Environmental and Socio-Economic Effects Report

Terrace – Kitimat Transmission Project (TKTP)

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EXECUTIVE SUMMARY

This Environmental and Socio-Economic Effects Report (ESER) was written in support of an application for a Licence of Occupation (LOO) for BC Hydro's proposed Terrace to Kitimat Transmission Project (TKTP; the Project). The Project scope includes a new approximately 50 kilometre (km), 287-kilovolt (kV) single circuit transmission line, along with associated infrastructure, to replace the existing 2L099 and the replacement of a 3 km long transmission line (2L103). The new transmission line will connect the Skeena substation near Terrace to the Minette substation near Kitimat. The 2L103 transmission line connects the Minette substation to Rio Tinto's Alcan Kitimat substation. Subject to unforeseen conditions, the Project's planned in-service date is the latter part of 2020. For the purposes of this report and the planning and permitting processes for the Project, decommissioning of the existing 2L099 transmission line, which is expected to take place after the new line is in service, is not within the scope of the Project. The decommissioning of the existing line is not assessed in this report, as its purpose is to assess the potential environmental and socio-economic effects of the new line. Further engagement and consultation around the decommissioning of the existing line will take place separately and additional studies and/or planning will be conducted as appropriate.

Project clearing and construction will begin once the LOO has been granted. However, a centre line survey and bridge work may occur before the LOO is granted. While certain provincial legislation, including some Acts, do not apply to BC Hydro, pursuant to the *Hydro and Power Authority Act*, BC Hydro may elect to obtain certain permits, authorizations or approvals under those Acts on a "without prejudice" basis and considers the spirit and intent of relevant legislation in developing Project plans and environmental management plans and in completing this ESER.

The objective of this ESER is the characterization of residual Project effects on discipline-specific Valued Components (VCs) in the Local Study Areas (LSAs). The following eight disciplines are included in this ESER: fish and aquatic resources, vegetation, wildlife, non-traditional land use, visual resources, socio-economics, contaminants and archaeology and historical heritage. Input from the Haisla, Lax Kw'alaams, Kitsumkalum, Kitselas and Metlakatla First Nations informed the selection of discipline-specific VCs. Discipline-specific specialists gathered original and existing information to establish each VC's existing condition in the LSA. Disciplines shared a common methodology to determine if a VC was carried forward to a characterization of residual effects. Residual effects are those effects that remain after the application of effective and practicable mitigation measures that are not contrary to the safe operation and maintenance of a reliable transmission line. Mitigation measures include avoiding VCs and minimizing potential effects where VCs cannot be avoided. For example, mitigating through avoidance was proposed for the Lakelse River crossing, and proposed structure height and position were optimized so that minimal clearing will occur in old forests in the Lakelse River Special Resource Management Zone (SRMZ). Old forests in the SRMZ were for the most part avoided because BC Hydro wishes to support relevant SRMZ objectives outlined in the Kalum Land and Resource Management Plan, where practicable. An example of mitigating through minimizing is the proposed site-specific prescriptions at seven high value stream/wetland crossings to minimize potential Project effects.

Residual effects were characterized in a post-mitigation environment based on the following criteria: direction, context, magnitude, geographic extent, duration, frequency and reversibility. The most concerning adverse residual effect will likely be incurred by grizzly bear, which is a subcomponent of the bears VC. These anticipated adverse residual effects for grizzly bear may necessitate further consultation with First Nations and direction from regulators. Discipline-specific methods and characterization of residual effects are briefly summarized below.

Fish and Aquatic Resources

Fisheries crews conducted fish and fish habitat assessments and riparian assessments at 60 transmission line sites and 116 access road sites during the 2015 and 2016 field season. Of the 60 transmission line crossing sites sampled, 48 had a visible channel. Of the visible channels, six were large, named, fish-bearing watercourses, 32 were unnamed, fish-bearing streams and ten were non-fish-bearing. Of the 116 access road crossing sites sample, 54 had a visible channel, 61 were non-classified drainages or had no visible channel and one site was a fish-bearing wetland. Of the 54 with a visible channel, 40 were unnamed fish-bearing streams, and 14 were unnamed fish-bearing streams. Data from the 2015 field season were synthesized with the results of desktop research along with issues scoping, to select the following three fisheries VCs: fish habitat, coastal cutthroat trout and coho salmon. Potential adverse Project effects include destruction and alteration of fish habitat, fish mortality, changes in water quality, loss of riparian vegetation, blockage of fish passage and increased fishing pressure due to increased access. Proposed mitigation measures are generally effective for avoiding or reducing potential adverse Project effects if implemented correctly and adapted as necessary to local site conditions, however some residual effects may occur. All fisheries VCs will likely incur adverse residual effects within the right-of-way (ROW) of the transmission line and access roads due to riparian vegetation clearing (**Table ES-1**). Increased fishing pressure may represent a negligible but irreversible residual effect on the coho salmon and coastal cutthroat trout VCs (**Table ES-2**).

Table ES-1: Characterization of Residual Effects on Fish and Aquatic Resources due to Riparian Vegetation Clearing

Valued Component	Direction	Context	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
Fish Habitat	Adverse	Medium	Low	Site-specific	Medium term	Intermittent	Reversible
Coastal Cutthroat Trout	Adverse	Medium	Negligible	Site-specific	Medium term	Intermittent	Reversible
Coho Salmon	Adverse	Low	Negligible	Site-specific	Medium term	Intermittent	Reversible

Table ES-2: Characterization of Residual Effects on Fish and Aquatic Resources due to Increased Fishing Pressure Caused by Increased Access

Valued Component	Direction	Context	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
Coastal cutthroat trout	Adverse	Medium	Negligible	Local	Long term	Continuous	Irreversible
Coho salmon	Adverse	Low	Negligible	Local	Long term	Continuous	Irreversible

Vegetation

Vegetation crews gathered original data throughout the LSA during the 2015 and 2016 field season. These data were synthesized with the results of desktop research to select the following nine vegetation VCs: First Nations botanical resources, plant species at risk, ecological communities at risk, old forests, old-growth management areas (OGMAs), riparian ecosystems, wetlands, sparsely vegetation ecosystems and unlisted terrestrial ecosystems. Adverse residual effects are likely to be incurred by all vegetation VCs because plant communities will be partially or wholly removed during the clearing/construction phase and prevented from returning to existing conditions during the operation/maintenance phase. Adverse residual effects on those vegetation VCs that physically overlap new roads or structures will likely be irreversible. The plant species at risk VC may incur a fully to partially reversible negative population growth rate for 31% of the area occupied by this VC in the LSA. The ecological communities at risk, old forests, OGMAs, riparian ecosystems and wetlands VCs will be directly subjected to irreversible or partially reversible adverse residual effects. Residual Project effects on the unlisted terrestrial ecosystems VC are likely to be fully reversible where they do not overlap with new access roads (**Table ES-3**).

Table ES-3: Characterization of Residual Effects on Vegetation Valued Components

Valued Component	Direction	Context	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
First Nations Botanical Resources	Adverse	Medium	Low	Local	Long term	Intermittent	Fully to partially reversible
Plant Species at Risk	Adverse	High	High	Local	Long term	Intermittent	Fully to partially reversible
Ecological Communities at Risk	Adverse	High	Low	Local	Long term to permanent	Intermittent	Irreversible
Old Forest	Adverse	High	Low	Local	Long term to permanent	Intermittent	Irreversible
Old Growth Management Areas	Adverse	High	Low	Local	Long term to permanent	Intermittent	Irreversible
Riparian	Adverse	High	Low	Local	Long term to permanent	Intermittent	Partially reversible to irreversible
Wetlands	Adverse	High	Low	Local	Long term to permanent	Intermittent	Partially reversible to irreversible
Unlisted Terrestrial Ecosystems	Adverse	Low	Low to medium	Local	Long term	Intermittent	Fully reversible to partially reversible

Wildlife

Wildlife crews gathered original data throughout the LSA during the 2015 field season. These data were synthesized with the results of desktop research to select the following eight wildlife VCs and 12 subcomponent species (in parentheses): landbirds (Olive-sided Flycatcher and Rusty Blackbird); waterbirds (Marbled Murrelet and Trumpeter Swan); raptors (Northern Goshawk); bears (grizzly bear and Kermode American black bear); ungulates (moose); furbearers (Pacific marten); bats (Keen's myotis); and amphibians (coastal tailed frog and western toad). The general categories of Project effects on wildlife considered in this assessment are (1) alteration of habitat, (2) direct and/or indirect mortality, (3) sensory disturbance and (4) alteration of movement pattern. Effects on wildlife are anticipated primarily through the clearing of vegetation, construction of structures and infrastructure components, vegetation management for right-of-way and access road maintenance, Project-related road traffic, and increased human access. Because of the sensitivity of many of the subcomponent species to vegetation clearing and road traffic on the one hand and the regulatory requirements of transmission line design, construction and maintenance on the other hand, mitigation measures with high effectiveness are limited. As a result, all subcomponent species are anticipated to be subjected to adverse residual effects, with mammals and amphibians incurring the highest number of residual effects (**Table ES-4**). Residual effects will likely have the greatest impact on grizzly bears, primarily due to the species' high sensitivity to linear corridors and road traffic, which may reduce grizzly bear use of important low-elevation habitats and increase risk of mortality. Additional consideration and/or mitigation for subcomponent species, especially grizzly bear, will be incorporated into the Project's construction environmental management plans.

Table ES-4: Characterization of Residual Effects on Wildlife Valued Components

Valued Component	Direction	Context	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
Landbirds	Adverse	High	Low	Local	Long term	Intermittent	Reversible
Waterbirds	Adverse	High	Low	Local	Long term	Intermittent	Irreversible
Raptors	Adverse	High	Negligible	Local	Long term	Once	Irreversible
Bears	Adverse	High	High	Regional	Long term	Continuous	Irreversible
Ungulates	Adverse	Medium	Low	Local	Long term	Intermittent	Irreversible
Furbearers	Adverse	Low	Medium	Local	Long term	Intermittent	Reversible
Bats	Adverse	High	Low	Local	Long term	Once	Irreversible
Amphibians	Adverse	High	Medium	Local	Long term	Intermittent	Reversible

Non-Traditional Land Use

The non-traditional land use (NTLU) discipline conducted an extensive review of the primary and secondary literature to select the following eight VCs: land use planning and management; land ownership; access and transportation; forestry; hunting, trapping and guide outfitting; tourism, parks and recreation; fishing; and agriculture. With respect to forestry, a merchantable timber volume analysis was conducted to estimate the total merchantable timber volume that would be affected by the Project. All NTLU VCs will incur reversible neutral to adverse residual effects, mostly due to unavoidable loss or disruption of lands available for these VCs (**Table ES-5**).

