected areas (also with the application of mitigation measures) is anticipated to be negligible. Changes in use of parks or protected areas during operations are not anticipated.

12.5.2.1 Summary

In summary, with the application of mitigation measures, residual effects on parks or protected areas will be adverse in direction, negligible in magnitude and will be limited to the LAA. During Project construction residual effects will be short term in duration and will occur during multiple irregular events as activities related to the physical modification to existing lands will alter existing acoustic environment conditions potentially affecting use and enjoyment of adjacent protected areas. No adverse residual effects are anticipated during Project operation.

Residual effects during construction will be reversible following the completion of construction activities. Residual effects during construction will occur in a disturbed socio-economic context as much of the PDA occurs in areas already modified by existing land uses.

12.5.3 Change in Tenured Land Use and Private Property

12.5.3.1 Private Property

Westcoast is in the process of consulting with private landowners to understand use constraints, obtain land-use agreements and where appropriate provide compensation. Upon successful agreement adverse residual effects on land owners will be reduced to negligible levels. Since Westcoast is negotiating an agreement with private landowners, further assessment is not required.

12.5.3.2 Overlap with ALR and Range Tenure

The PDA overlaps two areas totaling 67 ha designated as ALR. This represents 1.6% of the 4,092 ha area of ALR polygons 57883 and 581233 combined. The PDA also overlaps 25 ha of range tenure (6% of tenure under file ID RAN073716). During construction, access and use of ALR and range tenure overlapped by the PDA will be temporarily restricted. Following the completion of construction activities land will be reclaimed and returned to its original capability; albeit a time lag between disturbance and reclamation will occur. Where overlap with the PDA and ALR or range tenure occur (either on private property or Crown land), mitigation measures such as land use agreements, and where applicable, compensation, will lower the potential magnitude of adverse effects on land owners and tenure holders.

Acceptable land uses throughout the PDA will be negotiated with land-owners. Land use agreements with ALR users and range tenure holders will provide for on-going compatible use of lands. Mitigation measures provided Section 7 (Soil and Soil Productivity) satisfy ALC requirements for soil handling and protection. Considering the duration of construction, the application of mitigation measures and compatible uses of the ROW and ALR land (during operations), adverse effects on users of ALR land are expected to be low in magnitude, restricted to the PDA, long-term in duration (e.g., extending into Project operation to achieve full agricultural capability) and reversible following the completion of construction.

12.5.3.3 Overlap with Forestry Tenure

The PDA overlaps 25 ha of forest tenure cut blocks (Table 12-3), which correspond with overlapped tenured tree farm licenses held by the same licensees. The PDA also overlaps 5 ha of forest tenure managed license held by Banyon Consulting Ltd. Since construction requires the removal of trees from the PDA, and maintenance of the ROW during operations will prevent the reestablishment of trees, potential adverse effects on licensees could occur. Potential adverse effects will be managed through a timber salvage plan and ongoing engagement and negotiation with licensees. Residual adverse effects are confined to the PDA during construction

and to the ROW during operation. Effects are anticipated to be long-term in duration, extending through Project operation. Considering that only 25 ha of tenured forest area will be removed from two timber supply blocks representing less than 0.001% of total area (associated with these timber blocks), with the implementation of mitigation residual adverse effects on forest tenure are anticipated to be negligible.

12.5.3.4 Overlap with OGMA

As detailed in Table 12-4, the PDA overlaps two OGMAs totaling less than 1 ha. This spatial overlap represents 0.8% of the total area associated with OMGA AD19625200-8735 and less than 0.01% of OGMA AD19625200-874. This overlap does not exceed the criteria defined in the Ministry of Agriculture and Land's Ministerial Order (that disturbance shall not exceed 10% in OGMAs less than 50 ha; or 5% or 40 ha, whichever is less, in OGMAs of 50 ha or greater).

The proposed pipeline route was selected to take advantage of previously disturbed areas by paralleling the existing Westcoast pipeline ROW to reduce environmental impacts and habitat fragmentation. The OGMAs identified above could not be avoided due to their location in relation to these existing linear features (76.8% of the PDA within these OGMAs occur within preexisting cleared areas). The mitigation measures to be implemented in the OGMA are include minimizing of the proposed ROW width and intermittent TWS, including log decks, to the extent feasible as well as revegetation of log deck areas (see Section 9.0).

Considering overlap between the PDA and OGMAs does not exceed criteria defined in the Ministerial Order, that 76.8% of overlap occur within pre-existing cleared areas and that Project design mitigation measures reduce the potential magnitude of adverse effect by limiting the proposed ROW width and intermittent TWS within OGMAs, effects are low in magnitude. Since land clearing will be limited to the PDA effects are not expected to extend into the LAA or RAA.

12.5.3.5 Overlap with Mining Tenure

As detailed in Table 12-4, the PDA overlaps five mine tenures totaling 171 ha. This spatial overlap represents 0.1% to 1.7% of the total area held under each respective mine tenure. Since access and use of overlapped areas within the PDA will be restricted during construction and discouraged during operation there is potential for adverse effects on licensees. Potential adverse effects will be mitigated through engagement and negotiation, and if appropriate through compensation to move existing infrastructure (see Section 12.4). Residual adverse effects could extend into the LAA as restricted access to the PDA could interfere with ongoing mining operations occurring in within the remaining area held under mine tenure. With the implementation of appropriate mitigation measures, and considering the small percentage of overlapped tenure residual adverse effects are anticipated to be negligible.

12.5.3.6 Overlap with Oil and Gas Tenure

As detailed in Table 12-4, the PDA overlaps 13 ha of oil and gas tenure and parallels existing pipeline infrastructure. Since access and use of overlapped areas within the PDA will be restricted during construction and discouraged during operation, there is potential for adverse effects on licensees. Potential adverse effects will be mitigated through engagement and negotiation, and if appropriate through compensation, to move existing infrastructure (see Section 12.4). Residual adverse effects are limited to the PDA as access and use of oil and gas infrastructure within the LAA will not be affected (compatible land uses). With the implementation of mitigation measures residual adverse effects are anticipated to be negligible.

12.5.3.7 Overlap with Energy Generation and Transmission

As detailed in Table 12-4, the PDA overlaps less than 1 ha of electric powerline. Vertical clearance requirements for equipment lowering-in line pipe could conflict with existing above ground electric powerlines. Similarly, buried electric powerlines do not have a compatible land use with construction activities engaged in trenching of the ROW (ground disturbance). During operation, overlapping areas of the PDA for transmission line use are compatible with that of the Project. Since overlapping use of the PDA with electric powerlines are not compatible during construction there is potential for adverse effects on licensees. Potential adverse effects will be mitigated through engagement and negotiation, and if appropriate through compensation to relocate existing infrastructure (see Section 12.4). Residual adverse effects could extend to the LAA as the process of relocating existing electric powerlines could affect other electric energy generation and transmission infrastructure within the LAA as well as end-user (e.g., customer) use. With the implementation of mitigation measures residual adverse effects are anticipated to be low in magnitude.

12.5.3.8 Overlap with Trapping and Guide Outfitting

As detailed in Table 12-4, the PDA overlaps 171 ha of trapline tenure representing 0.1% of trapline license TR0731T010, 0.2% of TR0722T007 and 0.1% of TR0722T006. The PDA also overlaps with 171 ha of land licensed to guide outfitters representing 0.01% of total land licensed under ID 701245 and 0.03% under ID 701222.

Since access and use of overlapped areas within the PDA will be restricted during construction and discouraged during operation there is potential for adverse effects on licensees; however, trapping and guide outfitting may have compatible land uses with the Project and would be subject to negotiation with Westcoast. Potential adverse effects on licensees will be mitigated through engagement and negotiation, and if appropriate through compensation (see Section 12.4).

Prior to application submission registered outfitters and trapline holders were notified of the Project with mailed information packages that included the Project fact sheet, mapping, and the NEB brochure "Information for Proposed Pipeline or Powerline Project: What you Need to

Know". Registered outfitters and trapline holders were then notified of Westcoast's Project application submission with a letter referencing the NEB website and directing any concerns or comments to Westcoast and the NEB. Following receipt of regulatory approvals licensees will be notified of regulatory decisions and construction schedule (prior to construction) through mail, email or phone calls.

In addition, Project construction and operation could affect habitat availability, mortality risk and movement patterns of wildlife (see Section 10 Wildlife and Wildlife Habitat). Potential adverse effects on wildlife and wildlife habitat will be mitigated through measures identified in Section 10.4 (Wildlife and Wildlife Habitat).

Overall, residual adverse effects on trapping and guide outfitting could extend to the LAA because change in habitat availability, change in mortality risk and change in movement patterns could occur within a 1 km buffer of the PDA (see Section 10 Wildlife and Wildlife Habitat). Restricted access to the PDA during construction and discouraged use during operation could also affect access routes to other trapping and guiding locations within the LAA. Together, considering residual effects to Wildlife and Wildlife Habitat are assessed as being low in magnitude, that residual effects on trapline license-holders will be mitigated (see Table 12-7), and that overlapped areas represent less than 0.1% of total trapline tenure and guide outfitting tenure residual adverse effects are anticipated to be negligible. Effects are limited to the PDA and will be long-term in duration, extending throughout operation.

12.5.3.9 Overlap with Other Crown Tenures

As detailed in Table 12-4, the PDA overlaps 35 ha of other Crown tenures (roadways and railways, commercial recreation areas, and sand and gravel quarries). Where conflicting uses exist between the Project and existing land uses (e.g., sand and gravel quarrying) potential adverse effects on licensees will be mitigated through engagement and negotiation, and if appropriate, through compensation to move existing infrastructure (see Section 12.4). Where existing land uses may be compatible with the Project (commercial recreation and roadways and railways) best management practices and requirements regarding the construction of pipelines, as well as engagement and negotiation with licensees will reduce the magnitude of potential adverse effects. Where the PDA overlaps Section 16 Map Reserves additional consultation and/or permitting through responsible authorities may be required.

Residual adverse effects could extend into the LAA because restricted access to the PDA could interfere with ongoing operations of, for example sand and gravel quarrying operations occurring within the remaining area held under tenure. Considering spatial overlap with land used for sand and gravel quarrying represents 6.8% of total area held under tenure, with the implementation of mitigation, residual adverse effects are anticipated to be negligible to low in magnitude.

12.5.3.10 Summary

In summary, with the application of mitigation measures residual effects on tenured land use and private property during Project construction and operation will be adverse in direction, negligible to low in magnitude and limited to the PDA and LAA. During Project construction residual effects will be short term in duration and occur continuously because physical modifications to existing lands and restricted access to areas overlapped by the PDA will affect use. During Project operation residual effects will be long-term in duration and occur continuously, as access to the PDA will be discouraged by Westcoast; however, overlapping use of lands for several purposes (i.e., ALR and range land use, oil and gas tenure, energy generation and transmission, trapline tenure, guide outfitting tenure and other crown land tenures) may be compatible with Project use of the PDA and, potential effects, would be the subject of negotiation with Westcoast. Residual effects during both construction and operation will be reversible following Project decommissioning and reclamation. Residual effects during both construction and operation will occur in a disturbed socio-economic context as much of the PDA occurs in areas already modified by existing land uses. Following Project decommissioning and reclamation, there may be a net increase in access in the LAA resulting in a positive effect for area users.

12.5.4 Change in Non-Tenured Land Use

12.5.4.1 Hunting

As described in Table 12-3 and Section 12.2.2.3.1.1 the PDA overlaps with 171 ha of WMU 7-22 (less than 0.01% of total area) and WMU 7-31 (less than 0.01% of total area) in which hunting activities occur. Similar to the rationale provided in Section 12.5.2.6 (Trapping and Guide Outfitting) in addition to changes in access and use during construction and operation, the Project has the potential to affect habitat availability, mortality risk and movement patterns. Potential effects on Wildlife and Wildlife Habitat are mitigated through measures provided in Section 10.4 leaving low magnitude residual adverse effects occurring within the LAA for Land and Resource Use.

Since access will be restricted during construction and discouraged during operation (overlapping land use could be compatible and would be the subject of negotiation with Westcoast) and temporary changes in the presence of game animals will likely occur (see Section 10, Wildlife and Wildlife Habitat) the Project is anticipated to have adverse effects on hunting activities within the PDA. While access and use of land within the rest of the LAA will not be affected, the presence of game animals in the LAA may be affected as animals temporarily or permanently relocate due to sensory disturbance. Overall, with the application of mitigation measures to engage and provide notification of changes in access to identified stakeholders (see Section 12.4) and considering affected land within the PDA represents less than 0.01% of WMU 7-22 and less than 0.01% of WMU 7-31, effects on hunting are anticipated to be low in magnitude. Effects are anticipated to extend into the LAA based on the conclusions of Section 10 (Wildlife and Wildlife Habitat).

12.5.4.2 Fishing

As described above and as informed through Section 8 (Fish and Fish Habitat) there are 12 fish bearing watercourses overlapped by the PDA. The assessment of Fish and Fish Habitat concludes that adverse changes in fish habitat are anticipated to be low in magnitude and changes in fish health and mortality risk are low in magnitude (see Section 8). Although the magnitude of effects as assessed in Section 8 are anticipated to be negligible to low adverse effects on individuals wishing to engage in fishing activities at locations within the PDA could occur as access to the PDA will be restricted during construction and discouraged during operation. In total, these 12 watercourses represent a small percentage of potential areas within the LAA where fishing activities could take place. With the application of mitigation measures to engage and provide notification of changes in access to identified stakeholders (see Section 12.4); adverse effects are anticipated to be low in magnitude.

12.5.4.3 Recreational Sites and Trails

As described in Section 12.2.2.3.1.3, the PDA does not overlap with any RST BC recreational trails or known recreational trials that are not designated as map reserves, recreation reserves or protected areas. Regardless, it is conservatively assumed that non-designated trails and recreational sites exist within the land overlapped by the PDA. Considering that access to the PDA will be restricted during construction and discouraged during operation, potential adverse effects on users of non-designated recreational trails and sites could occur. While access and use will be discouraged during operations, overlapping recreational use of lands within the PDA and may be compatible (e.g., a hiking trail that crosses the ROW) and will most likely continue to occur once construction is complete. Adverse effects could extend into the LAA as access to the PDA will be restricted during construction and discouraged during operation. This restricted access could affect the use of linear recreational features such as non-motorized use trails (e.g., hiking and snowshoeing trails) and motorized-use trails (e.g., ATV, UTV and dirt bike trails). With the application of mitigation measures such as those targeted at facilitating engagement with identified stakeholders to provide early notice of changes in access (see Section 12.4) residual adverse effects on non-designated recreational trails and sites are anticipated to be negligible.

12.5.4.4 Visual Quality

Project construction has the potential to alter the visual quality of the landscape from viewpoints which may be important to local stakeholders, recreationalists and resource users, and to a greater extent the tourism sector within the PRRD. Of concern are potential adverse effects on visual resources classified within the BC VLI. The Project will overlap with 12 VLI polygons with VQCs preservation and partial retention to modification. With the application of mitigation measures and because pipeline developments are often not visible from similar elevation viewpoints due to vegetation and topographical shielding, residual effects on visual quality will be moderate in magnitude.

12.5.4.5 Summary

In summary, with the application of mitigation measures residual effects on non-tenured land use during Project construction and operation will be adverse in direction, low to moderate in magnitude and will be limited to the LAA. During Project construction residual effects will be short-term in duration and will occur continuously as physical modifications to existing lands and restricted access to areas overlapped by and near to the PDA will affect use. During Project operation residual effects will be long-term in duration and will occur continuously as access to the PDA will be discouraged by Westcoast; however, overlapping use of lands by individuals engaging in recreational activities, hunting and fishing may be compatible with Project use of the PDA and would be the subject of negotiation with Westcoast. Residual effects during both construction and operation will be reversible following Project decommissioning and reclamation. Residual effects during both construction and operation will occur in a disturbed socio-economic context as much of the PDA occurs in areas already modified by existing land uses. Following Project decommissioning and reclamation, there may be a net increase in access in the LAA, resulting in a positive effect for area users.

12.5.5 Summary of Residual Effects

Project residual effects on Land and Resource Use are summarized in Table 12-8.

Table 12-8 Summary of Project Residual Effects on Land and Resource Use

Project Phase	Residual Environmental Effects Characterization						
	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Change in parks or protected areas							
Construction	Adverse	Negligible	LAA	Short Term	Multiple/Irregular	Reversible	Disturbed
Operation	-	-	-	-	-	-	-
Change in tenured land use and private property							
Construction	Adverse	Negligible - Low	PDA - LAA	Short Term	Continuous	Reversible	Disturbed
Operation	Adverse	Negligible - Low	PDA - LAA	Long Term	Continuous	Reversible	Disturbed
Change in non-tenured land use							
Construction	Adverse	Low - Moderate	PDA - LAA	Short Term	Continuous	Reversible	Disturbed
Operation	Adverse	Low - Moderate	PDA - LAA	Long Term	Continuous	Reversible	Disturbed

NOTE:
- Not applicable.

12.6 CUMULATIVE EFFECTS

The Project residual effects described in Section 12.5 that are likely to interact cumulatively with residual effects of other physical activities are identified in this section and the resulting cumulative effects are assessed. This is followed by an analysis of the proposed Project contribution to residual cumulative effects.

Two conditions must be met to initiate an assessment of cumulative effects:

- Proposed Project is assessed as having residual effects on the VC
- Project residual effects act cumulatively with residual effects of other physical activities

If either condition is not met, the assessment of cumulative effects concludes with a statement that further assessment of cumulative effects is not warranted because the proposed Project does not interact cumulatively with other projects or activities.