Table ES-5: Characterization of Residual Effects on Non-Traditional Land Use Valued Components

Valued Component	Direction	Context	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
Land Use Planning and Management	Adverse	Low	Low	Site-specific	Long term	Continuous	Reversible
Land Ownership	Adverse	Low	Low	Site-specific	Long term	Continuous	Reversible
Access and Transportation	Neutral (Positive and Adverse)	Low	Negligible	Site-specific	Long term	Intermittent	Reversible
Forestry	Adverse	Low	Low	Site-specific	Long term	Continuous	Reversible
Hunting, Trapping and Guide Outfitting	Adverse	Low	Low	Site-specific	Short term	Intermittent	Reversible
Tourism, Parks and Recreation	Adverse	Low	Low	Local	Long term	Continuous	Reversible
Fishing	Adverse	Low	Negligible	Local	Short term	Intermittent	Reversible
Agriculture	Adverse	Low	Low	Site-specific	Long term	Continuous	Reversible

Visual Resources

The visual resources VC is defined as the interaction between known viewpoints and scenic features of the landscape such as mountains, ridgelines and vegetation cover. Visual resources specialists simulated potential Project effects at 45 observation points in the Kitimat Valley using an amalgamated terrain model in ArcGIS. Photographs were taken from each observation point towards the provisional route to corroborate the findings of the amalgamated terrain model. Of the 45 observation points assessed, adverse residual effects on this VC will likely be observable at the Clague Mountain Hiking Trail Crossingand Lakelse River Crossing observation points (**Table ES-6**).

Table ES-6: Characterization of Observable Residual Effects on the Visual Resources Valued Component

Observation Point	Direction	Context	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
Clague Mountain Hiking Trail Crossing	Adverse	Medium	High	Local	Long term	Continuous	Reversible
Lakelse River	Adverse	Medium	High	Local	Long term	Continuous	Reversible

Socio-Economics

After consultation and a desktop review, members of the socio-economics discipline identified the following four VCs: employment and procurement opportunities; temporary accommodation; transportation and traffic; and emergency, health and policing services. All socio-economic VCs will likely incur reversible residual effects. The employment and procurement opportunities VC may be subjected to a positive residual effect. During the three years of construction, the Project would likely provide an annual average of 44 person-years of temporary and short-term employment, with a maximum of 140 jobs at peak periods. Given BC Hydro's hiring policies, the availability of local skilled labour and competition for labour from other major projects, it is estimated that 45% of positions (average 20, peak 42) will be resourced locally. During the closure phase, the Project is anticipated to generate socio-economic effects similar to those identified for the construction phase, but of a smaller magnitude. The temporary accommodation VC will likely incur a positive and adverse residual effect, while the transportation and traffic and emergency, health and policing services VCs may experience adverse residual effects (**Table ES-7**).

Table ES-7: Characterization of Residual Effects on Socio-Economic Valued Components

Valued Component	Direction	Context	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
Employment and Procurement Opportunities	Positive	Low	Low	Regional	Short term	Continuous	Reversible
Temporary Accommodation	Positive and Adverse	Low	Low	Local	Short term	Intermittent	Reversible
Transportation and Traffic	Adverse	Low	Low	Local	Short term	Intermittent	Reversible
Emergency, Health and Policing Services	Adverse	Low	Low	Regional	Short term	Intermittent	Reversible

Contaminants

A contaminant is a substance that is introduced to the environment by humans that is capable of directly or indirectly injuring the health or safety of a person or property or directly or indirectly adversely affecting VCs from other disciplines. The contaminants discipline defined VCs as environmental media that had a potential to be contaminated and to affect other VCs either directly or indirectly through altered habitat. A desktop review was conducted for the LSA to evaluate the likelihood of encountering contaminated media during construction and to assess whether Project activities had the potential to generate contaminated media. Five potential sources of historical contamination were identified: the Skeena substation; the location at which the provisional route crosses the railway; a historical landfill near the Eurocan pulp and paper facility; the Minette substation; and locations affected by industrial air emissions from historical smelting operations in the Kitimat area. Seven Project activities were identified as having a potential to either generate or relocate contaminated media. These are associated with construction (e.g. excavating, clearing and grubbing, importing soils, dewatering foundation excavations, applying coatings to structures and operating and servicing equipment) and maintenance activities (e.g. vegetation control and road maintenance). Potential Project effects can be prevented or mitigated by implementing appropriate procedures to be provided in the construction EMP; therefore, no residual effects are anticipated (**Table ES-8**).

Table ES-8: Location of Contaminants Valued Components Likely to Occur in the Local Study Area

Structure	Site – Rational
1	Skeena substation – Potential for historical release of insulating oils, imported fill of unknown origin.
1, 2, 3, 4 21, 69, 116	Railroad – Potential for soil and groundwater effects due to operation and maintenance of railway, imported fill of unknown origin for rail and ballast, leaching of wood preservative from railway ties.
174–178	Historical industrial landfill associated with Eurocan pulp and paper mill – The construction and containment of this landfill and the nature of the site contamination and migration are not known.
182	Minette substation – Potential for historical release of insulating oils, imported fill of unknown origin.
~120–182	Local Study Area – Industrial air emissions from historical Kitimat-area smelting operations.

Archaeology and Historical Heritage

Members of the archaeology and historical heritage discipline conducted a desktop review to identify the following three VCs: archaeological sites, cultural heritage sites and historic sites. Archaeology and historical heritage crews conducted an archaeological impact assessment (AIA) in the LSA during the 2015 and 2016 field season in accordance with Heritage Inspection Permit # 2015-0075. Several archaeological site VCs (culturally modified trees (CMTs)) and cultural heritage sites VCs (trapline trees, blazed trees, a historical trail and industrial logging remains) were documented during the 2015/16 AIA. The historical site VC was not recorded during the AIA, so this VC was not carried forward to a characterization of residual effects. With the implementation of proposed mitigation measures where Project interactions cannot be avoided, adverse residual Project effects on archaeological sites and cultural heritage resource sites are anticipated as it is likely not possible to avoid all CMTs within the transmission line ROW or most of those on access roads. Loss of CMTs can be mitigated by obtaining dendrochronological dates at point of harvest. Where cultural heritage resources such as blaze trees, marten traps and trees with old logging features cannot be avoided, adverse residual effects will ensue (**Table ES-9**). Positive residual effects such as access to redcedar stands via the Project ROW may contribute to the reconnection of First Nations communities to traditional life-ways. As well, the increased presence of people in the landscape opened up by the Project ROW may result in discovery and recording of new CMT sites. Clearing/construction phase work at the Lakelse River crossing should not result in disturbance to the most important cultural heritage resource, the Lakelse South-Side Trail, as this site lies within the SRMZ.

Table ES-9: Characterization of Residual Effects on Archaeology and Historical Heritage Valued Components

Valued Component	Direction	Context	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
Archaeological Sites	Positive and Adverse	High	Medium to High	Point or site-specific	Long term/ permanent	Once	No
Cultural Heritage Sites	Positive and Adverse	High	Medium to High	Point or site-specific	Long term/ permanent	Once	No

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Definition
AADT	average annual daily traffic
AIA	Archaeological Impact Assessment
ALC	Agricultural Land Commission
ALR	Agricultural Land Reserve
Amec Foster Wheeler	Amec Foster Wheeler Americas Limited
AOA	Archaeological Overview Assessment
APLIC	Avian Power Line Interaction Committee (USA)
ASAB	Archaeological Sites Advisory Board
AWPRV	Approved Work Practices for Managing Riparian Vegetation
AWPWC	Approved Work Practices for Water Crossing Installation, Maintenance and Deactivation
BC	British Columbia
BC CDC	BC Conservation Data Centre
BC *EAA*	British Columbia *Environmental Assessment Act 2002*
BC Hydro	British Columbia Hydro and Power Authority
BC MFLNRO	British Columbia Ministry of Forests, Lands and Natural Resource Operations
BC MOE	British Columbia Ministry of Environment
BEC	Biogeoclimatic Ecosystem Classification
BGC	biogeoclimatic
BMP	best management practice (refers to procedures and minimum standards for common construction, maintenance, and operations activities that BC Hydro will follow to meet federal and provincial regulatory environmental requirements; in some instances refers to published guidelines or standards from regulators (e.g. DFO) that were considered in Project design and planning, and the development of this report)
BP	before present
ca.	circa
CBD	Central Business District
CBW2	Kitimat Aerodrome
CEA Act	*Canadian Environmental Assessment Act 2012*
CEMP	Construction Environmental Management Plan
CHR	Cultural Heritage Resource
CMHC	Canada Mortgage and Housing Corporation
CMT	culturally modified tree
CN Rail	Canadian National Railway
COG	Coastal Gap ecoregion
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPCN	Certificate of Public Convenience and Necessity
CSR	Contaminated Sites Regulations
CWD	coarse woody debris

Acronym	Definition
CWH	Coastal Western Hemlock biogeoclimatic zone
CWHvm1	Coastal Western Hemlock Very Wet Maritime Submontane variant
CWHvm2	Coastal Western Hemlock Very Wet Maritime Montane variant
CWHws1	Coastal Western Hemlock Wet Submaritime Submontane variant
CWHws2	Coastal Western Hemlock Wet Submaritime Montane variant
CWS	Canadian Wildlife Service
DBH	diameter at breast height
DEM	Digital Elevation Model
DFO	Fisheries and Oceans Canada
EcoCat	Ecological Reports Catalogue
EMF	Electric and magnetic fields
EMP	Environmental Management Plan
EOR	Element Occurrence Record
EPP	Environmental Protection Plan
ESCP	Erosion and Sediment Control Plan
ESER	Environmental and Socio-Economic Effects Report
FISS	Fisheries Information Summary System
FPPR	*Forest Planning and Practices Regulation*
FPWC	Federal Policy on Wetland Conservation
FRPA	Forest and Range Practices Act
FSR	forest service road
FWA	Freshwater Atlas
FWB	Fish and Wildlife Branch
GBPU	Grizzly Bear Population Unit
GIS	Geographic Information System
GPS	Global Positioning System
HCA	Heritage Conservation Act
Hwy.	Highway (named/numbered)
IAMC	Interagency Management Committee
IAPP	Invasive Alien Plant Program
ICBC	Insurance Corporation of British Columbia
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ILRR	Integrated Land and Resource Registry
ISD	In Service Date
IVMP	Integrated Vegetation Management Plan
IWMS	Identified Wildlife Management Strategy
KIR	Kitimat Ranges ecosection
KIT	Kitimat (substation)
LHA	local health area
LiDAR	Light Detection and Ranging

Acronym	Definition
LNG	Liquefied Natural Gas
LOO	Licence of Occupation
LRMP	Land and Resource Management Plan
LSA	Local Study Area
MHmm1	Mountain Hemlock Moist Maritime Windward variant
MIN	Minette (substation)
NAM	Nass Mountain ecosection
NCR	No clearing required
NRA	Nass Ranges ecoregion
NWIPC	North West Invasive Plant Council
OCP	Official Community Plan
OGMA	Old Growth Management Area
OP	Observation Point
OPS	Operational Statements
PAD	permanent alteration or destruction
PEM	Predictive Ecosystem Mapping
POD	Point of Diversion
POI	point of intersection
Project (the)	Terrace to Kitimat Transmission Project
PY	person-year
RAAD	Remote Access to Archaeological Data
RCMP	Royal Canadian Mounted Police
RCP	Restoration and Closure Plan
RDEA	Regional District Electoral Area
Rescan	Rescan Environmental Services Ltd.
RFI	Recreation Features Inventory
RISC	Resources Inventory Standards Committee
RMZ	Resource Management Zone
ROW	right-of-way
RVMA	Riparian Vegetation Management Area
SARA	*Species at Risk Act*
SFC	Skeena Fisheries Commission
SKA	Skeena (substation)
SRMP	Sustainable Resource Management Plan
SRMZ	Special Resource Management Zone
TEDA	Terrace Economic Development Authority
TEM	Terrestrial Ecosystem Mapping
TFL	Tree Farm Licence
THLB	Timber Harvesting Land Base
TIRMP	Thunderbird Integrated Resource Management Plan

Acronym	Definition
TKTP	Terrace to Kitimat Transmission Project
TRIM	Terrain Resource Inventory Mapping
TSA	Timber Supply Area
UWR	ungulate winter range
VAC	Visual Absorption Capacity
VC	Valued Component
VLI	Visual Landscape Inventory
VQO	Visual Quality Objectives
VRI	Vegetation Resource Inventory
VSU	Visual Sensitivity Unit
WHA	Wildlife Habitat Area
WMU	Wildlife Management Unit
YXT	Terrace North West Regional Airport

UNITS OF MEASURE AND CHEMICAL SYMBOLS

Symbol/Unit	Definition
cm	centimetre
m^3	cubic metre
m^3/ha	cubic metres per hectare
m^3/s	cubic metres per second
dB	decibel
°C	degree Celsius
>	greater than
ha	hectare
Hz	hertz
km	kilometre
kV	kilovolt
<	less than
MW	MegaWatt
m	metre
masl	metres above sea level
Mi	mile
mG	milliGauss
mg/L	milligrams per litre
mm	millimetre
%	Percent
km^2	square kilometre
t/ha/a	tonnes per hectare per annum

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1 INTRODUCTION

BC Hydro is planning to build a new 287-kilovolt (kV) transmission line from Skeena (SKA) substation near Terrace to Minette (MIN) substation near Kitimat in northwestern British Columbia (BC). The goal of the Terrace–Kitimat Transmission Project (TKTP; the Project) is to replace the existing transmission line that has reached the end of its serviceable life. The information gathered under the Temporary Use Permit will lead to the submission of a Licence of Occupation (LOO) application for eventual clearing, access, and construction.

The 287 kV transmission line that links MIN substation (which serves the Kitimat area) to the transmission system at SKA substation just outside of Terrace has reached the end of its serviceable life and needs to be replaced. This transmission line (known as 2L099) is an important asset for BC Hydro as it provides electricity to Kitimat and connects the electricity system to existing industrial facilities in the area, including Rio Tinto Alcan and its Kemano generating facility that often provides surplus energy to the BC Hydro network. The new line will also provide capacity to enable future customer interconnections, such as the proposed Liquefied Natural Gas (LNG) facilities in the area.

One of the constraints related to this Project is the need to keep the existing transmission line in service while a new line is constructed. The existing transmission system is radial (i.e. there is only one circuit feeding the area) and the long outages that would be required to build a new line on the existing right-of-way (ROW) would leave too many customers without power for too long of a duration. Therefore, the new transmission line must be built along a new route (**Figure 1-1**).

In addition to replacing 2L099, BC Hydro is also planning to replace the short (less than three kilometres) 287 kV transmission line 2L103 that runs from MIN substation to the Rio Tinto Alcan site. This transmission line is the same design and age as the 2L099, and is experiencing the same end-of-life issues.

While addressing the end-of-life issues relating to 2L099 and 2L103, BC Hydro is also taking into consideration the future potential loads that may wish to connect in the Kitimat area. On this basis, the new transmission line will be built with a higher capacity than the existing transmission line and will utilize more modern standards and construction materials to ensure greater reliability and sustainability.

BC Hydro studied two options for replacing the existing transmission line. The preferred option, a single line on the west side of the Kitimat Valley, was selected based on technical feasibility, constructability, reliability, early environmental and archaeological study results, First Nations consultation, stakeholder and public input, and cost. The preferred option will hereafter be known as and referred to as the provisional route.

This Environmental and Socio-Economic Effects Report (ESER) is part of BC Hydro's planning process and will be used to support BC Hydro's application for a LOO. A Certificate of Public Convenience and Necessity (CPCN) is not required, pursuant to the Government of BC's *Clean Energy Act*. Nonetheless, it is BC Hydro's intention to observe similar standards of work on the Project to those required by a CPCN process. The Project does not require an environmental assessment certificate under the BC *Environmental Assessment Act (*BC *EAA) 2002* or the

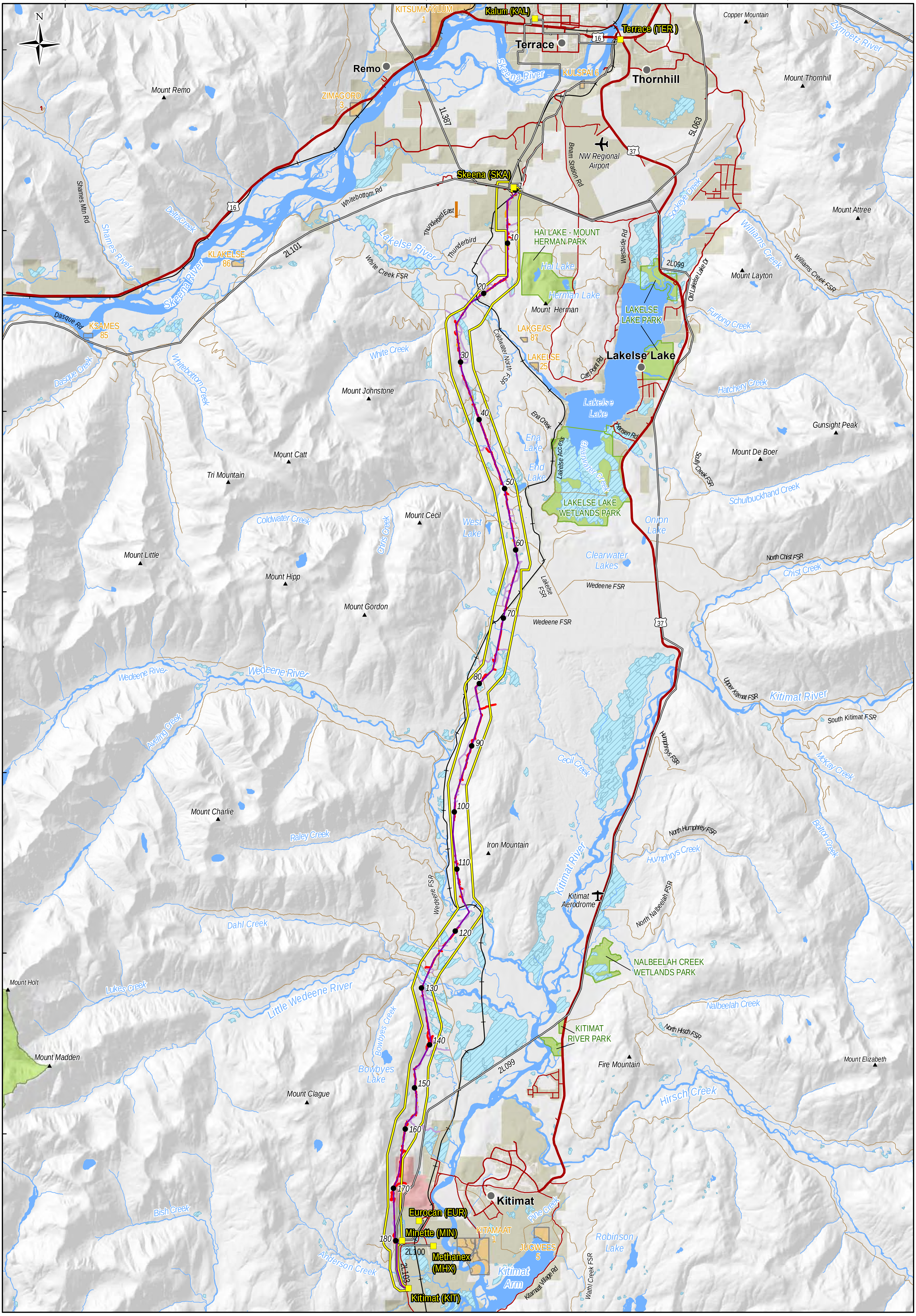
Canadian Environmental Assessment Act (CEA Act) *2012* as its voltage, length, and other aspects do not meet or surpass the thresholds defined in those acts and their regulations.

BC Hydro received a Temporary Use Permit (TUP) in 2015 for investigative work, such as geotechnical investigations, and a TUP amendment in 2016 for centreline survey and helipad contruction works, in the Project area. The analysis in this ESER will contribute to the development of the Management Plan for the Crown land application for the Statutory Right-of-Way (ROW) that will include requesting an interim License of Occupation (LOO) in order to commence preliminary work associated with the construction of the transmission line.

BC Hydro will submit the Crown land application in 2016 based on detailed engineered design and information gathered from studies conducted during geotechnical investigations and environmental baseline surveys. First Nations consultation, public input and regulatory reviews will further contribute to the Project's final design. Once the application is approved and a LOO is granted; occupant licence to cut, road use permits and other ancillary permits and authorization will be sought as required prior to commencement of access, clearing and construction.

The ESER identifies potential Project effects and proposed mitigation for each discipline (biophysical or socio-economic study topic). Each discipline-specific assessment follows a sequence of steps, which include describing the existing conditions, defining the spatial boundaries of the effects assessment, conducting issues scoping, selecting valued components (VCs), identifying potential effects, presenting mitigation and characterizing residual effects. The assessment will include, as appropriate, the clearing/construction, operation/maintenance, closure, and post-closure phases of the Project. The methodologies are described in more detail in Section 3, and discipline-specific methodologies are included in each discipline section as appropriate.