12.6.1 Identification of Project Effects Likely to Interact Cumulatively

The Project PDA is adjacent to existing pipeline infrastructure and there is an existing moderate level of overlap between existing tenured and non-tenured land uses in the RAA. This information is presented in Section 12.2 (Existing Conditions) and is therefore considered in the assessment of the residual environmental effects of the Project (Section 12.5). Other existing and reasonably foreseeable projects occurring within the RAA that have the potential to result in cumulative environmental effects are shown in Table 12-9.

Table 12-9 Potential Cumulative Effects on Land and Resource Use

Other Physical Activities with Potential for Cumulative Effects	Potential Cumulative Effects			Rationale
	Change in Parks or Protected Areas	Change Tenured Land Use and Private Property	Change in Non-Tenured Land Use	
Existing and future cut blocks for companies such as Louisiana-Pacific Canada Ltd., Chetwynd Mechanical Pulp, Sawchuck Contracting, West Fraser Mills, and Canadian Forest Products	✓	✓	✓	Residual effects of each project have the potential to act cumulatively with those of the Project restricting access and use of areas overlapped by Project tenures.
Existing linear infrastructure (resource roads and access roads)	✓	✓	✓	
Other pipelines (including Coastal GasLink, Westcoast Connector, and Prince Rupert Gas Transmission, and the FSJ Mainline)	✓	✓	✓	
Gas Facilities (including Taylor Complex [McMahon Gas Plant, Cogen, Taylor Gas Liquids, CS], Westcoast Kwoen Gas Plant, and Pine River Gas Plant	✓	✓	✓	
Site C Clean Energy Project	✓	✓	✓	
Hydro lines and the W.A.C. Bennett dam	✓	✓	✓	
Gething Mine, Carbon Creek Mine, Willow Creek Mine, Sukunka Mine, Suska Mine, Brule Mine and Central South Mine Project	✓	✓	✓	
Multiple BC OGC facilities for such companies as Canadian Natural Resources Limited, Crew Energy Inc., Talisman Energy, Shell, Terra Energy, Tourmaline Oil Corp., and Arc Resources Ltd.	✓	✓	✓	
Proposed Taylor Wind Project	✓	✓	✓	

NOTE:
✓ Those "other projects and physical activities" whose residual effects are likely to interact cumulatively with project residual effects.

Adverse residual effects on parks and protected areas, tenured land use and private property, and non-tenured land use, have the potential to interact cumulatively with other past and existing projects. The Project is assessed as having residual effects on parks or protected areas, several tenured land uses including forestry, mining, oil and gas, energy generation and transmission, trapping and guide outfitting and other crown tenures. Spatial overlap between the Project RAA and these tenured land uses are summarized in Table 12-3. The Project is also assessed as having adverse residual effects on non-tenured land use including hunting, fishing, recreational sites and trails and visual quality. Spatial overlap between the Project RAA and these non-tenured land uses are provided in Section 12.2.2.3.

12.6.2 Cumulative Effects Assessment for Change in Tenured Land Use and Private Property and Non-Tenured Land Use

Without the application of Project-residual effects, adverse cumulative effects on parks and protected areas within the RAA are anticipated to be low in magnitude as the majority of these areas are avoided by industrial development precluding changes in access and use due to overlapping land use. However, cumulative adverse effects related to changes in use of these areas is expected to be low to moderate in magnitude as use will be affected by adjacent construction and operation-based activities. Overall, cumulative adverse effects on tenured land use and private property as well as non-tenured land use is expected to be moderate in magnitude as proponents of projects identified in Table 12-8 would be expected by regulators to implement similar mitigation measures and to compensate tenure holders, where appropriate. The RAA is also characterized as having a disturbed socio-economic context where multiple overlapping land uses already occur.

While the Project is assessed as having residual effects on tenure and non-tenured land uses that could interact cumulatively with those of other projects and physical works, Project contributions to cumulative effects are minor in comparison to the regional context. Considering the small spatial extent of residual effects (largely confined to the PDA), the PDA being in an area largely disturbed by existing industrial land uses, the Project's short construction duration (approximately 12 months), and mitigation measures targeted at reducing adverse effects on tenure holders and stakeholders, cumulative effects are considered to be adverse but low in magnitude.

12.7 DETERMINATION OF SIGNIFICANCE

With the application of recommended mitigation measures, Project-specific residual effects on Land and Resource Use during construction and operation are predicted to be not significant. Project activities and physical works (once properly mitigated) comply with established land use plans and policies (i.e., the Dawson Creek LRMP and the Burnt Pine Caribou Augmentation Plan) and ALR requirements. Overall, with the application of mitigation measures, adverse Project residual effects are not anticipated to create a change or disruption that restricts or degrades present land use capability to a point where activities cannot continue at or near current levels and where compensation is not possible.

Considering the Project's minor contribution to cumulative effects (which, without the Project range in magnitude from low to moderate and occur within a disturbed socio-economic context) within a regional context and with the application of recommended mitigation measures, cumulative residual effects on Land and Resource Use during construction and operation are predicted to be not significant. The Project's contribution to adverse cumulative effects is not anticipated to create a change or disruption that restricts or degrades present land use capability to a point where activities cannot continue at or near current levels and where compensation is not possible. Project activities comply with established land use plans and policies (i.e., the Dawson Creek LRMP and the Burnt Pine Caribou Augmentation Plan).

13 INFRASTRUCTURE AND SERVICES

13.1 SCOPE OF ASSESSMENT

This section defines and describes the scope of the assessment of potential effects on Infrastructure and Services. This VC was selected because Project activities, including traffic and the presence of non-resident workers, could place increased demands on local services and infrastructure, such as accommodation, health, policing, firefighting, ambulance, and transportation.

13.1.1 Regulatory Setting

The scope of this section takes into consideration Table A-3 of the NEB Filing Manual (NEB 2016) which provides filing requirements and guidance for assessing socio-economic elements, including infrastructure and services. This section of the ESA focuses on those components identified in Table A-3 for Infrastructure and Services, except for the following:

- Railways are covered under other Crown tenures in Section 12 (Land and Resource Use)
- Adverse effects on navigation and navigation safety are addressed in Section 14 (Navigable Waters)
- Recreation, powerlines, or potentially affected facilities; these are addressed in Section 12 (Land and Resource Use)
- In addition to regulatory requirements, the assessment scope also reflects:
  - The potential size (magnitude) and likely duration of Project effects
  - Experience of Westcoast with similar projects in the past, including mitigation and management measures undertaken
  - The professional judgment of the assessment practitioners

13.1.2 Selection of Potential Environmental Effects and Measurable Parameters

Potential effects of the Project were identified through public and regulatory consultation with stakeholders, past experience, and professional judgment (see Section 3). Table 4-1 of the ESA provides additional background on which socio-economic elements were included in the assessment of potential Project effects, and rationale for their inclusion. During the preparation of this ESA, Westcoast notified the Aboriginal Groups listed in Section 3.2.2.

Table 13-1 summarizes the potential effects, measurable parameters, and rationale for selection of the Infrastructure and Services VC. Measurable parameters were selected to provide a means of qualitatively assessing the expected change to existing socio-economic conditions as they relate specifically to Infrastructure and Services.

Table 13-1 Potential Effects and Measurable Parameters for Infrastructure and Services

Potential Effect	Rationale for Inclusion of the Potential Project Effect in the Assessment	Measurable Parameter(s) for the Effect	Rationale for Selection of the Measurable Parameter
Infrastructure and Services VC			
Change in accommodations	• The Project's construction workforce will utilize commercial accommodation	• Availability of commercial accommodations (e.g., vacancy rates, number of rooms)	• Illustrates extent of Project demand compared to baseline conditions
Change in infrastructure and services	• The Project's construction workforce may use health, emergency, and policing services • Project-related traffic accidents, if they occur, could require use of regional emergency service providers	• Parameters based on infrastructure and services affected (e.g., police officers/1,000 population, peak demand/rated capacity)	• Infrastructure and service demands related to population size, which is influenced by the number of non-resident workers • Service provider and infrastructure capacity relates to the ability to manage Project effects
Change in transportation infrastructure	• Transporting construction materials, equipment and workers increases traffic volumes on local road networks, potentially increasing travel times and affecting road safety	• Road traffic volume (i.e., vehicles/day)	• Movement of workers and goods may increase demand on traffic on local roads and highways

13.1.3 Boundaries

13.1.3.1 Spatial Boundaries

The PDA represents the physical footprint of the Project. The LAA used for the assessment of effects on Infrastructure and Services includes those communities that are located within an approximate commuting time of one hour of the Project, which consists of:

- Peace River Regional District Electoral Areas (PRRDEA) C and E
- The City of Dawson Creek
- The District Municipality (DM) of Chetwynd
- The DM of Hudson's Hope
- The DM of Tumbler Ridge
- The Village of Pouce Coupe
- East Moberly Lake 169 Indian Reservation (IR) (Saulteau First Nations)
- West Moberly Lake 168A IR (West Moberly First Nations)

The RAA consists of the PRRD, and includes all of the communities in the LAA, and the following:

- DM of Taylor
- The City of Fort St. John
- McLeod Lake 1 IR (McLeod Lake Indian Band)
- Halfway River 168 IR (Halfway River First Nation)

13.1.3.2 Temporal Boundaries

See Section 2.4 for the Project schedule and temporal boundaries for this VC.

13.1.3.3 Administrative Boundaries

The LAA and RAA overlap with Peace River South Local Health Area (LHA) – 59, and Peace River North LHA – 60 located within the Northeast Health Service Delivery Area, of the Northern Health Authority (BC Stats 2015). LHA - 59 consists of the following LAA communities: DM of Chetwynd, City of Dawson Creek, Village of Pouce Coupe, DM of Tumbler Ridge, West Moberly Lake 168A IR (West Moberly First Nations), East Moberly Lake 169 IR (Saulteau First Nations). LHA- 60 consists of the following RAA communities: DM of Hudson's Hope, City of Fort St. John, and Halfway River 168 IR (Halfway River First Nation).

The Project is also located within the Northeast Development Area 8, which is one of eight economic regions in BC used by Statistics Canada to show the location of tabulated and disseminated census data (BC Stats n.d.). The LAA also overlaps with the North East administrative boundary of BC Emergency Health Services (BCEHS).

13.1.4 Residual Environmental Effects Description Criteria

Table 13-2 presents the criteria that are applied to characterize Project residual effects on Infrastructure and Services.

Table 13-2 Characterization of Residual Environmental Effects on Infrastructure and Services

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories	
Direction	The long-term trend of the residual effect	Positive	Residual effect is positive compared to baseline condition
		Adverse	Residual effect is negative relative to baseline condition
		Mixed	Residual effects can be both positive and negative compared to baseline conditions
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	Negligible	No measurable change from baseline conditions
		Low	A measurable change but residual effect cannot be distinguished from baseline conditions within normal range of variability
		Moderate	Measurable change but unlikely to pose a serious risk or benefit to the VC or to represent a management challenge
		High	Measurable change that is likely to pose a serious risk or benefit to the VC and, if negative, represents a management challenge
Geographic Extent	The geographic area in which an environmental effect occurs	LAA	Residual effect is limited to the LAA
Frequency	Identifies when the residual effect occurs and how often during the Project or in a specific phase	Single	Residual effect occurs once
		Multiple/Irregular	Residual effect occurs sporadically throughout assessment period
		Multiple/Regular	Residual effect occurs repeatedly and regularly throughout assessment period
		Continuous	Residual effect occurs continuously
Duration	The period of time required until the measurable parameter or the VC returns to its existing condition, or the effect can no longer be measured or otherwise perceived	Short-term	Residual effect will last no longer than the construction phase
		Long-term	Residual effect extends through the operations phase
		Permanent	VC or sub-component unlikely to recover to baseline conditions

Table 13-2 Characterization of Residual Environmental Effects on Infrastructure and Services

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories	
Reversibility	Pertains to whether a measurable parameter or the VC will return to its existing condition after the Project activity ceases	Reversible	Residual effect will no longer occur after Project closure and reclamation (or sooner)
		Irreversible	Residual effect is irreversible after closure of the Project (i.e., permanent)
Ecological and Socio-economic Context	Existing condition and trends in the area where environmental effects occur	Low Resilience	Occurs when infrastructure and services have limited capacity to accommodate increased demand
		Moderate Resilience	Occurs when infrastructure and services can accommodate moderate levels of increased demand
		High Resilience	Occurs when infrastructure and services have high capacity to accommodate increased demand

13.1.5 Significance Thresholds for Residual Environmental Effects

A significant adverse residual effect occurs when there is an exceedance of available capacity, or a substantial decrease in the quality of a service provided, on a persistent and ongoing basis, which cannot be mitigated with current or anticipated programs, policies, or mitigation measures.

13.2 EXISTING CONDITIONS

13.2.1 Methods

The proposed Project is located within the PRRD, approximately 15 km west of the DM of Chetwynd, BC. The assessment focused on hotel and motel accommodations and community level infrastructure and services within the DM of Chetwynd because the Project is anticipated to house its temporary workforce in this LAA community. The DM of Chetwynd is also the closest community to Project construction-related activities.

The description of existing conditions is also based upon data obtained from a variety of sources, including:

- Government sources, including Statistics Canada and BC Stats
- Police resource information obtained from the BC Ministry of Justice – Police Services Division
- Traffic volume data obtained from the BC MOTI
- Provincial Health Services Authority
- Industry sources, including hotel and motel accommodation data
- Phone interviews with managers of commercial accommodations located in Chetwynd

13.2.2 Overview

13.2.2.1 Commercial Accommodations

As of 2010 there are 15 hotels/motels with 656 rooms located in the City of Dawson Creek, and a total of 55 hotels/motels and 3,215 rooms located in the rest of the Northeast Development Region (BC Stats 2010). There are approximately eleven motel/hotels located within the DM of Chetwynd (Destination BC Corporation 2015).

Commercial accommodations in Chetwynd reported approximately 60% utilization in the fall/winter months, and 80-90% utilization in the spring/summer months (Louise 2015 pers. comm.). According to local sources, demand for commercial accommodations in Chetwynd varies throughout the year, with higher demand in the spring and summer months and lower demand in the fall and winter months (Louise 2015 pers. comm., Anonymous 2015. pers. comm.). This is attributed to a combination of factors including: oil and gas activities, other industry construction, and tourism (Louise 2015 pers. comm., Anonymous 2015. pers. comm.). From 2014 to 2015, overall demand in commercial accommodations declined in Chetwynd by approximately 10-20% due to such factors as fluctuation in the requirements of the oil and gas industry and proximity to construction projects (Louise 2015 pers. comm.).

13.2.2.2 Health Services

Northern Health along with the provincial government are responsible for providing quality services that meet the health needs of communities by preventing, diagnosing, and treating illnesses (Provincial Health Services Authority 2014a). The First Nations Health Authority (FNHA) is responsible for planning, management, service delivery and funding of health programs to First Nations communities (FNHA n.d.).

The average number of physicians, specialists, and supplementary health practitioners per 100,000 population in LHA-60 and LHA-59 is lower than in BC overall (Table 13-3) (PHSA 2014a, PHSA 2014b).

Table 13-3 PRN LHA - 59 and 60, 2009–2010 Available Health Practitioners per 100,000

Health Practitioners	LHA - 59 Average (per 100,000)	LHA - 60 Average (per 100,000)	BC Average (per 100,000)
Physicians	100	86	110
Specialists	59	22	94
Supplementary practitioners	63	60	133
SOURCES: PHSA 2014a, b, BC Stats 2015			

13.2.2.3 Police and Emergency Response Services

13.2.2.3.1 Police Services

Policing in the LAA is provided by the Royal Canadian Mounted Police (RCMP) "E" Division - North District (BC Ministry of Justice 2014). The Dawson Creek detachment has both municipal and provincial policing services, while the Chetwynd, Tumbler Ridge, and Hudson's Hope detachments are limited to provincial services (BC Ministry of Justice 2014).[9] In addition to providing services to Dawson Creek, the detachment also provides policing services to the Village of Pouce Coupe. The Chetwynd detachment provides police services to East Moberly Lake 169 IR (Saulteau First Nations) and West Moberly Lake 168A IR (West Moberly First Nations) (BC Ministry of Justice 2014).

Of the communities within the LAA, Dawson Creek had the highest annual crime rate at 123 per 1,000 residents (Table 13-1). Between both the municipal and provincial detachments Dawson Creek also had the highest number of caseloads per officer at 60 and 64, (Table 13-4) (BC Ministry of Justice 2014). Out of the provincial detachments in the LAA, Chetwynd has the highest crime rate at 104 per 1,000 population, and the second highest number or of caseloads per officer (57), following the Dawson Creek provincial detachment (BC Ministry of Justice 2014). The other provincial detachments in the LAA had generally lower crime rates and caseloads per officer compared to the BC provincial average (Table 13-4).

Table 13-4 Police Resources and Crime Rates in the LAA–2013

Community/Responding Detachment	Crime Rate[1] (per 1,000 population)	Case Load [2] (per 1,000)
Chetwynd/Provincial Detachment	104	57
Dawson Creek/Municipal Detachment	123	60
Dawson Creek/Provincial Detachment	37	64
Hudson's Hope/Provincial Detachment	61	26
Tumbler Ridge/Provincial Detachment	55	30
BC Municipal Detachments Average	67	56
BC Provincial Detachments. Average	95	65

NOTES:
1 Crime rate is the number of Criminal Code offences or crimes (excluding drugs and traffic) reported for every 1,000 persons.
2 Case load is number of Criminal Code offences per authorized strength. Caseloads represent the workload per officer, and as a result, is a strong indicator of the demand for police services.
SOURCE: BC Ministry of Justice 2014.