BC Hydro acknowledges that while First Nations have had the opportunity to participate in the field work and geotechnical studies undertaken to date and will continue to be invited to participate in any further work, they may wish to provide further information to BC Hydro so that BC Hydro may better understand the First Nations' views about the potential effects of the provisional route on their Aboriginal title and rights. In addition to engagement related to the development of the ESER, BC Hydro has worked, and will continue to work, directly with First Nations to better understand the potential Project effects and how they can best be avoided, mitigated or accommodated, as appropriate.



Legend

- Populated Place
- Existing Substation
- Existing Transmission Line
- Highway
- Arterial
- Local Road
- Forest Service Road
- Railway
- Watercourse
- Waterbody
- Wetland
- Park
- First Nation Reserve
- Private Parcel
- Sandhill Private Parcel

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
DataBC Data
Distribution Service
Open Government License
(http://www.data.gov.bc.ca/)

CLIENT: Prepared for BC Hydro	PROJECT: Terrace to Kitimat Transmission Project (TKTP)
TITLE: Terrace–Kitimat Transmission Project Overview	DATE: September, 2016 · ANALYST: WR · QA/QC: MY · Figure 1-1
	GIS FILE: 24-02-011_introduction_figure
	JOB No: VE52379
	COORDINATE SYSTEM: NAD 1983 UTM Zone 9N

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Last updated by willem.van-riet

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2 PROJECT DESCRIPTION

2.1 Project Scope

The Project scope involves the construction of an approximately 50-kilometre (km) 287 kV single circuit transmission line, along with associated infrastructure, originating at the existing SKA substation near Terrace and terminating at the existing MIN substation near Kitimat. The Project follows a new route along the west side of the valley between Terrace and Kitimat. This is a more direct route than the existing transmission line, which mostly runs along the east side of the valley adjacent to the highway. The provisional route was selected following a rigorous process that examined costs, constructability, reliability, terrain, geotechnical risks, environmental elements and archaeological studies, and took into account the results of consultation with First Nations and various stakeholders.

In addition, the existing 2.7 km 2L103 line running south from MIN to Rio Tinto Alcan's Kitimat substation (KIT) will be replaced. The new line will run adjacent to the existing line. This report covers construction of both lines.

For the purposes of this report and the planning and permitting processes for the Project, decommissioning of the existing 2L099 transmission line, which is expected to take place after the new line is in service, is not within the scope of the Project. The decommissioning of the existing line is not assessed in this report, as its purpose is to assess the potential environmental and socio-economic effects of the new line. Further engagement and consultation around the decommissioning of the existing line will take place separately and additional studies and/or planning will be conducted as appropriate.

2.2 Project Design and Mitigation in Design

Project design is an iterative process whereby economic, environmental and geotechnical issues and constraints are considered. This process began early on in the Project planning with two route options—an east option and a west option on either side of Highway 37. Through First Nations and public consultation and based on the above-mentioned factors, the western route was selected as the provisional route. An engineering study area encompassing the provisional route was defined through a process taking into account important features, such as avoiding private lands, federal lands, parks and protected areas, and geographical constraints, such as glacial marine clays, wherever practicable,(**Figure 1-1**). This initial "mitigation in design" step built avoidance of important features into the early project planning and design process. Further mitigation measures were employed during the design of the specific route alignment and structure locations. BC Hydro transmission line engineers took into account areas including Old Growth Management Areas (OGMAs), old forest, wetlands, and important stream crossings. For example, mitigation measures have been specifically applied to the Lakelse River crossing whereby BC Hydro redesigned the river crossing to avoid cutting any of the old growth trees within 200 (m) of either side of the river. This redesign mitigated concerns raised by First Nations during consultation and recognized that this area has been identified as a Special Resource Management Zone (SRMZ) by the Kalum Land and Resource Management Plan (LRMP) in which Section 3.1 states, "no logging will occur in Subzone 1." Mitigation in design was achieved by relocating the crossing to a new location and increasing structure height of each structure on either side of the river; as a result, only seven old growth trees will be cut in Subzone 1. This also minimizes potential effects on habitat in that area, which is discussed in more detail in subsequent effects assessment sections (e.g. wildlife).

2.3 Transmission Line Structures

The majority of the transmission line structures will consist of free-standing, steel, H-frame structures supporting three high-voltage conductors and will be 30 m to 33 m high (**Figure 2.3-1**). The spanning distance between the structures is generally between 350 m and 500 m. As noted in the previous section, two structures on either side of the Lakelse River will be roughly 60 m high and are expected to be composed of steel lattice structures in order to span the tall old growth trees on either side of the river and avoid the need for clearing in the area. The provisional route design has identified 183 new structures required to complete the connection between SKA substation to KIT substation.

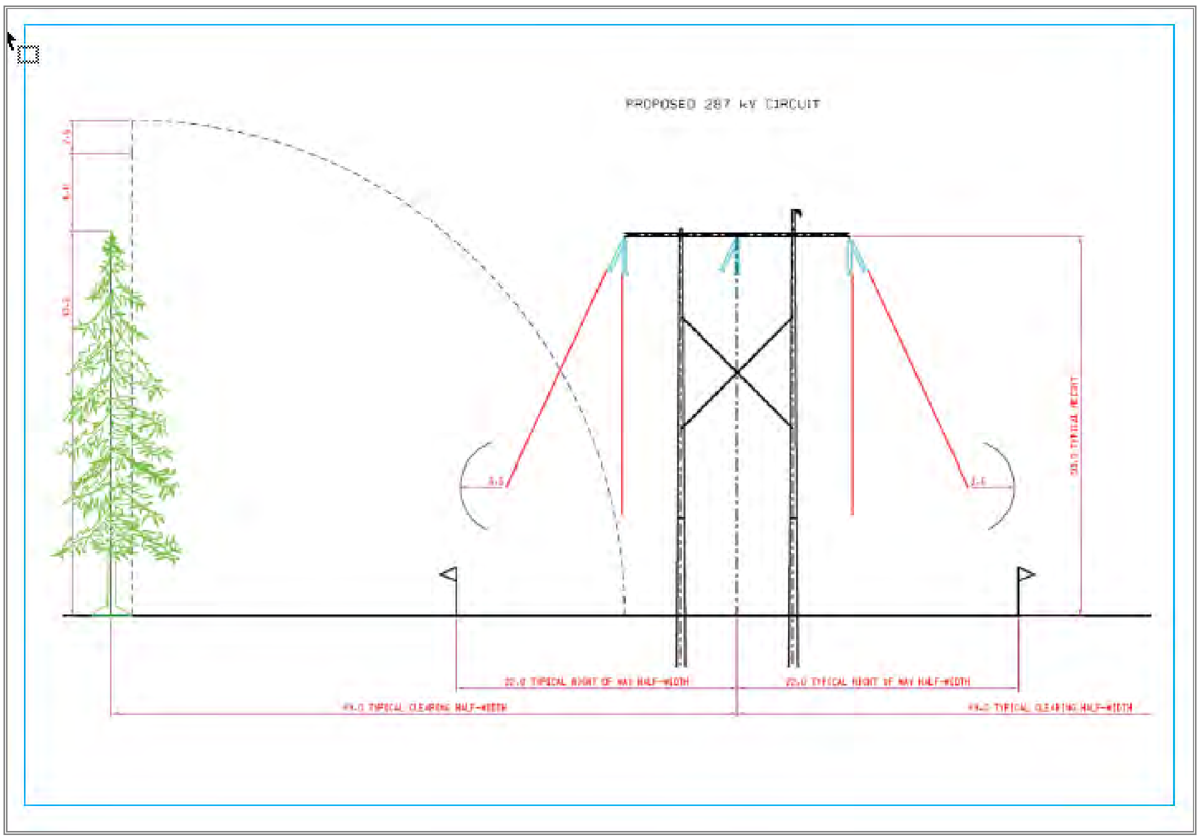


Figure 2.3-1: Typical H-Frame and ROW Cross Section

2.4 Project Phases

There are four main Project phases: clearing/construction, operation/maintenance, closure, and post-closure.

2.4.1 Clearing/Construction

The clearing/construction phase includes clearing vegetation, access road construction, installation of foundations and line construction activities.

2.4.1.1 Clearing

2.4.1.1.1 Transmission Line Clearing

BC Hydro's policy with respect to clearing for new transmission lines is to ensure public safety and long-term line security while minimizing environmental effects and costs. Clearing width requirements vary with line voltage, structure configuration/phase spacing, conductor height, electrical clearance, tree heights, tree growth rates, topography/ground slope, and other factors. The clearing for a new transmission line includes clearing the future anticipated Statutory ROW (herein referred to as Statutory ROW), a one-time danger tree clearing strip and removal of individual danger trees.

The Project Statutory ROW (the provisional route) will be approximately 53 km long and 42 m wide (21 m on either side of centre line). This is the minimum clearing width for the transmission line ROW. Within the Statutory ROW area, the clearing must provide safe clearance from trees that may grow up into the conductors (prolonged exposure). In order to determine which trees must be removed, a 30-year growth allowance is added to the tree heights and an electrical clearance of 6.0 m is added (prolonged exposure clearance for a 287 kV line). The required clearance from a conductor to a tree is the sum of the tree height, the estimated tree growth allowance, and the required electrical clearance. After the line is in service, the Statutory ROW is legally surveyed. This will become the ROW area that is regularly managed and maintained by BC Hydro.

In addition to trees that can grow up into the conductors, the clearing must provide safe clearance from trees that can fall towards the conductors (temporary exposure). This is called the one time danger tree clearing strip and occurs along the outside edge of the Statutory ROW where required. A 10-year tree growth allowance is added to the tree heights and an electrical clearance of 2.6 m is added (temporary exposure clearance for a 287 kV line). The clearing may require an additional width beyond the ROW that may extend up to 40 m from either side of the provisional route, however, overall clearing corridor width will vary from 42 m (minimum) to 120 m (maximum).This one time danger tree clearing strip is allowed to grow back with vegetation and is not cleared to the same extent again. The expectation is that the vegetation will grow back and be windfirm and healthy (i.e. trees will be subject to wind during their growth, making them windfirm) and unlikely to fall onto the transmission line. Occasionally, trees that grow up in this area may become a security risk to the line and require targeted removal through BC Hydro's Edge Tree Program.

In areas where there is no road access and the transmission line will be accessed via helicopter, there may be a requirement to clear additional defined areas to facilitate helicopter-landing pads. These sites may extend outside of the onetime danger tree-clearing strip for safety reasons but will be limited in number and defined in area. The helicopter landing pads will be included in the Statutory ROW area when it is surveyed.