9 Under the terms of the Provincial Police Service Agreement and the *Police Act* the provincial government is responsible for providing policing and law enforcement services to unincorporated/rural areas and municipalities under 5,000 population (Ministry of Justice 2014). The funding structure for provincial detachments that serve communities under a population of 5000 is 70% provincial and 30% federal. Municipalities with population between 5,000 and 14,999 contract the provincial government for municipal police services (i.e., municipal detachments) (Ministry of Justice 2014). The funding structure for these detachments is 70% municipal and 30 % federal (Ministry of Justice 2014).

13.2.2.3.2 Emergency Response Services (Fire and Ambulance)

Fire and emergency response services are provided throughout the LAA through municipal and volunteer run fire departments, and through the coordinated efforts of the PRRD Emergency Services program (PRRD n.d.). The following LAA communities have local fire and emergency response services: DM of Chetwynd (Chetwynd Volunteer Fire Department), City of Dawson Creek (Dawson Creek Fire Department), DM of Hudson's Hope (Hudson's Hope Fire and Rescue Service), Village of Pouce Coupe (Pouce Coupe Volunteer Fire Department), and Village of Tumbler Ridge (Tumbler Ridge Fire Department) (PRRD n.d.). The Moberly Lake Volunteer Department provides fire protection for the unincorporated Moberly Lake rural areas as well as the West Moberly First Nation and Saulteau First Nation (Northern Development and Initiative Trust 2015).

The BCEHS provides pre-hospital emergency medical services and inter-facility patient transfer and transport services under three agencies: the BC Patient Transfer Network, Trauma Services BC, and BC Ambulance Services (BCAS) (BCEHS 2015a, b).

The PRRD tracks 9-1-1 calls (including RCMP, BC Ambulance, and fire dispatch related calls) for all of the communities located in the LAA (PRRD 2013). In 2012 9-1-1 call volumes showed a 5% increase in 2011 for a total of 18,835 calls, an increase of 22% from 2010. The RCMP saw a 1% increase from 2011–2012, but an overall increase of 21% from 2010–2012. BC Ambulance calls increased 13% from 2011–2012 and 23% 2010-2012. The Dawson Creek dispatch experienced an increase of 26% from 2011–2012, and the Fort St. John dispatch experienced an increase of 39% from 2011–2012.

13.2.2.4 Landfills, and Potable and Wastewater Management

13.2.2.4.1 Landfills

There are two landfills located within the LAA, one in Chetwynd and one in Bessborough, both operated by the PRRD (PRRD 2015). The Chetwynd Landfill has 9–12 years capacity remaining and will go through a progressive closure starting in 2016 (PRRD 2015). However, the Bessborough Landfill has over 100 years' lifespan remaining and will undergo operational capacity upgrades starting in 2016 (PRRD 2015).

13.2.2.4.2 Potable and Wastewater Management

The DM of Chetwynd's primary source of water is the Pine River, providing up to 95% of all municipal water use (DM of Chetwynd 2012). Raw water reservoirs provide a total storage of 44 million gallons, which accounts for approximately 60 days of water supply for Chetwynd. A secondary well provides additional capacity (5%) during times of high turbidity levels in the Pine River (DM of Chetwynd 2012).

The wastewater lagoon treatment facility located in the DM of Chetwynd is aging and will undergo infrastructure upgrades following funding allocation from the provincial and federal governments (Infrastructure Canada 2015). Upgrades will help reduce the quantity and improve

the quality of treated water flowing into the Pine River, and will verify that the system complies with current wastewater treatment standards and requirements (Infrastructure Canada 2015).

13.2.2.5 Transportation

Highways within the LAA include Highways 29, 97, 52 and 2. Highway 97 connects the DM of Chetwynd with the City of Dawson Creek. From the City of Dawson Creek, Highway 97 continues north to the DM of Taylor and the City of Fort St. John. Highway 29 connects the DM of Chetwynd with East Moberly Lake 169 IR (Saulteau First Nations), West Moberly Lake 168A IR (West Moberly First Nations), the DM of Hudson's Hope and the City of Fort St. John. To the south, Highway 29 connects the DM of Chetwynd with the DM of Tumbler Ridge. West of the City of Dawson Creek, Highway 52 connects Highway 97 with the DM of Tumbler Ridge. Highway 2 connects the City of Dawson Creek with the Village of Pouce Coupe. Class ratings based on average daily traffic (ADT) and winter average daily count (WADC) for these highways is summarized in Table 13-5.

Table 13-5 Highway Class Rating Type – LAA

Highway	Summer Class Rating Type	ADT	Winter Class Rating Type	WADT
97	3	1,000–5,000	A[1]	> 5,000
29	3	1,000–5,000	B[2]	1,000–5,000
2	3	1,000–5,000	A[1]	> 5,000
52	4	500–1,000	B[2]	1,000–5,000

NOTES:

1 High volume traffic (>5,000 WADC) or commuter routes – includes very high ski hill commuter routes.

2 All trunk and main routes (1,000 to 5,000 WADC) not included in A – includes lower volume ski hill traffic.

SOURCE:

BC MOTI 2015a.

A summary of annual average daily traffic (AADT) and summer average daily traffic (SADT), counts of the number of vehicles passing a traffic monitoring site in a given year (AADT) and for the months of July and August (SADT), for highways 97 and 2 are provided in Table 13-6. Traffic monitoring sites were chosen such that existing conditions regarding traffic volumes could be characterized against sections of highway most likely to be influenced by Project-related traffic.

Table 13-6 Traffic Volumes on Highway 97 and 29

Highway	Traffic Monitoring Site ID	Description	2011/2013		2014		Percent Change (%)	
			AADT	SADT	AADT	SADT	AADT	SADT
97	P-43-2NS[1]	Route 97, 0.3 km south of Westcoast Energy Pump Stn #2 at Willow Flats 42.0 km South of Chetwynd	1,420	1,575	1,551	1,906	9.2	21.0
	43-009NS	Route 97, 1.0 Km south of Route 29, Chetwynd	3,471	3,737	4,223	4,524	21.7	21.1
	43-019NS	Route 97, 1.5 km north of Route 29 (at north end of Wabi Creek Bridge), Chetwynd	6,343	6,830	7,430	7,960	17.1	16.5
	43-021NS	Route 97, 4.2 km south of Rice Road (Road 283), north of Chetwynd	2,034	2,801	1,904	2,605	-6.4	-7.0
29	43-032NS	Route 29, 100 m North of 47th Street, Chetwynd	3,410	3,699	4,341	4,651	27.3	25.7
	43-018NS	Route 29, at north end of Dickebush Creek Bridge, 17.1 km south of Route 97	850	922	700	750	-17.7	-18.7

NOTE:

[1] AADT and SADT provided for 2011 reflects data for Highway 29, as where AADT and SADT provided for 2013 reflects data for Highway 97.

SOURCE:

BC MOTI 2015b,c,d,e,f,g

13.3 PROJECT INTERACTIONS

Potential interactions between the Project and Infrastructure and Services are summarized in Table 13-7. Project effects on Infrastructure and Services will be driven by two factors: the presence of a non-resident workforce and the movement of equipment and materials to and from the worksite. Because it is not possible to determine either the extent of non-resident worker participation in individual construction activities or to isolate the transportation requirements for individual activities, Project-related effects on Infrastructure and Services are described collectively for each phase of the Project. Those project activities not expected to interact with the Valued Component (e.g., "-") are not carried through the effects assessment.

Table 13-7 Potential Project Effects on Infrastructure and Services

Project Activities and Physical Works	Potential Effects		
	Infrastructure and Services		
	Change in demand for accommodation	Change in demand for infrastructure and community services	Change in demand on transportation infrastructure
Construction	✓	✓	✓
Operation	N/A	N/A	N/A

NOTES:
✓ Indicates that an activity is likely to contribute to the potential effect.
N/A Not applicable.

The assessment focuses on the construction phase, where effects are likely to occur because:

- Some non-residents will be brought into the LAA for the duration of the construction, adding to demands for commercial accommodations and infrastructure and services
- Movement of labour and materials will place additional demands on transportation infrastructure

Project operation is anticipated to result in negligible effects on Infrastructure and Services because the proposed Project represents an expansion of an existing operation and very few, if any additional workers will be required to operate the Project. Consequently, further analysis of the operation phase is not required.

13.4 MITIGATION

Table 13-8 describes the mitigation measures that will be used to manage Project effects, where practical, on Infrastructure and Services.

Table 13-8 Mitigation Measures for Infrastructure and Services

Effect	Project Mitigation and Other Management Measures
Change in accommodation	• Peak construction activities will be timed so that use of commercial accommodation for workers who permanently reside outside the LAA will occur during seasons with low occupancy, where practical. This timing also coincides with several environmental restrictions (such as fish and nesting bird timing windows).
Change in community infrastructure and services	• An emergency response plan will be developed and implemented to address field health services, emergency call-out procedures, fire response plans, and other concerns. • Personnel trained in first response will be employed to provide emergency first aid onsite and will have vehicles suitable for the transport of injured workers. • A construction safety program will be established that addresses applicable laws and regulations related to health, safety and environmental (HSE) performance. • Workers will be made aware of Work Safe BC's Regulations and Guidelines for Oil and Gas Industry—Construction (Pipelines, Facilities, Roads) (WorkSafeBC 2015) • Personnel will adhere to the contractor's fit for duty policy.
Change in transportation infrastructure	• The Project construction schedule and road crossing procedures will be confirmed with local authorities and required permits will be obtained prior to the start of construction activities. • A traffic and access management plan will be developed to support safe driving practices and limit impacts to landowners, residents and local communities and to communicate and manage changes in access. The Plan will require that appropriate signage be posted in advance and during construction, indicating access restrictions.

13.5 RESIDUAL EFFECTS

13.5.1 Change in Demand for Commercial Accommodations

Project construction will require an average workforce of 200 with a peak workforce of 400 reached mid-construction (month 3). It is Westcoast's preference to hire local workers; however, during periods of peak construction it is estimated that the workforce will be comprised of approximately 160 persons from the LAA, 90 person from other parts of BC and 150 persons from other parts of Canada. The peak construction workforce will be sustained for 3 to 4 weeks.

Currently, Westcoast plans to house workers in local commercial accommodation (hotels and motels) in the Chetwynd area and/or in existing open lodge facilities. Given increased vacancies in commercial accommodations between 2014 and 2015 in Chetwynd, and the availability of up to 3,871 commercial accommodations rooms available in the LAA, the Project's peak workforce should be well accommodated.

In consideration of the mitigation measures included in Table 13-8, Project-related residual effects on commercial accommodations will be positive because Project-related construction activities are anticipated to take place in the fall/winter months when vacancy rates are lowest in Chetwynd. The added revenue created by the temporary workforce is considered beneficial

as it will support local commercial accommodation business owners when they have available capacity. Project residual effects will be low in magnitude, may extend into the RAA, and occur during the schedule of workforce turn-a-rounds, and are short-term and reversible. Project residual effects will occur in a moderately resilient socio-economic context given the overall high level of demand for commercial accommodations in the LAA.

13.5.2 Change in Demand for Community Infrastructure and Services

During peak construction, the Project's non-resident workforce could place increased demand on community infrastructure and services. Taking into consideration the temporary nature of the proposed Project construction activities and the relatively small peak number of non-resident workers directly employed by the Project, increased demand for medical and emergency services in the case of an accident could occur during construction related activities and/or commuting between work-shifts. However, based on the implementation of the emergency response plan, consideration for on-site safety training and trained on-site safety attendants, Project-related residual effects on health services will be adverse but short-term, low in magnitude, and reversible.

The Project's non-resident workforce has potential to place increased demand on police and emergency response services, by increasing the potential for work-related accidents or injuries, increasing the potential risk of motor vehicle incidents during commutes to and from work. However, project-specific mitigations measures, such as the traffic and access management plan, and Westcoast's fit for duty policy will help to reduce overall effects on police and emergency response services. The Projects-residual effects will be short-term, low in magnitude, and reversible.

The proposed Project has potential to affect landfill capacity from the disposal of waste debris associated with pipeline construction, and from the disposal of waste created by the non-resident workforce staying in commercial accommodations. Household waste from the non-resident workforce will be disposed at a local landfill able to support increased demand. Waste from the construction of the Project will not be disposed of at municipal solid waste facilities within the PRRD, but will be transported and disposed of at an authorized, independent location. Given the small size of the Project's non-resident peak workforce and short duration of construction activities, effects on landfills and potable and waste water are anticipated to be short-term, low in magnitude, and reversible.

In summary, the proposed Project has the potential to affect community infrastructure and services, including health services, police and emergency services, and landfill and potable/ wastewater infrastructure. However, considering the peak construction period, during which an estimated 150 non-resident workers will be needed, is expected to last only three to four weeks, and the average non-resident workforce over the year-long construction period is approximately 74 persons, the Project residual effects on community infrastructure and services is anticipated to be short term and low in magnitude. With the implementation of mitigation measures, residual effects will be adverse but reversible at the end of construction. Considering

the high capacity utilization of health services and high case load of RCMP in the LAA (see Section 13.2.2.2 and Section 13.2.2.3) effects will occur in a low-moderate socio-economic context.

13.5.3 Change to Transportation Infrastructure

During construction Project-generated traffic is estimated as follows:

- > 1 round trip/day to move construction waste based on the generation of 70 cubic yards of waste
- 61 round trips/day will be required to move workers to and from marshaling locations and the PDA
- 25 round trips/day will be required to move equipment and materials to the PDA

Trips associated with the movement of construction wastes are based on the generation of 70 cubic yards of waste for the construction period. Estimates for the number of trips required to move workers to and from marshaling locations and the PDA are based on the assumption that 10% of the workforce will be transported in crew cab vans (capacity assumed to be four persons), 20% will be transported in 24 person vans (capacity assumed to be 20 persons) and 70% will be transported in 52 person buses (capacity assumed to be 45 persons). Estimates regarding the movement of equipment and materials are based on Project design, Westcoast's previous experience constructing projects of similar size and scope within the RAA, as well as publicly available information for projects of similar size within the LAA.

Based on the above estimates the Project will increase ADT by 172 trips (86 round trips). In comparison to AADT within the LAA this increase is relatively small (on average an increase of 2-11% at monitoring sites along Highway 97 and 0.1-0.3% at monitoring stations along Highway 29). While it is unlikely that Project-generated traffic will increase the ADT by 172 counts along each of the major roadways within the LAA, a conservative assumption that this scenario will occur has been taken. More likely, increased traffic will be mainly along highway 97 from the PDA east through the DM of Chetwynd to the City of Dawson Creek, as a majority of LAA-based goods and labour will be obtained from these locations.

Assuming a maximum increase of 86 round trips at all monitoring sites, the largest increase in AADT and SADT is anticipated to occur at traffic monitoring site P-43-2NS on Highway 97 with a 2.2% increase and a 1.7% increase respectively. This is followed by traffic monitoring site 43-021NS with a 1.8% increase in AADT and a 1.3% increase in SADT. In both cases this increase will occur along Highway 97. In terms of Highway 29, the largest increase is anticipated at traffic monitoring site 43-018NS with a 4.9% increase in AADT and a 4.4% increase in SADT. Table 13-9 provides a summary of residual increased traffic within the LAA.

Table 13-9 Residual Effects on Traffic Volumes Highway 97 and 29–Local Assessment Area

Highway	Traffic Monitoring Site ID	2014		Project Contributed Traffic			Total		Percent Change (%)	
		AADT	SADT	ADT	AADT	SADT	AADT	SADT	AADT	SADT
97	P-43-2NS [1]	1,551	1,906	86	34	33	1,585	1,939	2.2	1.7
	43-009NS	4,223	4,524	86	34	33	4,257	4,557	0.8	0.7
	43-019NS	7,430	7,960	86	34	33	7,464	7,993	0.5	0.4
	43-021NS	1,904	2,605	86	34	33	1,938	2,638	1.8	1.3
29	43-032NS	4,341	4,651	86	34	33	34	33	0.8	0.7
	43-018NS	700	750	86	34	33	34	33	4.9	4.4

NOTE:
[1] AADT and SADT provided for 2011 and 2012

In all but one case Project-generated traffic does not increase AADT beyond the classified range of these Highways (Class 3 highways with ADT from 1,000 to 5,000). The exception is traffic monitoring site 43-019NS along Highway 97 where existing 2014 AADT is already above 5,000 daily counts. Through the use of a transportation management plan (see Section 13.2 – Mitigation) the scheduled movement of goods and labour will be effectively managed, lowering the potential for unforeseen increases in Project-related daily traffic.

Residual effects on change in demand on transportation infrastructure are anticipated to be adverse in direction, low in magnitude and will extend throughout the LAA. Effects will be short-term and occur continuously during the construction phase. Residual effects occur within a moderately resilient socio-economic context where current AADT is within an acceptable range for Class 3 highways. Residual effects are reversible following the completion of Project construction when Project-generated traffic will be reduced.

13.5.4 Summary of Residual Effects

Project residual effects on Infrastructure and Services are summarized in Table 13-10.

Table 13-10 Summary of Project Residual Effects on Infrastructure and Services

Project Phase	Residual Socio-Economic Effects Characterization						
	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Change in Demand for Accommodations							
Construction	Positive	Low	RAA	Short Term	Multiple/Regular	Reversible	Moderate Resilience
Change in Demand for Community Infrastructure and Services							
Construction	Adverse	Low	LAA	Short Term	Multiple/Irregular	Reversible	Low-Moderate Resilience
Change in Demands on Transportation Infrastructure							
Construction	Adverse	Low	LAA	Short Term	Continuous	Reversible	Moderate Resilience

13.6 CUMULATIVE EFFECTS

13.6.1 Identification of Project Effects Likely to Interact Cumulatively

Two conditions must be met to initiate an assessment of cumulative effects:

- The Project is assessed as having adverse residual effects on the VC
- The residual effects act cumulatively with residual effects of other physical activities

The effects of past and existing projects on Infrastructure and Services within the RAA are included in the baseline conditions described in Section 13.2.2. Effects of past and existing physical activities have therefore been incorporated into the assessment of Project residual effects.

Within the RAA there are 28 reasonably foreseeable projects that have the potential to affect socio-economic conditions within the RAA. Total demand for labour with these reasonably foreseeable projects is estimated to peak at 5,900 person years (PYs[10]) of direct labour (based on Project descriptions and publicly available information).

[10] PYs – a unit of measurement used to describe the amount of work done by an individual throughout the entire year (based on an ideal amount of work per day).

13.6.2 Cumulative Effects Assessment for Changes in Infrastructure and Services

In combination with the Project, reasonably foreseeable projects will place increased demands on Infrastructure and Services in excess of available supply. In particular, the in-migration of workers and use of fly-in-fly-outworkers will lead to increased demand on commercial accommodations and emergency services. Similarly, the movement of these workers coupled with Project-related transportation of construction materials will increase traffic on local roads and highways. However, within the context of future demand on Infrastructure and Services within the RAA, the predicted effects of the Project will be extremely small. Average increased demand associated with the Project will result in 200 PYs of direct labour which accounts for only 15% of total demand in the RAA. It is expected that other projects will be responsible for implementing mitigation measures and meeting the permitting requirements of the BC Environmental Assessment Office, NEB or other responsible authorities who will address the potential magnitude of cumulative effects in northeastern BC (see Prince Rupert Gas Transmission 2014, Coastal GasLink 2014, BC Hydro 2012). With the adoption of identified mitigation and management measures the Project's contribution to cumulative effects on Infrastructure and Services in the RAA can be characterized as adverse, low in magnitude, short-term in duration and reversible.

13.7 DETERMINATION OF SIGNIFICANCE

A significant adverse residual effect occurs when there is an exceedance of available capacity, or a substantial decrease in the quality of a service provided, on a persistent and ongoing basis, which cannot be mitigated with current or anticipated programs, policies, or mitigation measures. Based on a peak workforce of 400 workers and with the application of mitigation measures, the Project is not expected to result in an exceedance of available infrastructure and service capacity, nor is a substantial, persistent and ongoing decrease in the quality of services that cannot be managed with current or anticipated programs, policies. Therefore, the Project effect on Infrastructure and Services will not be significant.

A significant adverse residual cumulative effect occurs when there is an exceedance of available capacity, or a substantial decrease in the quality of a service provided, on a persistent and ongoing basis, which cannot be mitigated with current or anticipated programs, policies, or mitigation measures. The Project's contribution to cumulative effects on Infrastructure and Services is extremely small (200 PYs) in comparison to potential demand associated with 5,900 PYs of employment associated with the 28 reasonably foreseeable projects in the cumulative effects case. With the application of mitigation measures cumulative effects on Infrastructure and Services are not expected to result in an exceedance of available capacity nor will it result in a substantial, persistent and ongoing decrease in the quality of services that cannot be managed with current or anticipated programs, policies.

14 NAVIGABLE WATERS

14.1 SCOPE OF ASSESSMENT

This section describes the scope of the assessment of potential effects on Navigable Waters. Navigable Waters was selected as a VC because trenched crossing methods (planned or contingency) of watercourses during Project construction has the potential to temporarily affect the safe use and navigation of waterways. Section 8 (Fish and Fish Habitat) of the Application addresses effects that influence or are influenced by effects on Navigable Waters.

14.1.1 Regulatory Setting

Navigation and navigation safety is one of the socio-economic elements identified in the NEB Filing Manual, (NEB 2016) that should be considered in an assessment of pipeline projects. As of July 2, 2013, under the revised *National Energy Board Act* and the *Canada Oil and Gas Operations Act*, as part of the *Jobs, Growth and Long-Term Prosperity Act*, the NEB is responsible for approving pipelines and their works in, on, under, over, through or across navigable waters. Defined by the NEB, navigable water or waterways "includes a canal and any other body of water created or altered as a result of the construction of any work. As well, a navigable water is considered as any body of water capable, in its natural state, of being navigated by floating vessels or any description for the purpose of transportation, recreation or commerce, and may also be a human-made feature such as a canal or reservoir" (NEB 2016). The NEB further notes that "the changes to the NEB Act do no[t] restrict the NEB's consideration of the impacts of a project on navigation and navigation safety to the Schedule or "navigable waters" that is proposed for inclusion in the *Navigation Protection Act,* once that Act comes into force" (NEB 2016).

14.1.2 Selection of Potential Environmental Effects and Measurable Parameters

Potential effects of the Project on Navigable Waters were identified through public and regulatory consultation with stakeholders, past experience, and professional judgment (see Section 3). During the preparation of this assessment, Westcoast notified the Aboriginal Groups and Métis communities listed in Section 3 regarding areas that could be affected by the Project.

Table 14-1 summarizes the potential effects, measurable parameters, and rationale for selection of the Navigable Waters VC. Measurable parameters were selected to provide a means of qualitatively assessing the expected change to existing socio-economic conditions.

Table 14-1 Potential Effects and Measurable Parameters for Navigable Waters

Potential Effect	Rationale for Inclusion of the Potential Project Effect in the Assessment	Measurable Parameter(s) for the Effect	Rationale for Selection of the Measurable Parameter
Change in navigation and navigation safety	• Instream construction may restrict navigation and affect the safety of waterway users	• Proportion of navigable channel affected • Attribute data on use of waterways (e.g., types of vessels, purpose of use)	• Qualifies the length and potential magnitude of effect • Provides information on the use of navigable waterways

14.1.3 Boundaries

14.1.3.1 Spatial Boundaries

The spatial boundaries for the assessment of Navigable Waters include areas that might interact directly or indirectly with the Project. The following spatial boundaries were used to assess Project and cumulative effects on Navigable Waters:

- The PDA includes all navigable waterways subject to direct disturbance from the footprint of the Project.
- The LAA encompasses the physical area in which Project activities and facilities could have direct or indirect effects on navigable waters. The LAA includes the PDA and a 5 km buffer upstream and downstream of Project watercourse crossings.
- The RAA is used as context to determine the significance of Project-specific effects on navigable waters as well as assess where Project-specific residual effects overlap with the residual effects of past, present, and reasonably foreseeable future activities (i.e., cumulative effects; see section 4.3.1). Because the LAA is sufficiently large to encompass potential cumulative effects on Navigable Waters, it will also be used as the RAA.

14.1.3.2 Temporal Boundaries

See Section 2.4 for the Project schedule and temporal boundaries for this VC.

14.1.3.3 Administrative Boundaries

Administrative boundaries for the assessment of Navigable Waters relate to those established through land and resource management plans. The entire PDA occurs within the Dawson Creek LRMP. The Dawson Creek LRMP is subdivided into smaller planning units (RMZs). Each RMZ outlines permissible land and resource uses. Overlapped RMZs under the Dawson Creek LRMP applicable to the assessment of navigable waters include the Pine River Corridor 3B, 3C, 3H (provincial land use category- special management, river corridor). Within this RMZ, land use objectives aim to maintain water quality (the Pine River is the primary water source for the DM of Chetwynd), recreation and tourism opportunities and visual quality (BC MFLNRO 1999).

14.1.4 Residual Environmental Effects Description Criteria

Table 14-2 presents the criteria that are applied to characterize Project residual effects on Navigable Waters.

Table 14-2 Characterization of Residual Effects on Navigable Waters

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories	
Direction	The long-term trend of the residual effect	Positive	Residual effect is positive compared to baseline condition
		Adverse	Residual effect is negative relative to baseline condition
		Mixed	Residual effect can be both positive and negative compared to baseline conditions
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	Negligible	No measurable change from baseline conditions
		Low	Measurable change but residual effect cannot be distinguished from baseline conditions within normal range of variability
		Moderate	Measurable change but unlikely to pose a serious risk or benefit to the VC or to represent a management challenge
		High	Measurable change that is likely to pose a serious risk or benefit to the VC and, if negative, represents a management challenge
Geographic Extent	The geographic area in which an environmental effect occurs	PDA	Residual effect is limited to the PDA
		LAA	Residual effect is limited to the LAA
		RAA	Residual effect is limited to the RAA
Duration	The period of time required until the measurable parameter or the VC returns to its existing condition, or the effect can no longer be measured or otherwise perceived	Short-term	Residual effect will last no longer than the construction phase
		Long-term	Residual effect extends through the operations phase
		Permanent	VC or sub-component unlikely to recover to baseline conditions

Table 14-2 Characterization of Residual Effects on Navigable Waters

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories	
Frequency	Identifies when the residual effect occurs and how often during the Project or in a single phase	Single	Residual effect (or event) occurs once
		Multiple/ Irregular	Residual effect occurs sporadically throughout assessment period
		Multiple/ Regular	Residual effect occurs repeatedly and regularly throughout assessment period
		Continuous	Residual effect occurs continuously
Reversibility	Pertains to whether a measurable parameter or the VC will return to its existing condition after the Project activity ceases	Reversible	Residual effect will no longer occur after Project closure and reclamation (or sooner)
		Irreversible	Residual effect is irreversible after closure of the Project (i.e., permanent)
Ecological and Socio-economic Context	Existing condition and trends in the area where environmental effects occur	Undisturbed	Area is relatively undisturbed or not adversely affected by human activity
		Disturbed	Area has been previously disturbed by human development or human development is still present

14.1.5 Significance Thresholds for Residual Environmental Effects

A significant adverse residual effect to Navigable Waters is defined as one where:

- Proposed activities for the Project will create a change or disruption that widely restricts or degrades present uses of navigable waterways to a point where navigation cannot continue at or near current levels, and for which this change is not mitigated

The residual effects assessment considers adverse effects after mitigation and other management measures are implemented.

14.2 EXISTING CONDITIONS FOR NAVIGABLE WATERS

14.2.1 Methods

14.2.1.1 Use of Existing Data

Spatial information was primarily obtained from the Province of BC's data warehouse (DataBC) and analyzed using ArcGIS. Information on intersected watercourses (e.g., mean channel width, wetted width) was taken from studies completed for Section 8 (Fish and Fish Habitat). Additional information on navigable waters was obtained from other publicly available secondary sources.

14.2.2 Overview

14.2.2.1 Intersected Watercourses

The Project intersects 60 mapped watercourses (see Figure 8-1). Of these, 40 have been determined to be unnavigable based on the following classifications:

- NCD
- No watercourse evident
- Wetland
- Existing access (bridge)

These 40 watercourses are not considered further. In addition, one stream crossing (A-7 Pine River) is associated with an existing access road and not considered further. See Section 8 and Appendix B.1 for detailed information on all watercourses intersected by the Project. Physical characteristics of the remaining 19 watercourses were compared to Transport Canada's Minor Waters User Guide to determine navigability (see Table 14-3); this is appropriate because the NEB's definition of navigable water does not restrict consideration to those watercourses identified in the *Navigation Protection Act.* Additionally, "for the purposes of practical application, the NEB intends to follow Transport Canada's longstanding practices of being guided by the following: navigable water will be considered as any body of water capable, in its natural state, of being navigated by floating vessels of any description for the purpose of transportation, recreation or commerce, and may also be a human-made feature such as a canal or reservoir" (NEB 2016). Therefore, watercourses that meet the class criteria of a minor navigable water do not require assessment, in accordance with the Minor Waters User Guide, and are not assessed further. Based on this screening, only two proposed crossings of the Pine River were assessed (P-29 and P-32; Table 14-3).

Table 14-3 Intersected Watercourses

Crossing No.	Centerline Coordinates		Watercourse Name	Mean Bankfull Depth (m)	Stream Class	Mean Channel Width[1] (m)	Mean Wetted Width (m)	Mean Residual Pool Depth (m)	Further Assessment Required [3]
	Latitude	Longitude							
P-2	55.64986	-122.17219	Tributary to Pine River	0.4	S2	5.9	0.8	0.1	No
P-3	55.65007	-122.16761	Tributary to Fur Thief Creek	0.2	S2	5.5	2.9	0.1	No
P-4	55.64953	-122.1487	Tributary to Pine River	0.7	S6	1.2	0.2	0	No
P-5	55.64799	-122.13911	Tributary to Pine River	0.5	S5	3.2	0.3	0	No
P-7	55.646297	-122.127661	Tributary to Pine River	0.5	S6	2.2	0	0	No
P-11	55.64375	-122.1147	Tributary to Pine River	0.6	S6	1.8	0	0	No
P-15	55.63106	-122.08246	Rocket Creek	0.77	S2	8.1	0	0	No
P-17	55.63046	-122.07504	Tributary to Pine River	1.0	S5	7.7	0.9	0.1	No
P-18	55.62993	-122.06798	Tributary to Pine River	0.7	S6	1.9	0	0	No
P-19	55.62898	-122.06248	Tributary to Pine River	0.4	S6	1.9	0.5	<0.1	No
P-27	55.60448	-122.02932	Tributary to Pine River	1.1	S2	19.0	11.1	0.7	No
P-29	55.60310	-122.02122	Pine River	4.0	S1B	78.0	78.0	0	Yes
P-32	55.60752	-121.96986	Pine River	65.0	S1B	65.0	60.0	1	Yes
P-40	55.61453	-121.89816	Commotion Creek	0.5	S2	8.7	3.4	0.4	No
P-47[2]	55.61992	-121.82628	Stone Creek	1.0	S2	10.5	0	0	No
P-49	55.60852	-122.05359	Tributary to Pine River	1.4	S2	6.9	2.6	0.7	No
P-54	55.64908	-122.20633	Tributary to Pine River	0.6	S3	3.2	3.0	0.0	No
P-55	55.60882	-122.03843	Tributary to Pine River	0.6	S5	3.1	1.9	0.0	No
A-4	55.64327	-122.11497	Tributary to Pine River	0.7	S5	3.1	0	0	No

NOTES:

1 Mean width from 50 m upstream of centerline to 100 m downstream of centerline

2 Stone Creek will not be crossed by the pipeline

3 Physical characteristics at each stream crossing were applied against Transport Canada's Minor Waters User Guide to determine navigability. Where the waterway has been determined to be navigable, further assessment is required.

14.2.2.2 Pine River

The Pine River, a tributary to the Peace River, supplies water to and receives treated wastewater from the DM of Chetwynd, supports sport fish populations and recreational angling, and is a popular waterway used for recreational purposes (BC MFLNRO 1999). Freeze up of the Pine River, based on studies completed for the Peace River, is estimated to occur between late November and January, with break-up between April and the end of May (BC Hydro 2013, Prowse and Conly 1998).

Table 14-4 Existing Infrastructure Crossings of the Pine River and Hasler Creek within the LAA

Latitude	Longitude	Existing Infrastructure and Tenure	Relative location of P-29 and P-32 Crossing to Existing Infrastructure Crossings
55.60310	55.60310	• Oil and gas pipeline ROW – tenure number 178; client number 0208753 • Oil and gas pipeline ROW – tenure number 456; client number 0234950 • Oil and gas pipeline ROW – tenure number 800662; client number 0337943	P-29 - Within a 150 m buffer of the crossing (Pine River) P-32 –5 km upstream from the crossing (Pine River)
55.612447	-121.986106	• Electric power line ROW – tenure number 2122; client number 0313318	P-29 – Approximately 3.7 km downstream of the crossing (Pine River) P-32 – Approximately 1.3 km upstream of the crossing (Pine River)
55.60752	-121.96986	• Oil and gas pipeline ROW – tenure number 178; client number 0208753 • Oil and gas pipeline ROW – tenure number 456; client number 0234950 • Oil and gas pipeline ROW – tenure number 801821; client number 8001837 • Bridge (over Pine River – Westcoast Rd.)	P-29 –5km from the crossing (Pine River) P-32 – Within a 150 m buffer of the crossing (Pine River)
55.606706	-121.969241	• Train bridge (CN) over the Pine River	P-29 – beyond LAA/RAA boundary P-32 – Approximately 150 m downstream of the crossing (Pine River)
55.594290	-121.978153	• Electric power line ROW – tenure number 804321; client number 8003718 • Oil and gas pipeline ROW – tenure number 809397; client number 8007856 • Oil and gas pipeline ROW – tenure number 800662; client number 0337943 • Bridge (over Hasler Creek – an unnamed access road off Westcoast Rd.)	P-29 – beyond LAA/RAA boundary P-32 – Approximately 250 m downstream of the crossing (Hasler Creek)
SOURCE BC MFLNRO 2015			

Recreational activities occurring on the Pine River include angling, boating, kayaking and canoeing (Northern Development Initiative Trust 2016). Most canoeing and kayaking on the Pine River occurs downstream from Twidwell Bend, outside of the RAA, with a popular put-in spot being East Pine Provincial Park. One of the more popular canoe and kayak routes along the Pine River is a multi-day trip beginning near East Pine Provincial Park and continuing to Taylor, BC) (Destination BC Corp. 2015). Common types of pleasure craft operating on the Pine River include shallow-draft vessels such as aluminum jet boats and zodiacs (Peace Country River Rats 2016). Recreational pleasure craft groups such as the Peace Country River Rats, a jet-boat club based in Fort St. John, are current users of the Pine River (Peace Country River Rats 2016). Use of the Pine River by pleasure craft operators occurs primarily during summer months with reduced usage during spring and fall (due to instream obstructions such as snow and ice). Water-based navigation of the Pine River is assumed to not occur during freeze-up. Based on the average channel depths for the Pine River (see Appendix C) use of the Pine River within the LAA by the Peace Country River Rats is assumed to be limited. However, changes in navigation and navigation safety would be of concern to recreational users of the Pine River.