The total average clearing width will be approximately 82 m wide, ranging from the 42 m minimum width to a maximum width of about 120 m. Details are provided in **Table 2.4-1**.

In addition to the one time danger tree clearing strip, there may be a requirement to remove individual danger trees along the outside edge of the clearing boundary. These would include trees that are taller than the dominant trees and pose a security threat to the line within 10 years. Rather than moving the clearing boundary out to capture these trees, they are individually marked for removal.

There may also be danger trees as defined by the WorkSafeBC regulations that are required to be removed. These may not be marked for clearing during the transmission line-clearing layout if they are not a security threat to the line; however, the clearing contractor will be responsible for identifying and removing these trees.

Substantial conductor height above the ground may preclude the necessity to clear vegetation in some areas. For example, when spanning very deep incised ravines or gullies where tree height (including the growth factor) does not encroach within the electrical clearance limits, a zone of trees may be left standing underneath the conductors.

Table 2.4-1: Transmission Line ROW Clearing Requirements

Requirements	Transmission Line Clearing Approximate Quantities
Transmission line length (50 km of new line and 3 km for replacement of 2L103)	53 km
Statutory ROW	42 m–44 m
Potential additional danger tree clearing strip*	Up to 39 m either side of Statutory ROW
Maximum anticipated clearing width	120 m
Transmission line clearing area range	222 ha–636 ha

Notes: *will vary depending on height of trees adjacent to Statutory ROW; ha = hectare; km = kilometre; m = metre; ROW = right-of-way

2.4.1.1.2 Clearing Standards

Clearing standards define the techniques that will be used to clear and prepare the transmission line ROW. The standards will be designed to consider and respond to many factors such as BC Hydro's experience with similar transmission lines, public and worker safety, environmental concerns, terrain/topography, soil texture and moisture conditions, type of vegetation, access, ecological sensitivity (e.g. riparian areas) and long-term costs/benefits.

Table 2.4-2 describes some typical clearing standards that may be used to clear the transmission line ROW. This is not an all-inclusive list and other standards may be developed. The first letter of the standard describes the method of cutting trees and brush (H = Hand; M = Mechanical). The second letter of the standard describes the method of handling trees and waste wood (H = Hand; M = Mechanical; O = Other). The two letters are followed by a number that identifies the variations within a similar group of standards. **Table 2.4-2** describes typical core clearing standards that will be refined and customized as the Project advances from definition phase to implementation phase. As more fieldwork and consultation is completed and as biophysical information is collected, the standards are expected to evolve to incorporate Project–specific factors.

Table 2.4-2: Typical Core Clearing Standards

Clearing Standards	HH-1	HO-2	HO-3	HO-4	MM-2	MM-3	MM-5	MM-8	MO-2	MO-3
Typical Site Conditions	RVMAs and/or sites not accessible by ground based equipment	Sites not accessible by ground based equipment	Sites not accessible by ground based equipment	Inaccessible No road access	Accessible by ground based equipment Only Within BC Hydro Statutory ROW	Accessible by ground based equipment	Accessible by ground based equipment Wet sites Winter time on snow pack or frozen ground	Accessible by ground based equipment Recently harvested cutblocks Only Within BC Hydro Statutory ROW	Accessible by ground based equipment	Accessible by ground based equipment Wet sites Winter time on snow pack or frozen ground
Typical Existing Vegetation	Varies from Mature trees to tall growing regeneration	Tall growing regeneration	Mature and Immature trees	Mature and Immature trees	Varies from Mature trees to tall growing regeneration	Varies from Mature trees to tall growing regeneration	Varies from Mature trees to tall growing regeneration	Small growing regeneration	Tall growing regeneration	Tall growing regeneration
Typical Felling Method	Hand-held equipment	Hand-held equipment	Hand-held equipment	Hand-held equipment	Heavy Equipment	Heavy Equipment	Heavy Equipment	Heavy Equipment	Heaving Equipment Mowing/mulching type equipment	Heaving Equipment Mowing/mulching type equipment
Typical Timber Removal	Equipment reaching in from adjacent roads and/or clearing areas and/or removal by hand	None Regeneration bucked or slashed by hand and scattered across clearing area to lie flat on ground	Cable System	Helicopter	Heavy equipment	Heavy equipment	Heavy equipment	Heavy equipment	None	None
Typical Waste-Wood Management	Hand piling and burning	Debris Left on site.	Hand piling and burning	Hand piling and burning	Machine piling and burning	Machine piling and burning	Machine piling and burning	Machine piling and burning	Debris/Mulch left on site	Debris/Mulch left on site
Typical Final Ground Conditions	Natural ground surface, stumps and low growing vegetation not significantly disturbed	Natural ground surface and stumps not significantly disturbed	Natural ground surface, stumps and low growing vegetation not significantly disturbed	Natural ground surface, stumps and low growing vegetation not significantly disturbed	Surface of cleared area stumped, grubbed, rough graded and seeded	Natural ground surface, stumps and low growing vegetation not significantly disturbed	Natural ground surface, stumps and low growing vegetation not significantly disturbed	Surface of cleared area stumped, grubbed, rough graded and seeded	Natural ground surface and stumps not significantly disturbed	Natural ground surface and stumps not significantly disturbed

An example of a clearing standard that is expected to be used is the HH-1 standard. This standard is often associated with clearing within Riparian Vegetation Management Areas (RVMAs), which are established around classified waterbodies (streams, wetlands, and lakes). Falling activities are conducted by hand to protect streambank stability. Equipment access into RVMAs is limited. Typically, equipment can reach into the RVMA from adjacent areas to remove timber and woody debris. Any remaining waste wood is piled and burned by hand. The clearing activity shall not significantly disturb the natural ground surface, stumps or vegetation that is to be conserved.

Another example of a clearing standard that will be used is the MM-2 standard. The felling, clearing, and waste wood management will take place with heavy equipment. The stumps will be removed and the surface of the cleared area will be grubbed and rough-graded. This clearing standard is typically prescribed within the ROW outside of RVMAs and where ground conditions are suitable.

2.4.1.2 Construction

Transmission line construction includes performing foundation works, installing support structures/poles, stringing of the line and commissioning. During construction, progressive restoration efforts and sediment and erosion control measures will be ongoing to the greatest extent practicable. Post-construction restoration of disturbed areas will include decompacting and revegetating were necessary. Other aspects of construction (access roads, foundations, and structures, etc.) are described in the subsections below.

2.4.1.2.1 Access Roads

The Project will require both the use of existing roads and creation of new access roads. New roads typically have an average clearing width of 20 m but may be more depending on the minimum width necessary to accommodate the road, regard for safety, topography, drainage of water in the area, stability of the terrain, and operation requirements (e.g. quarries, landings, storage of bridge, culvert material, etc.). Total soil disturbance width will be approximately 15 m (including the cut slope, ditch, running surface and fill slope), but this will vary depending on terrain/ground slope. It is estimated that approximately 41 km of new road construction will be required in total throughout the Project area (**Table 2.4-3**).

Use of existing roads will include paved roads such as Highway 37 and gravel roads such as Forest Service Roads (FSRs), Road Permit roads and non-status roads. Some of the existing roads will require substantial upgrades such as brushing, ditching, subgrade stabilization, drainage structures, and surfacing: these are referred to as reconstruction roads. Some existing roads will just require regular routine maintenance (minor brushing/ditching, spot surfacing and grading): these are referred to as maintenance roads. Due to the routine nature of maintenance roads, limited potential effects are possible, and so only reconstruction roads are considered further in this report. It is estimated that a total of approximately 39 km of reconstruction roads will be required for the Project (**Table 2.4-3**).

Table 2.4-3: New Access and Reconstruction Roads Length

Road Type	Approximate Distance (km)	Description
New permanent roads	36	newly constructed – will remain post-construction
New temporary roads	5	newly constructed – will be deactivated post-construction
Reconstruction roads	39	Existing roads requiring substantial upgrades - will remain post-construction

Note: km = kilometre

Source: Chartwell Road Design as of December 18, 2015

Access roads will be considered either permanent (for the Project life) or temporary. Permanent roads will remain in place after Project construction is completed, whereas temporary roads will be deactivated post-construction. It is anticipated that all of the roads that access the structures will be permanent for transmission line maintenance purposes and some of the roads that are constructed for equipment laydown areas, conductor-stringing pads and ROW clearing activities only may be temporary. This effects assessment considers new and upgraded roads only, as they will require the most extensive clearing and/or construction works.

Approximately 14 new bridges will need to be installed and three existing bridges require upgrades. Some early bridge work may be required in 2016 in order to complete investigative work and/or in preparation for construction (refer to Section 2.5 for further details on early bridge work).

2.4.1.2.2 Foundations, Structure Assembly and Stringing

Structure foundations may be of four types, depending on soil and ground conditions: direct bury, concrete shallow, rock and caisson. **Table 2.4-4** provides further details. The structures are assembled next to the foundations, then raised and set into place. In the final stage of construction, trailers carrying large reels of conductor are brought in and the conductor is strung onto the structures. Construction will require temporary work space outside of the ROW. These may include, but are not limited to, laydown areas, staging areas for equipment, soil stockpiles, and associated infrastructure (e.g. trailers, first aid stations and work sites).

Table 2.4-4: Structure Foundation Types

Foundation Type	Soil/Ground Condition	Description
Direct Bury	Typical soils	Pole stubs are embedded within a culvert to a maximum depth of 6 m
Concrete Shallow	Poor conditions at depth	A hole is excavated to pour 7 m x 7 m pad at depth of 2.85 m
Rock Foundation	Bedrock near surface	Overburden is excavated to expose rock
Caisson*	Soft soils	2.1 m diameter steel caisson driven into the soil to a depth of 12 m

Notes: m = metre. *Caisson = is a watertight retaining structure

Construction equipment will include, but is not limited to, trucks, backhoes, excavators, D caterpillars, lowbed tractor-trailers, fuel trucks, cranes, and transmission line tension stringing equipment. Construction will also require utilities, materials, energy and water needs, hazardous materials, waste generation and construction workforce. Protocols will be implemented for surface water run-off management and invasive plant species prevention and control.