The Pine River has been identified as important to Aboriginal Groups within the RAA for the practice of current and traditional activities and as travel ways (NOVA Gas Transmission Ltd. 2013). Changes in navigation and navigation safety would therefore be of concern to Aboriginal Groups.

14.3 PROJECT INTERACTIONS

Potential interactions between the Project and Navigable Waters are summarized in 14-5. Those project activities not expected to interact with the Valued Component (e.g., "-") are not carried through the effects assessment.

Table 14-5 Potential Project Effects on Navigable Waters

Project Activities and Physical Works	Change in navigation and navigation safety
Pre-Construction and Pipeline Construction (Pipeline construction)	
Engineering	-
Surveying	-
Clearing	-
Grubbing	-
Topsoil Salvage	-
Grading	-
Vehicle Stream Crossings	-
Stringing (i.e., pipe is lined up along the ROW)	-
Trenching*	-
Pipeline stream crossings	✓
Lowering-in and Tie-In	-

Table 14-5 Potential Project Effects on Navigable Waters

Project Activities and Physical Works	Change in navigation and navigation safety
Testing	-
Backfilling	-
Clean-up and reclamation	-
Operation Activities	
ROW Inspection	-
Vegetation Maintenance	-
Pipeline Cleaning, Maintenance, and Testing	-
Site Inspections	-
NOTE: ✓ Indicates that an activity is likely to contribute to the potential effect. - Not applicable * This includes blasting	

14.3.1 Change in Navigation and Navigation Safety

The scope and magnitude of potential adverse effects on navigation and navigation safety are dependent on the crossing method used at each location. Proposed crossing methods at P-29 and P-32 are summarized in Table 14-6.

Table 14-6 Crossing Methods

Crossing Number	Preferred Crossing Method	Contingency Crossing Method
P-29	Trenchless (HDD)	Open Cut
P-32	Trenchless (HDD)	Trenchless (direct bore) or Aerial

The preferred crossing method at P-29 and P-32 of the Pine River is a trenchless HDD. See Table 2-4 for additional information on pipeline stream crossings. The trenchless HDD method avoids in-stream works, does not introduce an overhead obstruction, and therefore precludes Project interactions with navigation. Therefore, no assessment related to effects of trenchless crossing methods on navigation is required for the preferred crossing method at P-32.

As contingency an open cut is proposed at P-29 and either a trenchless direct bore or aerial crossing at P-32. The contingency open cut method at P-29 will introduce in-stream works that could affect navigation and navigation safety. and is therefore considered further (see section 14.4 onward). Current users of the Pine River could therefore be adversely affected and further assessment is required.

Like the preferred trenchless HDD crossing method at P-32 the trenchless direct bore method avoids in-stream works, does not introduce overhead obstruction, and therefore precludes interactions with navigation. The contingency trenchless direct bore crossing method at P-32 is therefore not considered further. The aerial crossing method considered as contingency at P-329 involves the stringing of line pipe across the Pine River. The presence of overhead navigation obstructions (e.g., construction equipment and line pipe) have the potential to affect existing navigation and navigation safety of the Pine River. If during the contingency plan implementation of the P-32 crossing, these options are found to be ineffective with detailed engineering, alternative methods will be reviewed with the required regulators and required permits will be acquired. Current users of the Pine River could therefore be adversely affected and further assessment is required.

14.4 MITIGATION

Table 14-7 summarizes the mitigation measures that will be used to manage Project effects on Navigable Waters where practical. These measures will be applied only if watercourses are still navigable during the construction period (i.e., will not be needed if the watercourses have frozen up). Mitigation measures outlined in Section 8 regarding physical works in and near waterways also apply. All crossing methods and supporting activities (e.g., trenching, water withdrawal to support mud mixing for HDD and hydrostatic testing) will be conducted in accordance with applicable regulations, best management practices and procedures outlined in applicable EPPs.

Table 14-7 Mitigation Measures for Navigable Waters

Potential Effect	Project Mitigation and Other Management Measures
Change in navigation and navigation safety	• Notifications will be provided to potentially affected users of the navigable waterway at least two weeks prior to construction. • If directed by the regulatory agency responsible for navigation, install warning signs to caution users. Signs will be legible from at least 50 m upstream and downstream from the work site. The signs will have statements in dark lettering such as "Warning – Construction Ahead" against a light (such as white or yellow) background advising waterway users of the construction or obstruction within or over the watercourse. • Instream temporary works will be marked with yellow flashing lights if necessary from dusk to dawn, or during restricted visibility, and will be completely removed upon completion of construction.

Westcoast is committed to regular communication with stakeholders, providing advance notice regarding Project plans, and the continuous monitoring of mitigation and other management measures via engagement with local communities and organizations (see Section 3 for details of consultation activities).

14.5 RESIDUAL EFFECTS

14.5.1 Change in Navigation and Navigation Safety

The contingency open cut crossing of the Pine River at P-29 is anticipated to occur during winter months (corresponds with freeze-up). Winter construction corresponds with construction timing windows as well as periods where navigational use of the Pine River (during freeze-up) does not occur. Instream construction is anticipated to take 5-7 days and will affect the entire width of the navigation channel. With the implementation of mitigation measures and considering that construction will occur during winter months (freeze-up), adverse effects on navigation and navigation safety are anticipated to be low in magnitude. No adverse effects are anticipated during operations as the line pipe will not introduce any obstacles to navigation and navigation safety.

An aerial crossing at P-32 of the Pine River represents an overhead obstruction to navigation and could adversely affect navigation; however, the proposed crossing location parallels a pre-existing aerial pipeline crossing and is therefore not expected to introduce new obstruction to navigation. The height of the aerial crossing also precludes interaction with most river users (see existing conditions). Mitigation measures identified in Table 14-7 are expected to reduce adverse effects on navigation by clearly communicating changes in navigation near P-29 to area users and by providing warnings (as regulated) regarding navigation obstructions.

Considering the implementation of mitigation measures, that in-stream works at P-29 will last 5-7 days during freeze-up (when vessel navigation of the river will likely not occur) and pre-existing conditions (that of an existing aerial pipeline crossing) at P-32, effects on navigation during construction and operation are expected to be adverse in direction, low in magnitude and to extend into the LAA. At P-29 and P-32 adverse effects during construction are expected to be short-term (associated with the presence of overhead obstructions such as construction equipment) and long-term during operations at P-32 due to the presence of overhead line pipe. No adverse effects at P-29 are anticipated during operations. Adverse effects will occur continuously with the onset of construction at P-29 and P-32 and through operation at P-32. Following decommissioning, effects are reversible. Due to the presence of a pre-existing aerial pipeline crossings at P-32 and considering current uses of the pine river the socio-economic context in which effects occur is considered highly resilient.

14.5.1.1 Summary

Overall, adverse effects are expected to be adverse in direction, low in magnitude, to extend to the LAA, are short-term in duration and to occur continuously throughout construction at P-29 and P-32 and continuously during operations at P-32. No operational effects are anticipated at P-29. Effects are reversible following decommissioning and occur within a highly resilient socio-economic context.

14.5.2 Summary of Residual Effects

Project residual effects on Navigable Waters are expected; this is summarized in Table 14-8.

Table 14-8 Summary of Project Residual Effects on Navigable Waters

Project Phase	Residual Environmental Effects Characterization						
	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Change in navigation and navigation safety							
Construction	Adverse	Low	LAA	Short Term	Continuous	Reversible	High Resilience
Operation	Adverse	Low	LAA	Long Term	Continuous	Reversible	High Resilience
NOTES: - Not applicable.							

14.6 CUMULATIVE EFFECTS

14.6.1 Identification of Project Effects Likely to Interact Cumulatively

Two conditions must be met to initiate an assessment of cumulative effects:

- The Project is assessed as having adverse residual effects on the VC.
- The residual effects act cumulatively with residual effects of other physical activities.

Table 14-9 presents the Project and physical activities that might act cumulatively with the Project. The effects of past and existing projects on Navigable Waters within the RAA are included in the baseline conditions described in Section 14.2. Effects of past and existing physical activities have therefore been incorporated into the assessment of Project residual effects.

Table 14-9 Potential Cumulative Effects on Navigable Waters

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects
	Navigable Waters
Past and Present Physical Activities and Resource Use	
Existing Agricultural operations, residential developments, and commercial developments	✓
Existing forestry operations for companies such as Louisiana-Pacific Canada Ltd., Chetwynd Mechanical Pulp, Sawchuck Contracting, West Fraser Mills, and Canadian Forest Products	-
Existing well sites and small facilities such as gathering points, test facilities, seismic lines, and sales meters	-
Multiple Oil and Gas Facilities for such companies as Canadian Natural Resources Limited, Crew Energy Inc., Talisman Energy, Shell, Terra Energy, Tourmaline Oil Corp., and Arc Resources Ltd.	✓
Future and existing Highways, resource roads and access roads	✓
The Fort St. John Mainline	-
Spectra Kwoen Gas Plant	-
Future Physical Activities	
Wyndwood Expansion Project	-
Westcoast Connector Gas Transmission Project	-
Prince Rupert Gas Transmission Project	-
Coastal GasLink Pipeline Project	-
Jackfish Lake Expansion Project and High Pine Expansion Project	-
Highway 2 & 97N	-
Fort St. John & Taylor Area Projects[1]	-
Hudson's Hope Area Projects[2]	-
Chetwynd Area Projects[3]	-
Dawson Area Projects[4]	-

Table 14-9 Potential Cumulative Effects on Navigable Waters

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects
	Navigable Waters
Tumbler Ridge Area Projects[5]	-
Mackenzie Area Projects[6]	-

NOTES:

✓ Those "other projects and physical activities" whose residual effects are likely to interact cumulatively with project residual effects.

1 Site C Clean Energy Project, Hackney Hills Wind Project, Taylor Wind Project

2 W.A.C. Bennett Dam – GM Shrum Turbine Replacement & Rehabilitation, Gething Coal Project, Carbon Creek Coal Mine Project

3 Sukunka Mine, Suska Mine, Rocky Creek Wind Project, Wildmare Wind Project, Wartenbe Wind Project, Sundance Fuels

4 Dawson Creek & Chetwynd Area Transmission Project

5 Bullmoose River Coal, Roman Coal Mine, Echo Hill Coal Project, Horizon Mine Coal Project, Murray River Coal Project, Sundance Wind Project, Meikle Wind Project, Red Willow Wind Project

6 Aley Mine Project

Interactions identified in Table 14-9 as not likely to interact cumulatively with residual effects of other projects and physical activities (no check mark) are not discussed further. Reasonably foreseeable projects within the RAA that have the potential to cumulatively interact with the Project include existing and future oil and gas pipelines, electric power lines, and bridges that may span the Pine River or require in-stream or overhead works.

14.6.2 Cumulative Effects Assessment for Changes in Employment and Economy

The above mentioned present and foreseeable projects and physical activities will have cumulative adverse effects on navigation and navigation safety along the Pine River. Table 14-4 provides an overview of existing infrastructure that crosses the Pine River. For proposed crossing at P-29 there are four oil and gas pipeline ROW tenures (totaling six separate crossings of the Pine River) and one electric power line ROW tenure (one crossing) currently crossing the Pine River that occur within the RAA. The vehicle bridge over the Pine River (Westcoast Rd; Latitude 55.60752 Longitude -121.96986) does not represent an obstruction to navigation given the characterization of vessels that currently use the Pine River and is not considered in the assessment of cumulative effects.

At P-32 the same infrastructure occurs within the RAA as P-29 with the addition of one additional oil and gas pipeline tenure (1 crossing), one electric power line tenure (1 crossing) and a vehicle bridge over Hasler Creek on an unnamed access road (all occurring at latitude 55.594290, longitude -121.978153).

Adverse effects on navigation associated with the existing aerial crossings at P-32 and future maintenance and repair works associated with pipeline and electric power lines currently crossing the Pine River at P-29 and P-32 (as well as the bridge at P-32) will interact cumulatively with adverse effects of the Project during construction (at P-29 and P-32) and operation (at P-32). The use of regulated mitigation measures such as overhead obstruction warning signs by proponents of other projects and works within the RAA will lower incremental adverse effects on navigation and navigation safety along the Pine River. With the adoption of the mitigation and management measures listed in Table 14-7, the Project's contribution to cumulative effects on Navigable Waters in the RAA will be adverse, of low magnitude, long-term in duration, and reversible.

14.7 DETERMINATION OF SIGNIFICANCE

Adverse effects on navigation associated with the existing aerial crossings at P-29 and future maintenance and repair works associated with pipeline and electric power lines currently crossing the Pine River at P-29 and P-32 (as well as the bridge at P-32) will interact cumulatively with adverse effects of the Project during construction (at P-29 and P-32) and operation (at P-29). The use of regulated mitigation measures such as overhead obstruction warning signs by proponents of other projects and works within the RAA will lower incremental adverse effects on navigation and navigation safety along the Pine River. With the adoption of the mitigation and management measures listed in Table 14-7, the Project's contribution to cumulative effects on Navigable Waters in the RAA will be adverse, of low magnitude, long-term in duration, and reversible.

15 EMPLOYMENT AND ECONOMY

15.1 SCOPE OF ASSESSMENT

This section defines and describes the scope of the assessment of potential effects on Employment and Economy. This VC was selected because the Project will create employment and business opportunities, as well as generate government revenues, while also potentially contributing to labour shortages.

15.1.1 Regulatory Setting

The scope of this section takes into consideration guidance provided by the NEB Filing Manual (NEB 2016) (specifically Table A-3 which includes details on assessing socio-economic elements such as employment and economy).

15.1.2 Additional Guidance

In addition to regulatory requirements, the assessment scope also reflects:

- Issues and concerns raised by stakeholders, local and regional governments, Aboriginal Groups, and local residents
- The potential size (magnitude) and likely duration of Project effects
- Experience of Westcoast with similar projects in the past, including mitigation and management measures undertaken
- The professional judgment of the assessment practitioners

15.1.3 Selection of Potential Environmental Effects and Measurable Parameters

Potential effects of the Project were identified through public and regulatory consultations with stakeholders, past experience, and professional judgment (see Section 3). During the preparation of this assessment, Westcoast notified the First Nations and Métis communities listed in Section 3.2.2 regarding areas that could be affected by the Project.

Table 15-1 summarizes the potential effects, measurable parameters, and rationale for selection of the Employment and Economy VC. Measurable parameters were selected to provide a means of qualitatively assessing the expected change to existing socio-economic conditions.

Table 15-1 Potential Effects and Measurable Parameters for the Employment and Economy VC

Potential Effect	Rationale for Inclusion of the Potential Project Effect in the Assessment	Measurable Parameter(s) for the Effect	Rationale for Selection of the Measurable Parameter
Change in employment and economy	• Project construction will create employment and business opportunities, as well as generate revenue for governments	• Project-related employment • Project expenditures on goods and services	• The Project will generate employment and business opportunities • Project-related activities may contribute to labour shortages

15.1.4 Boundaries

15.1.4.1 Spatial Boundaries

The LAA, which is used for the assessment of effects on Employment and Economy, consists of:

- PRRDEA C and E
- The City of Dawson Creek
- The City of Fort St. John
- The DM of Chetwynd
- The DM of Hudson's Hope
- The DM of Taylor
- The DM of Tumbler Ridge
- The Village of Pouce Coupe
- East Moberly Lake 169 IR (Saulteau First Nations)
- Halfway River 168 IR (Halfway River First Nation)
- McLeod Lake 1 IR (McLeod Lake Indian Band)
- West Moberly Lake 168A IR (West Moberly First Nations)

The RAA is the same as the LAA, which encompasses a broad area for assessing cumulative effects, as well as Project effects.

15.1.4.2 Temporal Boundaries

See Section 2.4 for the Project schedule and temporal boundaries for this VC.

15.1.4.3 Administrative Boundaries

Administrative boundaries that might influence the assessment include defined boundaries of census subdivisions, municipalities, and regional districts. Administrative boundaries (e.g., municipalities, regional districts and Aboriginal Groups) relevant to this assessment are identified in Section 14.1.4.1.

Data from the 2011 Census of the Population (Census) were available for all communities within the LAA, while National Household Survey (NHS) data were available for most. NHS Aboriginal Profile data is not available for: PRRDEA E, DM of Hudson's Hope, DM Taylor, West Moberly Lake 168 IR, Halfway River 168 IR and McLeod Lake 1 IR (Statistics Canada 2013a, b).

15.1.5 Residual Environmental Effects Description Criteria

Table 15-2 presents the criteria that are applied to characterize Project residual effects on employment and economy.

Table 15-2 Characterization of Residual Environmental Effects on Employment and Economy

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories	
Direction	The long-term trend of the residual effect	Positive	Effect is improving or is desirable
		Adverse	Effect is worsening or is undesirable
		Mixed	Effects are both positive and negative compared to baseline conditions
		Neutral	Effect is not changing compared with baseline conditions and trends
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	Negligible	No measurable change from baseline conditions
		Low	A measurable effect but residual effect cannot be distinguished from baseline conditions within normal range of variability
		Moderate	Measurable change but unlikely to pose a serious risk or benefit to the VC or to represent a management challenge
		High	Measurable change that is likely to pose a serious risk to the VC and, if negative, represents a management challenge
Geographic Extent	The geographic area in which an effect occurs	LAA	Effect is limited to the LAA (the LAA and RAA are the same)
Frequency	Identifies when the residual effect occurs and how often during the Project or in a specific phase	Single	Residual effect (or event) occurs once
		Multiple/ Irregular	Residual effect occurs sporadically (and intermittently) throughout assessment period
		Multiple/ Regular	Residual effect occurs repeatedly and regularly throughout assessment period
		Continuous	Residual effect occurs continuously

Table 15-2 Characterization of Residual Environmental Effects on Employment and Economy

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories	
Duration	The period of time required until the measurable parameter or the VC returns to its existing condition, or the effect can no longer be measured or otherwise perceived	Short-term	Residual effect will last no longer than the construction phase
		Long-term	Residual effect extends through the operations phase
		Permanent	Measurable parameter unlikely to recover to baseline conditions
Reversibility	Pertains to whether a measurable parameter or the VC will return to its existing condition after the Project activity ceases	Reversible	Residual effect will no longer occur after Project closure and reclamation (or sooner)
		Irreversible	Residual effect is irreversible after closure of the Project (i.e., permanent)
Ecological and Socio-economic Context	Existing condition and trends in the area where effects occur	Low Resilience	Occurs in a fragile economy which has limited diversity and of which has limited capacity to accommodate an economic shock
		Moderate Resilience	Occurs in a stable economy which has moderate diversity and of which can accommodate moderate economic shocks
		High Resilience	Occurs in a diverse and dynamic economy where there is sufficient capacity to accommodate major shocks

15.1.6 Significance Thresholds for Residual Effects

A significant adverse residual effect has been defined as follows:

- An adverse effect that is distinguishable from current conditions and trends and cannot be managed or mitigated through adjustments to programs, policies, plans, or through other mitigation measures

The residual effects assessment considers both positive and adverse effects after mitigation and other management measures are implemented. However, a significance determination is provided for adverse effects only.

15.2 EXISTING CONDITIONS

15.2.1 Methods

The description of existing conditions was primarily based upon data from Statistics Canada, specifically the 2011 Census and 2011 NHS. Information presented for the RAA and Aboriginal populations are underrepresented as 2011 NHS and 2011 NHS Aboriginal Profile data are not available for all census subdivisions (see Section 15.1.4.3).

15.2.2 Overview

15.2.2.1 Population

The population of the LAA in 2011 was 48,442, representing 1.1% of the total provincial population (Statistics Canada 2012). The population of the LAA increased 4.1 percentage points from 2006 to 2011 while the total provincial population increased 7.0 percentage points (Statistics Canada 2012). Within the LAA the largest increase in population from 2006 to 2011 occurred in the DM of Tumbler Ridge, experiencing an increase of 10.4 percentage points from 2,454 to 2,710 (Statistics Canada 2012). The largest decrease in population within the LAA occurred in McLeod Lake 1 IR dropping 22.3 percentage points from 94 people to 73 (Statistics Canada 2012). Current population estimates are not available for the LAA; however, BC Stats estimates the population of BC as of July 1, 2014 at 4,638,415, an increase of 2.1 percentage points from 2011 (BC Stats 2015a). 2014 BC Stats estimates also indicate an increase of population in all communities within the LAA (for which data is available) between 2011 and 2014 with the exception of the Village of Pouce Coupe, which experienced a 1.6 percentage point drop. Table 15-3 provides a summary of population change within the LAA, the PRRD and BC from 2006 to 2014.

Table 15-3 Population Change 2006-2014

Location	Population			Percent Change (%)	
	2006 (Census)	2011 (Census)	2014 (BC Stats Estimate)	2006-2011	2012-2014
PRRDEA C	6,350	6,390	-	0.6	NA
PRRDEA E	3,031	2,764	-	-8.8	NA
DM of Dawson Creek	10,994	11,583	12,653	5.4	9.2
City of Fort St. John	17,402	18,609	21,523	6.9	15.7
DM of Chetwynd	2,633	2,635	2,793	0.1	6.0
DM of Hudson's Hope	1,012	970	973	-4.2	0.3
DM of Taylor	1,384	1,373	1,490	-0.8	8.5
DM of Tumbler Ridge	2,454	2,710	2,983	10.4	10.1

Table 15-3 Population Change 2006-2014

Location	Population			Percent Change (%)	
	2006 (Census)	2011 (Census)	2014 (BC Stats Estimate)	2006-2011	2012-2014
Village of Pouce Coupe	739	738	726	-0.1	-1.6
East Moberly Lake 169 IR	275	324	-	17.8	NA
Halfway River 168 IR	102	170	-	66.7	NA
McLeod Lake 1IR	94	73	-	-22.3	NA
West Moberly Lake 168A IR	51	95	-	86.3	NA
LAA[1]	46,521	48,442	-	4.1	NA
PRRD	58,264	60,082	66,321	3.1%	10.4%
BC	4,113,487	4,400,057	4,638,415	7.0%	2.1%

NOTES:

Numbers are rounded by Statistics Canada and BC Stats and are reported herein exactly as they are reported by Statistics Canada and BC Stats. Totals may not necessarily add up as a result of rounding.

- Data not available

NA Not applicable.

[1] LAA information is underrepresented as 2011 NHS and 2011 NHS Aboriginal Profile data are not available for all census subdivisions (see Section 15.1.4.3).

SOURCE:

BC Stats (2015a, b)

Based on available information, approximately 11% (5,465) of the LAA identify themselves as Aboriginal (Statistics Canada 2012, 2013a, b). This includes 345 people in PRRDEA C, 320 people in the City of Dawson Creek, 800 people in the City of Fort St. John, 110 people in the DM of Chetwynd, 60 people in the DM of Hudson's Hope, 30 people in the DM of Taylor, 150 people in the DM of Tumbler Ridge, 285 people in East Moberly Lake 169 IR, 160 people in Halfway River 168 IR, 65 people in McLeod Lake 1 IR and 60 people in West Moberly Lake 168A IR (Statistics Canada 2013 a,b).

15.2.2.2 Labour Force Activity

In 2011, the LAA labour force consisted of approximately 35,330 people aged 15 years and over (Statistics Canada 2013a). Approximately 11% (3,985 people) of the LAA labour force in 2011 were of Aboriginal identity (Statistics Canada 2013b). The labour force participation rate, a measure of those individuals aged 15 years and older who are working or looking for work, was 75.3% within the LAA and 72.4% among the LAA Aboriginal population (Statistics Canada 2013a,b). Provincial participation rates in 2011 were 64.6% for the total population and 62.4% among people of Aboriginal identity (Statistics Canada 2013a, b). The unemployment rate for the LAA in 2011 was 6.4% compared to the provincial unemployment rate of 7.8% (Statistics

Canada 2013a). The unemployment rate for persons of Aboriginal identity within the LAA was 10.6% compared to the provincial Aboriginal unemployment rate of 16.4% (Statistics Canada 2013b).

15.2.2.3 Employment by Industry and Occupation

In 2011, 45.6% of the LAA workforce aged 15 years and older worked in basic industries[11] and 53.5% in non-basic industries[12] (Statistics Canada 2013a). In comparison, 36.7% of the provincial workforce ages 15 years and older worked in basic industries, 63.3% in non-basic industries (Statistics Canada 2013a). Among basic industries, employment in mining, quarrying and oil and gas extraction was highest at 13.4% (3,550 people) followed by construction at 11.2% (2,955 people) (Statistics Canada 2013a). Within non-basic industries employment in business services[13] was highest at 13.8% (3,640 people) followed by retail trade at 12.5% (3,305 people) (Statistics Canada 2013a). 13.9% (395 people) of the Aboriginal population of the LAA was employed in the construction followed by 11.1% (315 people) in mining, quarrying and oil and gas extraction (Statistics Canada 2013b). Among non-basic industries 14.8% (420 people) of the Aboriginal LAA population were employed in finance and real estate and 14.8% (420 people) in retail trade (Statistics Canada 2013a).

In 2011, 25.6% (6,760 people) of the LAA workforce was employed in the National Occupational Classification trades, transport and equipment operators and related occupations (Statistics Canada 2013a). This was followed by 21.6% (5,710 people) in sales and service occupations and 14.4% (3,810 people) in business, finance and administration occupations (Statistics Canada 2013a). Within the LAA's Aboriginal population, 26.5% (755 people) were employed in sales and service occupations, 25.8% (735 people) in trades, transport and equipment operators and related occupations and 12.7% (360 people) in education, law and social, community and government services (Statistics Canada 2013b).

[11] Includes the following North American Industry Classification System (NAICS) 2007 (Statistics Canada 2015) industries: agriculture, forestry, fishing, and hunting; mining, quarrying, and oil and gas extraction; utilities; construction; manufacturing; health care and social assistance; and educational services.
[12] Includes the following NAICS 2007 industries: wholesale trade; retail trade; finance and insurance; real estate and rental leasing; professional, scientific, and technical services; management of companies and enterprises; administrative and support, waste management and remediation services; arts, entertainment and recreation, accommodation, and food services; other services (except public administration); public administration.
[13] Includes the following NAICS 2007 industries: transportation and warehousing, information and cultural industries, professional, scientific, and technical services, management of companies and enterprises, and administrative and support, waste management and remediation services.

15.2.2.4 Educational Attainment

In 2011, 25.7% of the LAA aged 15 years and older had no certificate, diploma or degree, 28.4% had a high school diploma or equivalent and 42.6% had a postsecondary certificate diploma or degree (Statistics Canada 2013a). For the Aboriginal population of the LAA 50.9% had no certificate, diploma or degree, 23.5% had a high school diploma or equivalent and 25.5% had a postsecondary certificate, diploma or degree (Statistics Canada 2013b). In comparison, within BC 16.7% of the total population had no certificate, diploma or degree 27.7% had a high school diploma or equivalent and 55.7% had a postsecondary certificate, diploma or degree (Statistics Canada 2013a). For the Aboriginal population of BC, 33.0% had no certificate, diploma or degree, 27.2% had a high school diploma or equivalent and 39.8% had a postsecondary certificate, diploma or degree (Statistics Canada 2013b).

15.2.2.5 Employment Income

Median and mean individual incomes for persons 15 years and older in the LAA for 2010 were $59,678 and $64,769 respectively (Statistics Canada 2013a). Individual median and mean incomes within the LAA were higher than average incomes for the province [$49,143 (BC median) and $58,016 (BC mean)].

Median and mean incomes for persons of Aboriginal identity 15 years and older of the LAA in 2010 were $42,158 and $48,492 respectively (Statistics Canada 2013b). Mean and median incomes of Aboriginal identify persons in BC overall were $40,910 (mean) and $54,010 (median). Median incomes for persons of Aboriginal identity were higher in BC overall than the LAA (Statistics Canada 2013 a,b).

15.3 PROJECT INTERACTIONS

Potential interactions between the Project and Employment and Economy are summarized in Table 15-4. Since every physical activity will have an effect on Employment and Economy, Project-related effects are described collectively for each phase. Those project activities not expected to interact with the Valued Component (e.g., "-") are not carried through the effects assessment.

Table 15-4 Potential Project Effects on Employment and Economy

Project Activities and Physical Works	Potential Effects
	Change in employment and economy
Construction	✓
Operation	N/A
NOTES: ✓ Indicates that an activity is likely to contribute to the potential effect. N/A Not applicable.	

Mechanisms affecting change in Employment and Economy during Project construction include:

- Project-related expenditures on labour, and goods and services have the potential to affect direct, indirect and induced business activity and increase GDP in BC and Canada
- The Project will create direct employment. It will also result in indirect employment (as a result of Project purchases of goods and services from local and regional businesses) and induced employment (as a result of the purchase of consumer goods and services by individuals who are employed directly or indirectly by the Project)

Project operation will have negligible effects on Employment and Economy. Because the Project is an expansion of existing pipeline infrastructure, few, if any, additional workers will be required to operate it. Therefore, further assessment of the operation phase has not been undertaken.

15.4 MITIGATION

Project effects on Employment and Economy will mostly be positive because construction will create employment and business opportunities for the existing workforce and business community. Mitigation and other management measures in Table 15-5 are expected to further enhance beneficial effects where practical.

Table 15-5 Mitigation Measures for Employment and Economy

Potential Effect	Project Mitigation and Other Management Measures
Change in employment and economy	• Westcoast will procure goods and services from local and Aboriginal businesses in accordance with its Local and Aboriginal Content Strategy. • Westcoast will follow its existing practice of encouraging local and Aboriginal content based on its Local and Aboriginal Content Strategy, its previous experience from operating in the area, and through engagement with Aboriginal communities, local municipalities, residents and the general public. • Westcoast has an Aboriginal contractors' database which will be used by the company and shared with its prime contractors.

15.5 RESIDUAL EFFECTS

15.5.1 Change in Employment and Economy

15.5.1.1 Construction Costs

Project construction is estimated to cost of approximately $170 million consisting of $69.7 million in materials (41%), $55.7 million in labour (33%), and $44.6 million (26%) in other costs (e.g., owner's costs less escalation, contingency, or Allowance for Funds Used during Construction [AFUDC]).

Table 15-6 provides a cost-breakdown for Project construction.

Table 15-6 Cost-Breakdown

Project Component	Cost Category	Cost (million $)	Percent of Total (%)
Pipeline	Materials - pipe (includes pipeline coatings, fittings, valves etc.)	20.4	12.0
	Labour	37.4	22.0
Pipeline Tie-in	Materials	3.4	2.0
	Labour	3.4	2.0
Construction (Other)	Contractors Costs	45.9	27.0
Project Execution	Other Costs [e.g., owner's cost (less escalation, contingency, or AFUDC]	44.6	26.2
	Labour	14.9	8.8
Total		170.0	100
SOURCE: Spectra 2015			

Approximately 90% ($152.7 million) of Project construction costs will occur within Canada. Of the approximately $170 million total Project cost, $57.2 million (33.6%) is estimated to occur within Northeastern BC, $24.4 million (14.4%) in other parts of BC, $41.5 million (24.4%) in Alberta, $29.6 million (17.4%) in other parts of Canada and $17.3 million (10.2%) outside Canada. Table 15-7 provides a breakdown of construction expenditures by region.

Table 15-7 Construction Expenditures by Region

Expenditure	Northeastern BC (million $)	Other BC (million $)	Alberta (million $)	Other Canada (million $)	Foreign (million $)	Total (million $)
Materials (pipeline and pipeline tie-in)	0.0	0.0	1.5	12.2	10.0	23.7
Construction Labour	20.6	8.2	8.2	4.1	0.0	41.2
Construction Materials (other)	22.7	9.1	9.1	4.5	0.0	45.3
Project Execution (labour and other costs)	13.9	7.1	22.7	8.8	7.3	59.8
Total	57.2	24.4	41.5	29.6	17.3	170.0
SOURCE: Spectra 2015						

15.5.1.2 GDP and Labour Income

A total capital expenditure of $170 million is estimated to generate $123 million in GDP ($55 million direct, $39 million indirect and $29 million induced) and $111 million in labour income ($56 million in direct labour income, $42 million in indirect labour income and $13 million in induced labour income). Within BC a total capital expenditure of $81.6 million is estimated to generate $54 million in GDP ($29 million direct, $11 million indirect, $13 million induced) and $42 million in labour income ($29 million in direct labour, $8 million in indirect labour and $6 million in induced labour). Error! Not a valid bookmark self-reference. provides a summary of GDP and labour income created by location.

Table 15-8 Gross Domestic Product, Labour Income and Jobs – British Columbia

Direct, Indirect or Induced Effect	BC		Other Canada		Total Canada	
	GDP (million $)	Labour Income (million $)	GDP (million $)	Labour Income (million $)	GDP (million $)	Labour Income (million $)
Direct	29	29	25	27	55	56
Indirect	11	8	27	34	39	42
Induced	13	6	16	7	29	13
Total[1]	54	42	68	69	123	111

NOTES:

[1] Totals may not add due to rounding

Calculated based on Project spending in BC and multipliers for the BC oil and gas engineering construction industry (Statistics Canada 2013c)

SOURCE:

Spectra 2015, Statistics Canada 2013c

15.5.1.3 Employment

Total Project expenditures of $170 million will create 1,000 PYs of employment (395 PYs of direct employment, 346 PYs of indirect employment and 259 PYs of induced employment). With $81.6 million in construction expenditures accruing within BC, 450 PYs of employment will be created (200 PYs in direct employment, 125 PYs in indirect employment and 125 PYs in induced employment).

Table 15-9 provides estimates of direct, indirect, and induced GDP, labour income and jobs created within BC during Project construction.

Table 15-9 Employment – British Columbia, Other Canada, Total Canada

Direct, Indirect or Induced Effect	Employment (PYs)		
	BC	Other Canada	Total Canada
Direct	200	195	395
Indirect	125	222	346
Induced	125	134	259
Total[1]	450	550	1,000

NOTES:

[1] Totals may not add due to rounding

Calculated based on Project spending in BC and multipliers for the BC oil and gas engineering construction industry (Statistics Canada 2013c)

SOURCE:

Spectra 2015, Statistics Canada 2013c

Within BC, direct employment associated with Project construction is estimated at 200 PYs, requiring an average workforce of 200 people and a peak workforce of 400 people. The peak workforce of 400 people will be reached mid-construction (month 3). Work rotations will consist of six days on and one day off. Table 15-10 provides an overview of the percent of workers required by occupation during construction.

Table 15-10 Required Occupations

Position	Workforce Breakdown (%)
General Labourers and other construction labour	18
Truck and Equipment Operators	46
Trades	21
Professional	8
Management	8
Total	100

SOURCE:
Spectra 2015

It is Westcoast's preference to hire local workers; however, based on Project design, existing conditions and previous experience constructing projects in the LAA, it is estimated that the average Project workforce will consist of 80 people from the LAA, 46 people from other parts of BC and 74 people from other parts of Canada.