2.4.2 Operation/Maintenance

Certain rights to the transmission line ROW will be granted to BC Hydro as a Statutory ROW. These rights allow BC Hydro to maintain safe operation of the new line. The Integrated Vegetation Management Plan for BC Hydro Transmission and Distribution Power Line Corridors (BC Hydro 2016) describes BC Hydro's vegetation management program along power lines and describes the planning and use of vegetation control methods used by BC Hydro to sustainably maintain the security and reliability of the transmission system. The primary goal of BC Hydro's vegetation management program is to ensure the safe and reliable operation of the power system. As this Project forms part of the bulk electric system, vegetation must also be managed in compliance with the North American Electric Reliability Council standard FAC-003-4, Vegetation Management (North American Electric Reliability Corporation, 2016), including any future amendment to the standard. BC Hydro currently achieves this goal by implementing four vegetation management techniques (BC Hydro, 2016):

1. Selective control — Wherever possible, control methods target only tall-growing vegetation and encourage or introduce desirable low-growing species, particularly shrubs and indigenous plants that are naturally present on the site, since this helps to suppress tall-growing species.
2. Compatible use — BC Hydro encourages the use of ROWs for activities that will not conflict with transmission lines and that control or prevent the growth of tall trees, such as recreational or agricultural uses.
3. No clearing required (NCR) — Areas not cleared are where trees at their mature height will never come within the "limits of approach" (minimum allowable/safe distance between vegetation and the conductor) at the maximum "conductor sag" (degree to which the line could sag towards the ground). NCR sites are those that will never require vegetation maintenance because they will not interfere with transmission lines integrity.
4. Altering existing vegetation — In rare cases where it is impractical to remove undesirable species from along the edges of the ROW, existing vegetation can be modified by pruning to maintain clearances from conductors, thus protecting the safety and integrity of the transmission lines.

Maintenance activity requires that some access along the ROW be left in place to support ground-based inspections and minor repair activities. The operation/maintenance phase is scheduled to extend over the life span of the transmission line, starting once the line is constructed and energized. Regular line maintenance and vegetation management will be required. The ROW will be inspected by vegetation personnel on a regular basis and a vegetation maintenance schedule will be implemented. Crews will perform regular inspections and, if defects are noted, repairs will be made. Helicopter overviews will be performed as necessary. Detailed inspections will be performed 7–10 years after the line has been in service. Access roads and drainage structures will be cleared or repaired as necessary.

While not expected, it is possible that major repair activity may require the re-establishment of access trails/roads, workspaces and staging areas similar to construction activity. This may occur over part of the ROW or all of it, depending on the nature of the repair. For these activities, restoration actions as outlined in **Section 2.4.3** will be undertaken to return the ROW to the defined target condition.

2.4.3 Closure

Closure refers to decommissioning of the Project and restoration, as appropriate. There is no defined life span of the Project as the line will be in place as long as needed; however, the assumption is that at an undefined point in the future the line will be decommissioned The closure phase would involve the removal of all transmission line facilities in a process called decommissioning. Decommissioning is similar to the construction of the Project and generally requires the re-establishment of access roads/trails, workspaces and staging areas and crane pads in order to remove project infrastructure. Foundations will be left in place, cut off at/below the surface of the ground or removed completely, depending on the requirements at the time. During restoration, the transmission line ROW will be restored to resemble its original condition or reclaimed to standards identified by regulators and/or in discussions with First Nations, local communities, and stakeholders, depending on land use objectives at that time. A restoration and closure plan (RCP) is typically prepared to detail the decommissioning process and provide specific environmental management objectives. This plan would be developed in consultation with First Nations and stakeholders, as appropriate.

Revegetation objectives will address erosion control, soil conservation/stability, minimize the introduction or spread of invasive plant species, and seek to meet current land use objectives. Revegetation objectives shall take into account measures to avoid or minimize Project effects or enhance land use objectives identified by First Nations, regulators and local stakeholders.

2.4.4 Post-Closure

Post-closure is expected to start immediately after completion of closure activities. Upon successful completion of the restoration and closure activities, the ROW, and its related reclaimed trails/roads/workspaces/staging areas and crane pads, will be left to integrate into the ecological cycles of the area. In time, the ability to visually identify the restored ROW and related facilities is anticipated to fade. Monitoring will take place post-closure as required to evaluate the success of restoration activities and adjust plans when necessary.

2.5 Schedule

The planned in-service date for the Project is fourth quarter of 2019 subject to unforeseen conditions and risks. A schedule showing all phases of the Project is provided in **Table 2.5-1**.

Some preliminary work, including a centre line survey and early bridge works, are expected to occur in spring 2016. The centre line survey work is to take place under an amendment to the temporary use permit for investigative activities related to the Project, which will be sought in early 2016. The centre line survey work, which is investigative work necessary to inform detailed project design, involves surveying proposed structure locations and the centre line between the structure locations. The centre line survey work will follow the preliminary centre line as closely as possible, and will be cleared of standing timber, underbrush, branches, and slash to a width of one to two metres and to a height of at least 2.2 m. This is so that the survey crews can walk the line and confirm sightlines. To gain access to areas where there are no roads, helicopter landing pads (heli-pads) will need to be constructed. In order to do this approximately 13 temporary heli-pads will need to be constructed.

Three sites where early bridge work will be required have been identified. These bridges access large sections of the provisional route. One of the three early bridge work sites is located on a non-status road. BC Hydro will submit an application for a Roadway Licence for the completion of the work. The two other sites are on Forest Services Roads and, while they do not require a Roadway Licence, may require a Water Sustainability Act Notification. These sites are located on fish-bearing streams and if in-stream works are required, fish timing windows will be observed whenever practicable (e.g. work preferred in July/August). Therefore, to ensure the clearing activities can commence in the spring of 2017, this bridge work will need to occur in the summer of 2016. The bridge work may include new bridge or engineered culvert installation, replacement of old bridge or bridge upgrades. Additional details will be provided as available; BC Hydro is currently conducting inspections/assessments at these sites.

Once the LOO authorization is granted, the construction phase is anticipated to occur over three years, from spring 2017 to fall 2019.

Table 2.5-1: Anticipated Project Activities and Schedule

	Planning/Design						Preliminary Clearing						Clearing						Construction						Operation / Maintenance		Closure / Decomissioning	Post Closure
	2014				2015				2016				2017				2018				2019				2020	2021-2059	2059	2059
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
Investigative and Geotechnical Works							■	■																				
Planning/Design	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■												
Heli-Pad Construction / Centre Line Survey										■	■	■																
Bridge Work											■	■		■	■	■												
Site Clearing (road, ROW, staging areas)														■	■	■	■	■	■									
Progressive Restoration (as necessary)										■	■	■	■	■	■	■	■	■	■	■	■	■	■					
Structure Foundation, Assembly, and Installation																■	■	■	■	■	■	■	■					
Stringing																							■	■				
Post-Construction Restoration																									■			
In-Service																									■			
Removals																									■			
Vegetation Management																										■		
Decommission and Restoration																											■	
Re-vegetation and Re-growth, monitoring as required																												■

Notes: ROW = right-of-way;
Assumes life span of transmission line structures, cables, transformers, and capacitors is a minimum of 40 years.
Assumes LOO received by Q1 2017

2.6 Project Setting

2.6.1 Geology

The provisional route is located within the Kitsumkalum-Kitimat trough of the Kitimat Mountain Range (Holland, 1964; Clague, 1984). The provisional route crosses terrain varying from flat to gentle terraced terrain to more steep terrain comprising colluvium and till–covered bedrock-controlled slopes. It crosses flat-lying and heavily incised terrain underlain by deposits of weak, fine-grained glaciomarine soils. These are of particular concern such as they are subject to active flow sliding. Rock bluffs are prevalent. Numerous watercourses of varying size occur in the Project area. Major streams crossing the study area include Lakelse River, Wedeene River, Little Wedeene River, Coldwater Creek, and Cecil Creek.

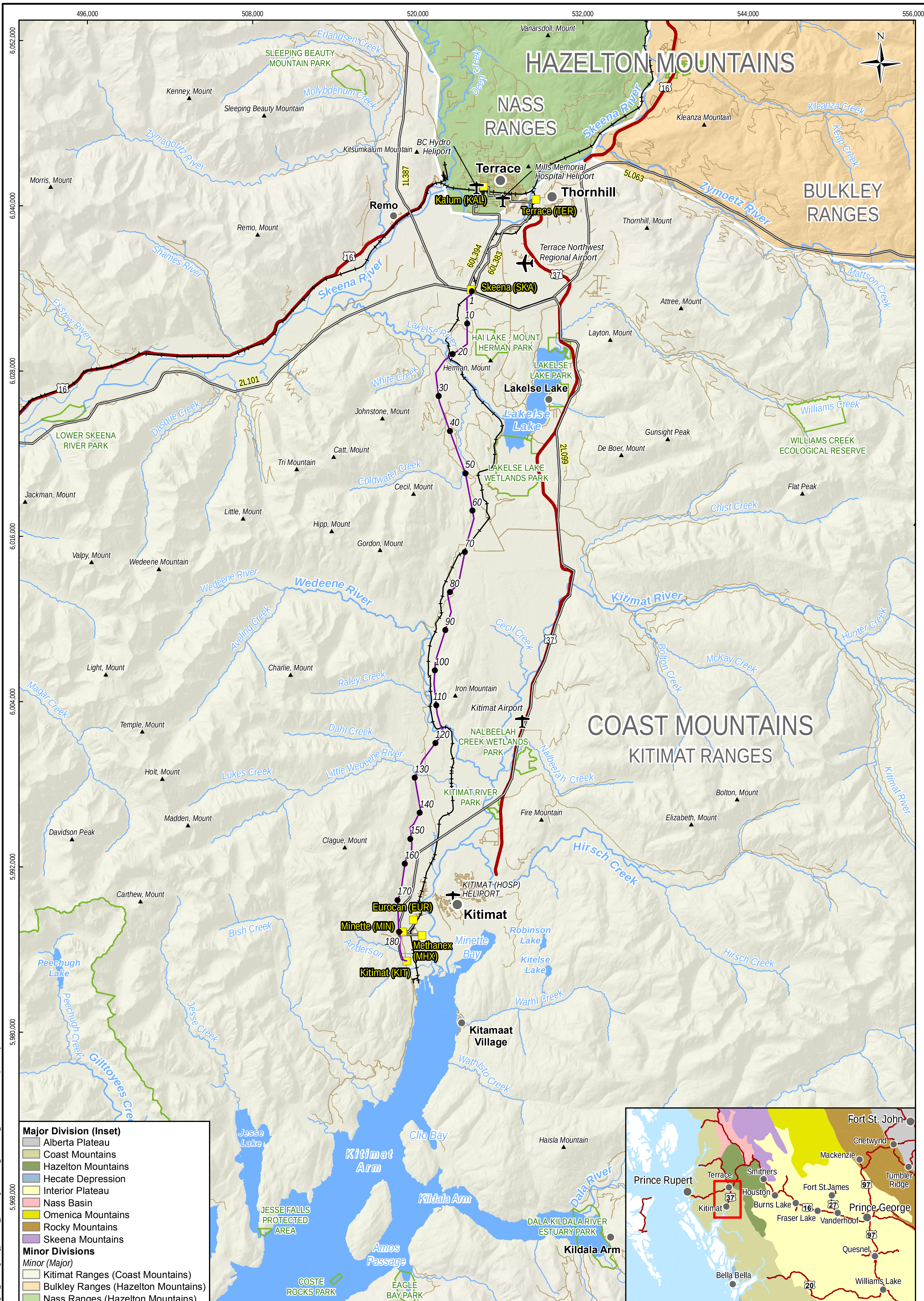
In general, the bedrock geology units underlying the Coast Mountain physiographic region within the Project area are Cenozoic to Paleozoic (Tertiary to Devonian) in age and primarily consist of volcanic and intrusive granodiorite rocks with members of the Stikine Assemblage and Telkwa and Poison Pluton Formations.