During periods of peak construction, it is estimated that the workforce will be comprised of 160 people from the LAA, 90 people from other parts of BC and 150 workers from other parts of Canada. Based on an unemployment rate of 6.4% and a workforce of 6,760 people in

construction related occupations (trades, transport, equipment operators and related occupations) it is estimated that 432 people would be available to work on the Project within the LAA. Overall, the construction period will be relatively short (estimated to be less than one year) and will directly involve relatively small amounts of labour (80 PYs during average periods of construction, 160 PYs during periods of peak construction) and the Project is not expected to cause any labour shortages in the LAA. Given the recommended mitigation and management measures, the residual effects of Project construction on employment and economy are expected to be positive, short-term, low in magnitude, and reversible. Effects are anticipated to extend into the RAA, will be continuous in frequency and to occur within a moderately resilient socio-economic context.

15.5.2 Summary of Residual Effects

Project residual effects on Employment and Economy are summarized in Table 15-11.

Table 15-11 Summary of Project Residual Effects on Employment and Economy

	Residual Environmental Effects Characterization						
Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Change in Employment and Economy							
Construction	Positive	Low	RAA	Short Term	Continuous	Reversible	Moderate Resilience

15.6 CUMULATIVE EFFECTS

15.6.1 Identification of Project Effects Likely to Interact Cumulatively

Two conditions must be met to initiate an assessment of cumulative effects:

- The Project is assessed as having adverse residual effects on the VC.
- The residual effects act cumulatively with residual effects of other physical activities.

Although the Project is likely to have an overall positive benefit to the LAA/RAA through employment opportunities and contribution to the economy, when combined with the labour requirements of other past, present, or foreseeable future projects, there may be increased pressure on available labour and businesses. Table 15-12 presents the Project and physical activities that might act cumulatively with the Project. The effects of past and existing projects on Employment and Economy within the RAA are included in the baseline conditions described in Section 15.2. Effects of past and existing physical activities have therefore been incorporated into the assessment of Project residual effects.

Table 15-12 Potential Cumulative Effects on Employment and Economy

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects Employment and Economy
Past and Present Physical Activities and Resource Use	
Existing Agricultural operations, residential developments, and commercial developments	✓
Existing forestry operations for companies such as Louisiana-Pacific Canada Ltd., Chetwynd Mechanical Pulp, Sawchuck Contracting, West Fraser Mills, and Canadian Forest Products	✓
Existing well sites and small facilities such as gathering points, test facilities, seismic lines and sales meters	✓
Multiple Oil and Gas Facilities for such companies as Canadian Natural Resources Limited, Crew Energy Inc., Talisman Energy, Shell, Terra Energy, Tourmaline Oil Corp., and Arc Resources Ltd.	✓
Future and existing Highways, resource roads and access roads	✓
The Fort St. John Mainline	✓
Spectra Kwoen Gas Plant	✓
Future Physical Activities	
Wyndwood Expansion Project	✓
Westcoast Connector Gas Transmission Project	✓
Prince Rupert Gas Transmission Project	✓
Coastal GasLink Pipeline Project	✓
Jackfish Lake Expansion Project and High Pine Expansion Project	✓
Highway 29 & 97N	✓
Fort St. John & Taylor Area Projects[1]	✓
Hudson's Hope Area Projects[2]	✓
Chetwynd Area Projects[3]	✓
Dawson Area Projects[4]	✓

Table 15-12 Potential Cumulative Effects on Employment and Economy

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects
	Employment and Economy
Tumbler Ridge Area Projects[5]	✓
Mackenzie Area Projects[6]	✓

NOTES:

✓ Those "other projects and physical activities" whose residual effects are likely to interact cumulatively with project residual effects.

1 Site C Clean Energy Project, Hackney Hills Wind Project, Taylor Wind Project

2 W.A.C. Bennett Dam – GM Shrum Turbine Replacement & Rehabilitation, Gething Coal Project, Carbon Creek Coal Mine Project

3 Sukunka Mine, Suska Mine, Rocky Creek Wind Project, Wildmare Wind Project, Wartenbe Wind Project, Sundance Fuels

4 Dawson Creek & Chetwynd Area Transmission Project

5 Bullmoose River Coal, Roman Coal Mine, Echo Hill Coal Project, Horizon Mine Coal Project, Murray River Coal Project, Sundance Wind Project, Meikle Wind Project, Red Willow Wind Project

6 Aley Mine Project

Socio-economic effects identified in Table 15-12 as not likely to interact cumulatively with residual effects of other projects and physical activities (no check mark) are not discussed further. Reasonably foreseeable projects within the RAA that have potential to cumulatively interact with the Project include oil and gas facilities and infrastructure, wind energy projects, highway upgrades, energy and transmission projects, and other developments.

Within the RAA there are 28 reasonably foreseeable projects that have the potential to affect employment and economy in the RAA. Together the total investment associated with these reasonably foreseeable projects is estimated at $17.8 billion and would require at peak approximately 5,900 PYs[14] of direct labour (based on Project descriptions and publicly available information). Cumulative demand for direct labour associated with these projects is estimated to increase from 680 PYs in Q1 2015 to 5,600 PYs in Q4 2017. Demand is estimated to remain above 4,500 PYS from Q1 2018 through Q4 2019. Figure 15-1 provides a graphical representation of demand for construction and mine labour from 2015 through 2019.

[14] PYs – a unit of measurement used to describe the amount of work done by an individual throughout the entire year (based on a standard 40 hr, 52 week work schedule.

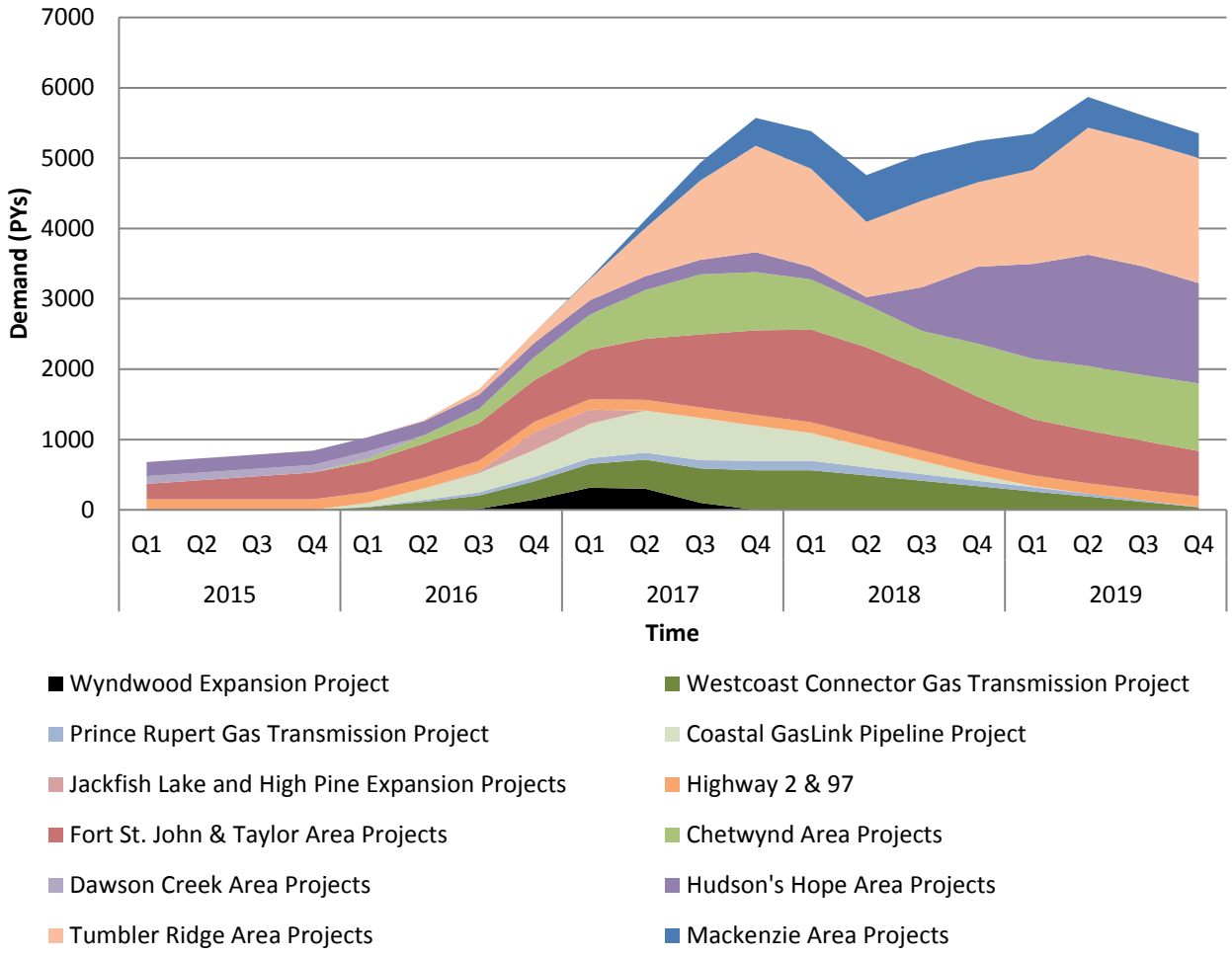


Figure 15-1 Cumulative Demand for Construction and Mine Labour (2015–2019)

15.6.2 Cumulative Effects Assessment for Changes in Employment and Economy

The above mentioned foreseeable projects will place increased demands on the RAA labour force and businesses with cumulative demand for labour, and goods and services potentially outpacing available supply. However, within the context of future economic and employment conditions in the RAA, the predicted effects of the Project will be extremely small.

With an estimated capital expenditure of $170 million the Project accounts for only 1% of total future investment in the RAA based on above reasonably foreseeable projects. Likewise, Project demand for labour (200 PYs) during construction accounts for only 5% of total demand within the RAA. Other considerations such as the use of fly-in-fly-out (FIFO) workers and provincial planning for increased industrial investment in northeastern BC (e.g., the BC Jobs Plan) will further reduce the potential magnitude of cumulative effects associated with labour demand within northeastern BC. With adoption of the mitigation and management measures listed in Table 15-5, the Project's contribution to cumulative effects on Employment and Economy in the RAA will be adverse, low, short-term in duration, and reversible.

15.7 DETERMINATION OF SIGNIFICANCE

Through the application of mitigation measures targeted at increasing beneficial effects of the Project and based on a capital expenditure of approximately $170 million, a peak workforce of 400 persons that will be sustained for a short period of three to four weeks (on average requiring 200 workers for approximately 11 months), residual effects on employment and economy will not be distinguishable from current conditions and trends. Residual effects from the Project are expected to be positive in direction with a low magnitude contribution to adverse cumulative effects. As such, residual effects and therefore the Project's contribution to cumulative effects can be managed though mitigation measures outlined in Section 15.4. Therefore, the Project effect on Employment and Economy will not be significant.

16 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

The NEB Filing Manual (NEB 2016) requires consideration of changes to the Project which may be caused by the environment. The Project's location and design have been considered and the following effects of the environment on the Project have been identified:

- Low temperatures and wind
- Extreme precipitation
- Watercourse migration
- Earthquakes
- Forest Fires
- Corrosion

Westcoast is planning to construct and test the Project in accordance with the provisions of the latest revision of the CSA Z662 oil and gas pipeline design 2015 standards for pipelines, the *NEB Act*, the Onshore Pipeline Regulations (NEB 2013), Westcoast's specifications, the American Society of Mechanical Engineers (ASME) and the National Building Code of Canada (NBCC).

16.1 LOW TEMPERATURES AND WIND

Extreme low temperatures have the potential to reduce the ductility of the materials used to construct Project components and increase their susceptibility to brittle fracture. The overlying soil will protect the buried pipeline from temperature extremes. Typically, soil temperatures at the proposed burial depth (e.g., 1.8 m) would seldom drop below freezing.

Strong winds could result in soil erosion and impact some construction activities such as clearing, stripping, trenching and pipeline lowering-in. To reduce these potential effects, the Project materials will be designed to meet CSA Z662 and Project construction will be based on the NBCC.

16.2 EXTREME PRECIPITATION

Extreme rain and snow can result in work stoppages and difficult working conditions, particularly during Project construction. Erosion and sediment control measures are designed to reduce structural loading in the event of extreme rain (e.g., erosive sediment-laden water) so that pipeline risk is limited. If unusual wet periods or excessive rain do occur, this can result in timing delays and the associated delay in completion can result in increased Project capital costs. Mitigation measures to avoid potential effects from extreme precipitation events include maintaining surface and subsurface drainage and installing drainage and erosion controls, such as silt fencing, check dams, and sediment barriers prior to construction start-up, and maintaining and adjusting these controls as needed during construction. See the EPP (Appendix A) for more details on contingency planning.

Excessive snow can result in timing delays, difficulty in construction traffic movement, and the inhibition of wildlife movement during the Project. Mitigation measures to avoid potential effects from excessive snow can include snow management discussions with appropriate regulatory agencies, including creating gaps around drainages and wildlife corridors, and implementing traffic management to suit weather conditions.

16.3 WATERCOURSE MIGRATION

Bank instability and the alteration of watercourses due to a rapid snowmelt or heavy runoff have the potential to adversely affect pipeline integrity. Parallel routing to watercourses has been altered to mitigate for areas where bank instability, scour, or lateral erosion could occur and crossings will be engineered using armouring and crossing techniques that reduce scour or erosion, as required. In addition, crossing profiles will be designed such that sag bends are set back far enough to prevent pipe exposure resulting from lateral erosion. The pipeline will be installed at sufficient depth below the scour depth of watercourses to reduce the likelihood of the pipe being exposed in the event of down-cutting by a stream during natural high flow periods. Westcoast Operations and Maintenance will monitor for scour post-construction to mitigate against future potential for pipeline exposure.

16.4 EARTHQUAKES

Earthquakes, landslides or seismic events are capable of adversely affecting the integrity of the pipeline through pipeline leaks or ruptures resulting in severe damage.

This Project is located in the southern Cordillera earthquake zone which is known as a seismically stable region; however rare infrequent seismic events may occur. According to Natural Resources Canada (NRCan), no significant earthquakes in the area have occurred since 1986 when an exceptional seismic event occurred in Prince George which reached 5.5 on the Richter scale, resulting in minor damage (NRCan 2015). Data on geology, seismology and geotechnical conditions will be investigated and incorporated into the design of the pipeline.

The proposed pipeline will be designed and constructed in accordance with the most recent version of CSA Z662. The intention of this design standard is to maintain pipeline integrity based on the level of risk for earthquakes in the area. The main earthquake or seismic hazard to a buried pipeline is ground displacement and the associated additional stresses and strains that the ground displacement may place on the pipeline. The Project is being designed using criteria that provide a reasonable level of confidence that the pipeline, when exposed to a significant seismic event for the area, will not pose a hazard to the public or environment considerably greater than other risks the public or environment might face in the event of a major earthquake.

It is widely recognized that modern steel pipelines designed and built to the CSA Z662 standard are a predictably safe means of moving petroleum products in earthquake prone areas. The pipelines are designed to deform longitudinally and in flexure to accommodate potential ground movements which helps them withstand the effects of most earthquake generated ground displacements without loss of product containment. The entire piping will be designed in accordance with the NBCC. The NBCC provides specific seismic loads for defined geological areas and requires those loads to be included in a structural analysis.

16.5 FOREST FIRE

Forest fires can delay construction and operations depending on the severity of the fire. The extent of a fire depends predominantly on the location and size of the event. If a forest fire occurs during operation is it unlikely to damage the pipeline; however it may affect surface facilities which in turn could impact operational services (Project-related fires are discussed in Section 17.4). Extreme caution and attention will be provided to reduce the risk of potential ignition sources during construction activities.

The BC MFLNRO has forest fire control programs in place to identify and control fires, and to limit their potential magnitude and extent, and therefore their potential effects on the Project. In addition, Westcoast has established mitigation measures and procedures to be followed in the event of a forest fire (EPP, Appendix A – Fire Contingency Plan, Spectra 2014). The pipeline parallels an existing ROW, is located partially on cleared agricultural land, and is located near residential developments. As a result, a large portion of the proposed pipeline has already been cleared of woody and fire loading material, which will further reduce the risk of forest fire from affecting the Project.

16.6 CORROSION

The natural elements, particularly the interaction of steel with air, soil, and groundwater, can result in corrosion of pipelines and related steel infrastructure. There is also risk that corrosion can affect the integrity of the existing and new pipeline. This could result in a pipeline failure, leak, rupture, or release if left unmaintained. The pipeline and associated appurtenances will be designed and constructed according to CSA Z662, thereby limiting the corrosion potential.

The pipeline will have cathodic protection and external coating to prevent or reduce external corrosion of the pipeline. In the event that an actual or suspected pipeline integrity problem is identified, it will be investigated following the Westcoast Integrity Management Plan and repairs made, if warranted.

Maintenance digs will be conducted on an as needed basis determined by Westcoast Operation and Maintenance schedule and in a manner similar to the pipeline construction activities, which is further discussed in the Spectra EMCPC (Spectra 2014) (i.e., ground disturbance procedures will be implemented, topsoil will be salvaged and replaced, subsoil will

be stockpiled separately, backfilled and feathered-out, salvaged soils will be replaced and reseeded).

The proposed pipeline will have specific integrity management procedures to verify that the ongoing requirements of the pipeline are met throughout its service life. Westcoast performs corrosion and condition monitoring on its pipeline(s) to identify areas of reduced integrity and a regular schedule will be developed for the proposed pipeline system in accordance with the Spectra EMCPC (Spectra 2014).

16.7 SUMMARY OF EFFECTS OF THE ENVIRONMENT ON THE PROJECT

A significant effect of the environment on the Project would be one that results in a catastrophic interruption in service or damage to the infrastructure requiring repairs that could not be economically implemented. The Project will be designed, constructed, operated, and maintained according to CSA Z662, the ASME and the Onshore Pipeline Regulations (NEB 2013). Regular inspections will be a key component of these standards across all stages of the Project's lifespan.

Based on the review of potential effects of the environment on the Project, coupled with consideration of Project design and relevant established standards, it is concluded that potential effects of the environment on the Project are manageable and are not expected to result in a failure of the Project, so are considered not significant.

17 ACCIDENTS, MALFUNCTIONS AND UNPLANNED EVENTS

The NEB Filing Manual (NEB 2016) requires the effects of accidents, malfunctions and unplanned events be considered in the environmental assessment. Accidents, malfunctions and unplanned events are accidents, upset events, or conditions that are not planned as a part of routine Project activities during any Project phase, despite best planning and application of mitigations.

Accidents and malfunctions can manifest as a result of abnormal operating conditions, process upsets, wear and tear, acts of nature, extreme weather events, human error, equipment failure, and other possible causes. Many accidents, malfunctions and unplanned events are preventable and can be readily addressed or prevented by good planning, design, equipment selection, hazards analysis and corrective action, emergency response planning, and mitigation. Pipeline integrity is addressed in Section 16.6, which discusses mitigation for corrosion, and Section 17.3.2, which identifies preventative and response measures.

17.1 IDENTIFICATION OF EVENTS AND POTENTIALLY AFFECTED VALUED COMPONENTS

The assessment team has conservatively selected scenarios that represent credible, high-consequence events that also adequately address the consequences of less likely or lower-consequence events. Based on the Project design, environmental and socio-economic sensitivities, existing emergency management programs, experience and professional judgment of the assessment team, the following accidents, malfunctions and unplanned events are considered in this assessment:

- Drilling Fluid Inadvertent Release: An inadvertent release is defined as an accidental release of drilling fluid during drilling operations, where permeable soils absorb drilling fluid circulation losses or where fractured bedrock substrates act as a conduit to the surface, resulting in surface discharge.
- Pipeline Leaks or Ruptures: The severity of any environmental effects from a rupture or leak depends on the location, timing, and the factors surrounding the event. The risks are primarily associated with toxicity of the gas and the physical disturbance of a rupture or explosion.
- Fire: This Includes fire and/or explosion in a Project component. The focus is on the consequence, and not the mechanism by which it occurs.
- Hazardous Materials Spill: This includes spills of fuel, petroleum products, or other chemicals used on site that could occur during construction or operation.
- Vehicle Accident: The consequence of any Project-related vehicle accident that may occur on a road transportation network, including vehicle accidents involving wildlife.

17.2 DRILLING FLUID INADVERTENT RELEASE

17.2.1 Causes and Interactions

An inadvertent drilling fluid release has the potential to affect locations both under a watercourse and at the trenchless method entry points at the Pine River crossings. Wildlife and Wildlife Habitat (Section 10), Fish and Fish Habitat (Section 8) and Soil and Soil Productivity (Section 7) VCs have the potential to be impacted in the unlikely event of an inadvertent release of drilling fluid.

17.2.2 Preventative and Response Measures

In order to prevent an inadvertent release from occurring, a trenchless drilling method will be used for the Pine River crossings. For this technology, the pipe is attached to the drill-head and cut materials flow back though the bore as it is fed under the river. In the case of a drilling fluid release, the contractor will follow the steps outlined in the spill contingency plan (Appendix A of the EPP, section 7.7). The appropriate agencies will be notified prior to commencement of drilling, in accordance with permit conditions. The contractor will also maintain the appropriate equipment and material on-site that could sufficiently manage and contain an inadvertent release of drilling fluid. In the case of a spill, the contractor will notify the Westcoast pipeline chief inspector, who will notify the appropriate regulatory agencies. The response strategy employed will depend on the size and extent of the inadvertent release. This will include, but is not limited to, water quality monitoring upstream and downstream of the inadvertent release; development of a fissure/fracture plug composed of a sealing agent; downhole cementing; drilling location realignment to a more secure path; and reporting.

17.2.3 Residual Effects and Significance

The effects of an inadvertent release under the Pine River would be the contamination of surface water, and loss of habitat for wildlife and fish. Surface water will be affected through the discharge of drilling fluids and sediment entering the watercourse. This will cause an increase in turbidity. Fish have the potential to be affected from sedimentation and turbidity caused by the inadvertent release of drilling fluid which would result in a potential loss of habitat or fish mortality. Increased levels of turbidity are known to reduce fish survival through gill irritation or damage, reduced feeding efficiency, and growth rate, all of which affect fish populations (see Section 8). For wildlife that occupies or utilizes the Pine River as a food source (Section 10), water source, or residence, there is a potential for a change in their habitat resulting from an inadvertent release of drilling fluid as a result of the changing physical properties within the watercourse. The potential occurrence of an inadvertent release is considered unlikely, and, if it occurs, to be of very short duration, infrequent, limited in area and cleaned up by on-site crews using standard equipment already on site. With the implementation of preventative and response measures, the potential effects of an inadvertent release on the environment are assessed as not significant.

17.3 PIPELINE LEAKS AND RUPTURES

17.3.1 Causes and Interactions

A rare and accidental pipeline rupture during Project operations could occur via leaks in valves or joints in the pipeline, or due to pipeline ruptures. A piping rupture represents an accident scenario on the Westcoast System, with potential effects on the environment. A pipeline leak or rupture may interact with the atmospheric environment VC because of possible elevated emissions to the atmosphere during this type of event. The result would be an increase in the release of CACs and (VOCs as well as GHGs and possibly natural gas into the atmosphere. These could result in exceedances of BC AAQOs. The proximity of the Project to surrounding projects in the area may lead to the unlikely event of a third-party rupture. A gas release from a third-party rupture could result in an explosion causing fire damage to property, environment or possibly human and wildlife injury as discussed in Section 17.4.

17.3.2 Preventative and Response Measures

Westcoast has designed and will operate the Project in accordance with the most recent version of applicable CSA standards and design measures, Onshore Pipeline Regulations and ASME code requirements, as well as in-house engineering standards and procedures. As such, a standard will be maintained that will limit the potential for leaks, ruptures, or other hazardous situations.

As part of the design process, Westcoast has identified and limited potential operational threats. Some of the design features and operational standards used to reduce the risk of a leak or rupture are:

- Conducting geotechnical evaluations when selecting the facility sites and route options for the Project
- Burial of the pipeline to a minimum of cover in accordance with the CSA standards; using greater depths of cover for site-specific instances such as at water, road, or rail line crossing, areas of deep tillage, and heavy equipment crossings
- Designing pipelines and facilities according to appropriate specifications (e.g., CSA Z662)
- Use of third party inspection during manufacturing, testing, coating, and shipping of the pipe
- Following welding specifications and conducting inspections during pipeline construction
- Using cathodic protection to prevent corrosion
- Using specified coatings and pipe materials to avoid stress, corrosion, and cracking
- Verifying that gas composition and quality meet operational specifications
- Scheduling pipeline integrity investigations (including excavations)
- Placing signage, vehicle barricades, and controlled crossing structures to protect operating pipelines

The Westcoast Gas Control Centre will continuously monitor flow rates and pressures of the proposed pipelines. Westcoast will have the ability to monitor the pipeline and control the emergency shut-down valves from its Gas Control Centre in both Fort St. John, BC and Calgary, Alberta, which are staffed 24 hours per day, 7 days per week. Pressure drops or changes in flow

not related to operational changes will be investigated without undue delay by Westcoast. The surface condition of the pipeline ROW and adjacent areas will be inspected on a routine basis in accordance with requirements of Westcoast's Pipeline Operations and Maintenance Manual. Any indications of leaks, construction activity performed by others, or other conditions that may affect the safety and operation of the pipeline will be promptly investigated.

The Westcoast Field Emergency Response Plan (FERP) for the Fort St. John Region will be updated to include a Project-specific FERP. The FERP provides the framework for managing any leaks detected with the objective of ensure public and worker safety, the environment, and the facilities.

The leak detection program utilized by Westcoast is the result of over 50 years of experience operating and maintaining pipelines throughout BC. The accuracy and effectiveness of this program is assessed and improved upon over time based on operating experience and leak investigations. The incident investigation process results in the continuous assessment and improvement of the accuracy and effectiveness of the leak detection program.

17.3.3 Residual Effects and Significance

Potential exceedances of the BC AAQO could affect human and ecological health if the release of air contaminants was to persist and there was extended exposure to receptors. The occurrence of a pipeline leak or rupture is expected to be infrequent and of very short duration. The likely scenario is one where pipeline flow would be quickly shutdown, using emergency shut off valves so that the issue can be addressed. Although there could be some short-term exceedances of BC AAQO associated with a pipeline leak or rupture, annual emission rates and ground-level concentrations are unlikely to be affected. With the implementation of prevention and response measures, the effects of a pipeline leak or rupture on the environment are assessed as not significant.

17.4 FIRE

17.4.1 Causes and Interactions

In the unlikely event of a Project-caused fire or explosion during commissioning and operations, particulate matter released into the local air shed would interact with the atmospheric environment VC. The storage of hazardous combustible materials or waste at the worksite has the potential to lead to a fire during construction or operations. There is also potential for a fire to interact with vegetation and wildlife habitat, and with the Employment and Economy and Infrastructure and Services VC's as there would be a risk of residential property loss and damage. Natural causes such as a forest fire could also cause a fire during all phases of the Project, as discussed in Section 16.5.

17.4.2 Preventative and Response Measures

Safety orientation and fire prevention training will be provided to contractors working on construction of the Project to mitigate risks and establish response measures. Flammable material will be either piled or stored for winter burning or will be burned inside containers to limit the potential for fire to spread. The equipment used on site will meet applicable CSA and ASME codes and standards designed to prevent fires and explosions. Westcoast will implement the EPP for the Project; this includes waste management practices, wildfire prevention, fire containment, and control, a spill response plan, an access plan, and a regular equipment inspection and maintenance program. Westcoast also has a FERP in place for the Fort St John region.

17.4.3 Residual Effects and Significance

A large fire can lead to alteration or loss of wildlife habitat, vegetation habitat and wetland habitats. Reductions in ambient air quality standards may occur if particulate matter levels exceed air quality standards if fires spread over large distances; however, such fires would be infrequent and are not expected to occur because of the limited nature of the Project (relative to other activities in the area). With the implementation of preventative and response measures, the effects of a fire on the environment are assessed as not significant.

17.5 HAZARDOUS MATERIALS SPILL

17.5.1 Causes and Interactions

A hazardous materials spill along the ROW or within the PDA could interact with the soils VC.
A spill of petroleum, oil, lubricants, or other hazardous materials may occur during construction or operation activities. Most spills are expected to be highly localized. In the event of a large spill, elevated contaminant levels in soil, groundwater, and vegetation may occur.

17.5.2 Preventative and Response Measures

Contractors working on construction of the Project will be aware of spill response procedures and be required to have Workplace Hazardous Materials Information System training.
All equipment used in the construction and operation of this Project will meet applicable codes, and equipment operators will follow established operational practices. Westcoast will implement the EPP for the Project; this includes a spill contingency plan, an access plan, and a wet soils contingency plan (Appendix A). As previously stated, Westcoast will develop a site-specific FERP in conjunction with the construction contractors.

17.5.3 Residual Effects and Significance

The potential effects of a spill would be the contamination of soils, groundwater, and vegetation. There are no adjacent large surface waterbodies that could be affected by an on-site spill. The potential occurrence of a spill is expected to be infrequent, of very short duration, limited in area, and easily cleaned up by on-site crews using standard equipment and materials kept on site. With the implementation of preventative and response measures, the effects of a spill on the environment are assessed as not significant.

17.6 VEHICLE ACCIDENT

17.6.1 Causes and Interactions

Any stage of the Project could be impacted from a vehicle accident. Traffic to and from the worksite during construction and operations and unsafe surface road conditions could potentially result in a vehicle accident. A vehicle accident has the potential to result in the release of hazardous materials to the soil and groundwater as well as interactions with the wildlife, fish, employment and economy and infrastructure and services VCs. This would be in the form of wildlife strikes, fuel and oil release, and fire as a result of an accident, as covered in Sections 16.

17.6.2 Preventative and Response Measures

There are no features of the Project that would substantially increase accident rates or decrease traffic safety. Project-related vehicles will be required to observe all traffic rules and provincial and federal highway regulations. The prime contractor will also create and implement a traffic management plan for the construction period. This plan will be reviewed and approved by Westcoast. Trucking activity for construction of the Project will be required to take place on designated truck routes and observe speed limits and weight restrictions.

Westcoast requires that contractors and subcontractors have a drug and alcohol program in place. Individual companies are accountable for their own personnel, and testing will take place when a supervisor or other official has reasonable grounds to suspect that an employee is or may be unable to work in a safe manner because of the use of alcohol and/or drugs.

17.6.3 Residual Effects and Significance

The occurrence of a vehicle accident is expected to be infrequent, and its likelihood more concentrated during the construction phase. Because Project personnel will be required to comply with applicable traffic rules and regulations, and traffic to and from the site will not be increased during operations, the effects of a vehicle accident on the environment are assessed as not significant.

17.7 SUMMARY OF EFFECTS OF ACCIDENTS AND MALFUNCTIONS

The Project is being designed, and will be constructed and operated, with full regard for health, safety, and environmental protection. The careful planning of the Project and the implementation of proven and effective mitigation measures such as those included in the EPP and FERP will reduce the potential for accidents, malfunctions, and unplanned events to occur. Overall, the potential environmental effects of Project-related accidents, malfunctions, and unplanned events on the VCs, including cumulative environmental effects, during all phases of the Project, are rated as not significant.

18 FOLLOW-UP AND MONITORING

Westcoast is committed to its corporate EHS Policy and has committed to a number of monitoring activities as part of the proposed mitigation for the pre-construction, construction and operations phases of the Project (Appendix A). Westcoast will implement an environmental inspection program during construction which will follow the Spectra EMCPC (Spectra 2014). Qualified EI's will work onsite during construction to verify that all construction activities are in compliance with regulatory commitments and mitigation measures as outlined in the EPP (Appendix A).

Westcoast will implement a Post-Construction Monitoring Program following construction, as per the Spectra EMCPC (Spectra 2014). Residual effects or other issues that are identified post-construction will be followed-up on with remedial actions and appropriate documentation within post-construction monitoring reports. Post-construction monitoring reports will also include any corrective actions implemented. Outstanding ROW issues arising after construction will be identified through Westcoast's continuous monitoring of all aspects of ROW integrity and addressed if warranted.

19 ENVIRONMENTAL AND SOCIO-ECONOMIC MANAGEMENT PLANS

Westcoast is committed to maintaining high standards and values for the health and safety of employees, contractors, and the public. Westcoast's EHS Policy establishes principles to protect and advance the company's essential interests and to fulfill its commitment to people and the environment. Westcoast recognizes that protecting and responsibly managing natural resources are critical to the quality of life in the areas it serves, the environment, and long-term business success. The policy applies to all aspects of the proposed Project and Westcoast employees and contractors are required to comply with the policy as a condition of their employment or contract.

19.1 ENVIRONMENTAL PROTECTION PLAN

The EPP documents environmental protection measures used to reduce potential adverse effects during construction of the Project (see Appendix A). The EPP is written in construction specification format. The EPP provides project-related environmental mitigation measures and commitments to be addressed during the detailed engineering design, construction, and post-construction reclamation of the Project. These include but are not limited to:

- Environmental alignment sheets
- An environmental approvals and permits list
- Best management practices for activities including stream crossings, vegetation clearing, and erosion and sediment control
- Roles and responsibilities
- Emergency and general Project contacts
- Construction specifications and typical drawings
- Contingency Plans
- Access Management Plan

The EPP is based on:

- The Project application to the NEB for an order pursuant to s.58 of the *NEB Act* (s. 58 Application)
- Westcoast's EHS Commitment
- Spectra's EMCPC Project-specific mitigation measures developed and applied by Westcoast
- Industry best management practices
- Construction activities taking place between August 2017 and December 2017 to meet the planned in-service date of Q1 2018.

Before starting construction, the EPP will be updated to incorporate the results of the approval process and the ongoing consultation program.

19.2 INSPECTION

Construction activities will be closely monitored and documented by Westcoast Els to verify that construction and quality standards are met and in compliance with the NEB section 58 requirements (NEB 2016).

20 CONCLUSIONS

Westcoast has assessed the potential interactions between the Project and the relevant environmental and social components and has concluded that adverse environmental and socio-economic effects associated with the Project can be mitigated with standard and project-specific environmental protection measures. Based on this analysis, the overall environmental and socio-economic effects of the Project are predicted to be not significant. The assessment of these residual effects and determination of significance are summarized in the individual discussions in Section 5 to Section 15.

Spectra's EMCPC (Spectra 2014) outlines environmental policies and procedures for construction and operation of its federally regulated projects in Canada. Furthermore, compliance with the environmental commitments, implementation of the mitigation measures as presented in the ESA, the EPP, and involvement in the design and planning of the Project by environmental specialists (including consultants), as well as periodic inspection of the Project during construction and operation, will reduce the potential for adverse environmental effects.

The conclusion of this assessment is that, with the implementation of the outlined mitigation, the adverse environmental and socio-economic effects of the Project will be not significant.

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APPENDIX A
ENVIRONMENTAL PROTECTION PLAN

APPENDIX B
TECHNICAL MEMORANDUMS

APPENDIX C
ARCHAEOLOGICAL IMPACT ASSESSMENT

APPENDIX D
PROJECT INTERACTIONS TABLE