2.6.2 Landforms

Landforms are physical features such as valleys and mountains that combine to make the topography of the province, a topography that is constantly in flux as a result of ongoing erosion. Physiographic areas are a means to describe the physical landforms of BC as described by Holland (1964). In a broad sense, the Project area lies within the Coast Mountains physiographic unit, which is a large area that extends along the mainland coast and comprises sedimentary and volcanic rocks. The Kitimat Ranges fall within the Coast Mountain area and represent the central portion of coastal BC. The Project area occurs entirely within the Kitimat Ranges physiographic area (**Figure 2.6-1**).

The Kitimat Ranges are characterized by granitic mountains with the majority of peaks reaching between 1,980 masl and 2,300 masl and a few as high as 2,700 masl (Holland, 1964). The highest peak is Atna Peak at approximately 2,755 masl (Holland, 1964). These mountains were overridden by the ice-sheet, and peaks are rounded with cirques on the north and northeastern sides. Major rivers cross the valley bottoms in the form of long straight valleys or channels known as lineaments (Holland, 1964).

Regional surficial geology mapping is available for the Project area (Skeena River – Bulkley River Area, Map Sheet 1557A, Sheet 2, 1975 – 1977 (Clague, 1984)). The mapping indicates that the provisional route generally crosses terrain underlain by bedrock with a veneer of till, gravel or colluvium or underlain by lower-lying terraces consisting of alluvial sands and gravels or fine-grained glaciomarine silts and clays and soft organic soils. In some areas, it appears that soft fine-grained soils are present as layers within the alluvial deposits, making the terrain unpredictable and subject to instability. The soil thickness varies significantly across the site. The fine-grained glaciomarine and organic soils are considered to represent potentially challenging foundation conditions for structures or roadways. Associated with these glaciomarine deposits are several actively unstable and potentially unstable areas along sections of the provisional route. The Light Detection and Ranging (LiDAR) imagery suggests flowslides, rilling, and gullying within these soils.



Legend

- Populated Place
- Airport
- Aerodrome/Heliport
- Existing Substation
- Existing Transmission Line
- Highway
- Existing Road
- Railway
- Watercourse
- Waterbody

Project Components

- Proposed Structures
- Provisional Route

0 2.5 5 10
Kilometers
Scale: 1:250,000

Reference:
DataBC Data Distribution Service
Open Government License
(http://www.data.gov.bc.ca/)
Geogratis/Geobase
Open Government License - Canada
(http://data.gc.ca/eng/about-datagcca)

CLIENT: Prepared for BC Hydro

PROJECT: Terrace to Kitimat Transmission Project (TKTP)

TITLE: Landforms – Overview of Physiographic Areas

DATE: September, 2016 | ANALYST: WR | QA/QC: CH | **Figure 2.6-1**

GIS FILE: 03-02-001_Landforms_v2

JOB No: VE52379

COORDINATE SYSTEM: NAD 1983 UTM Zone 9N

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A range of potential terrain hazards or forms of terrain instability may be of concern to the Project. Two forms of instability, which may affect parts of the routes, are considered to be present within the study area: shallow instability and deep-seated instability.

Shallow instability includes several forms of slope failure or attrition, where the instability is confined to surficial materials or near-surface materials, within roughly 1 m of the ground surface. Such instability includes processes such as:

- Surface erosion from upslope runoff or from stream flow eroding the toe of a slope;
- Solifluction, or soil creep, where water saturation and freeze-thaw effects trigger a process of ongoing downslope movement of shallow surficial soils and rootmat/vegetation cover (such processes mainly affect poorly drained soil materials comprising fine-grained materials); and
- Shallow sloughing, slumping or flow slides, which occur when the saturation of a soil material (such as glaciomarine silts and clays) exceeds its internal strength.

Deep-seated instability occurs where there are thick, weak glaciomarine silts and clays or within thick terrace sequences where there are layers of glaciomarine deposits present. The presence of groundwater seepage/groundwater pressure at depth reduces the inherent strength of the fine-grained material. Flow slides are often retrogressive in nature, implying that siting of structures will have to be carefully considered. Other than general ravelling due to erosion of steep rock slopes, there does not appear to be deep-seated failures within bedrock or soil/bedrock contact.

2.6.3 Climate

The proximity to the Pacific Coast means that Terrace and Kitimat have a humid climate with wet, cold winters and drier, warm summers.

The Project area climate is influenced by weather systems arriving from the Pacific Ocean and lifting over the coastal mountains. In winter, low-pressure systems dominate the weather and send moist, mild air onto the central coast. During the summer, high-pressure systems prevail. Wind speeds and direction depend on the location and time of year. The central coast is subjected to frequent frontal systems (**Figure 2.6-2** and **Figure 2.6-3**).

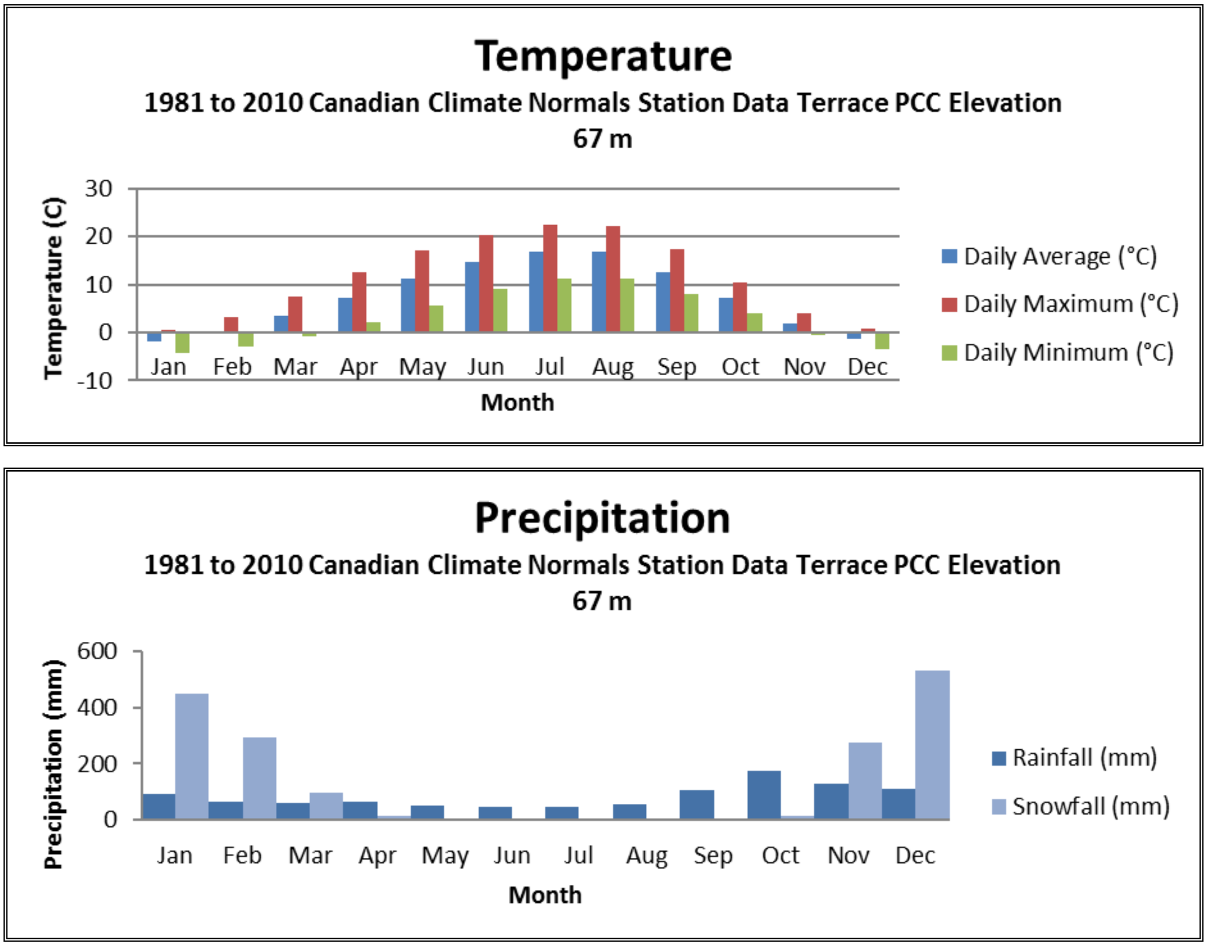


Figure 2.6-2: Terrace Temperature and Precipitation Normals

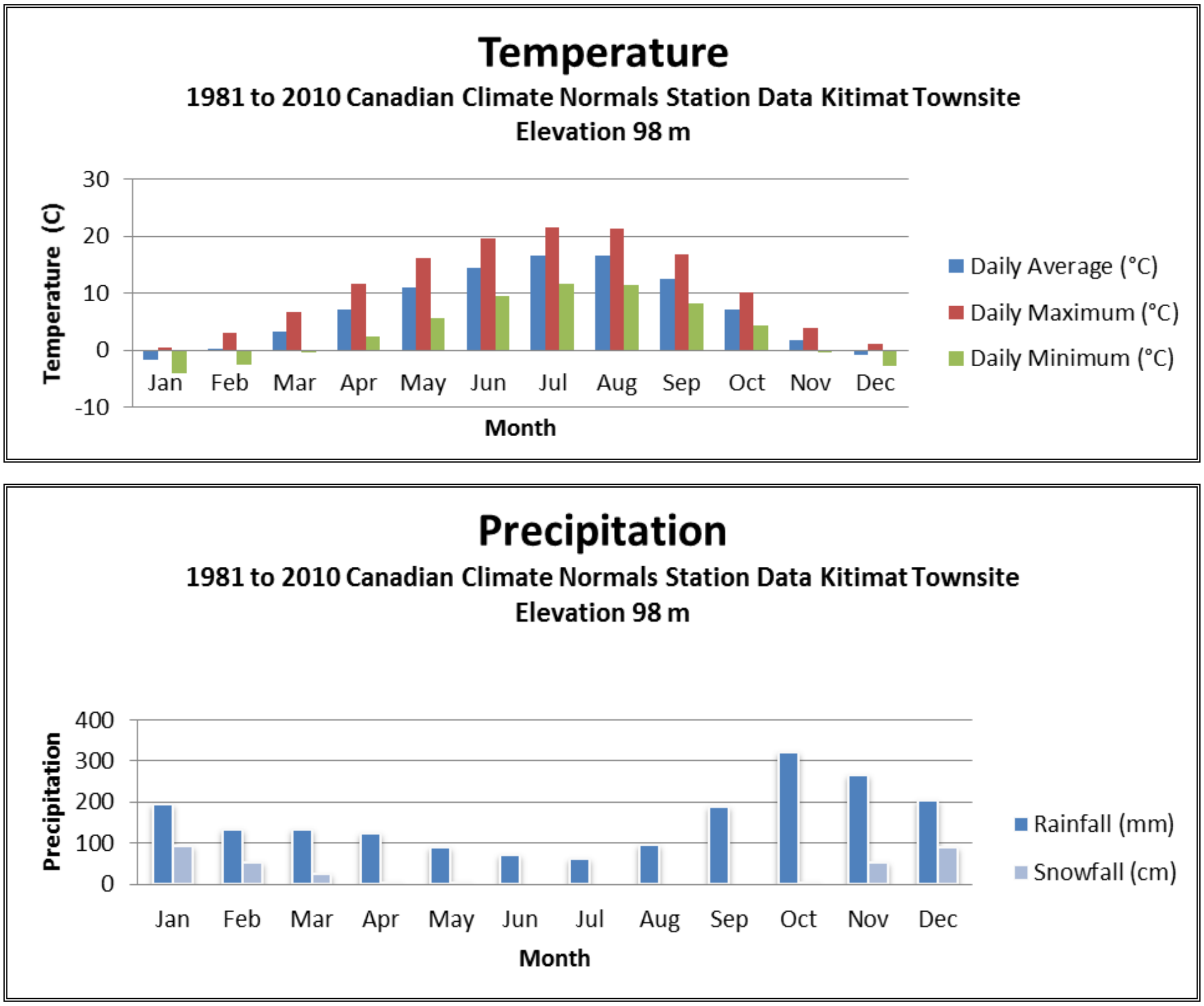


Figure 2.6-3: Kitimat Temperature and Precipitation Normals

2.6.4 Ecology

2.6.4.1 Ecoregion Classification System

The ecoregion classification system was adopted by BC Ministry of Environment (BC MOE) in 1985 and since then has been revised to reflect more detailed mapping (2011). There are 10 ecoprovinces in BC that define areas of similar climate, topography and geological history (Demarchi, 2011). The Project area is encompassed by a single ecoprovince—the Coast and Mountains.

Ecoprovinces are divided into ecoregions that are further divided into ecosections. There are two ecoregions: the Nass Ranges (NRA) covering the northern two-thirds and extending south to Nalbeelah Creek and Raley Creek and the Coastal Gap (COG), which overlaps with the southern third portion of the Project area from Dahl Creek and Little Wedeene River southwards towards MIN substation near Kitimat. The NRA is a transitional coastal-interior with windward slopes being rugged and characterized by a western redcedar and western hemlock forests and mountain hemlock at higher elevations. The COG is characterized by rounded, granitic and metamorphic mountains with steep rugged valley sides dominated by wet coastal forests. The Nass Mountain (NAM) ecosection occurs within the NRA ecoregion and the Kitimat Ranges (KIR) ecosection occurs within the COG ecoregion.

The NAM ecosection is a rugged, granitic mountain area lying north of the KIR ecosection. The Wedeene River drains into the Kitimat River. Lakelse Lake via Lakelse River drains into the Skeena River. Pacific air readily enters via the wide Skeena River Valley or overtop the Kitimat Ranges and then stalls, bringing heavy rain and cloud cover. Cold arctic air infrequently invades from the north but can bring extreme cold temperatures and deep snow events for short periods. The Kitimat River Valley bottom and lower to mid-slopes have wet western redcedar (*Thuja plicata*) and western hemlock (*Tsuga heterophylla*) forests.

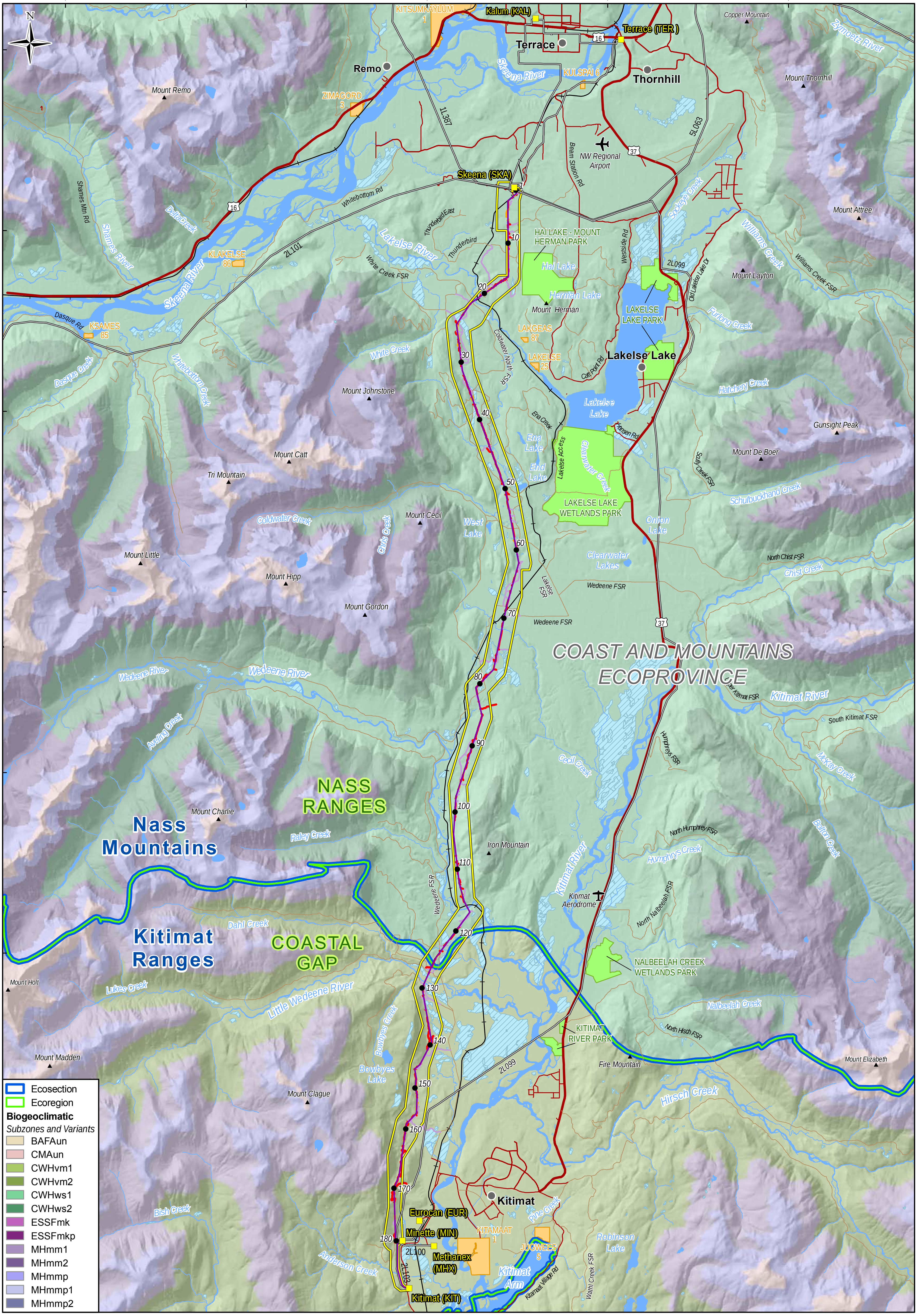
The KIR ecosection is an area of subdued, yet steep-sided mountains composed largely of eroded granitic rock that has resulted in bold, impressive, massive mountains. The lower Kitimat River Valley bottom and lower to mid-slopes have very wet western redcedar and western hemlock forests. There are numerous small sized lakes dotted across this portion of the ecosection. The lower Kitimat River and many shorter streams empty directly into the marine waters.

2.6.4.2 Biogeoclimatic Ecosystem Classification System

The Project area occurs primarily within the Coastal Western Hemlock (CWH) zone, which ranges in elevation from sea level to 1,000 masl. The CWH has a maritime climate with relatively mild temperatures and heavy rainfall. The growing season is the longest in the Prince Rupert Forest Region, but summers tend to be cool and cloudy. Winters are extremely wet and quite mild. Over most of the CWH, the soil does not freeze significantly during a normal winter (Banner et al., 1993). A small portion of the study area near Kitimat occurs in the Mountain Hemlock (MH) zone, which occurs at higher elevations and above the CWH zone. The Project area comprises five biogeoclimatic (BGC) variants:

1. Coastal Western Hemlock Wet Submaritime Submontane variant – CWHws1;
2. Coastal Western Hemlock Wet Submaritime Montane variant – CWHws2;
3. Coastal Western Hemlock Very Wet Maritime Submontane variant – CWHvm1;
4. Coastal Western Hemlock Very Wet Maritime Montane variant – CWHvm2; and
5. Mountain Hemlock Moist Maritime Windward variant – MHmm1.

A description of each variant is provided below and shown on **Figure 2.6-4**.



Y:\GIS\Projects\VE\VE52300\VE52379_BCH_TKT\Mapping\04_vegetation\05_permitting_loo\04-05-001_BGC_projDescr_v2.mxd
Last updated by willem.van-riet

Legend

- Populated Place
- Existing Substation
- Existing Transmission Line
- Highway
- Arterial
- Local Road
- Forest Service Road
- Railway
- Watercourse
- Waterbody
- Wetland
- Park
- First Nation Reserve

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
DataBC Data
Distribution Service
www.data.gov.bc.ca
Biogeoclimatic
Ecosystem Classification
www.for.gov.bc.ca/hre/becweb/resources/maps

CLIENT:
Prepared for BC Hydro

PROJECT:
Terrace to Kitimat
Transmission Project (TKTP)

TITLE:
Ecoregions and Biogeoclimatic Units

DATE:	ANALYST:	QA/QC:	
September, 2016	MY	WR	Figure 2.6-4

GIS FILE:
04-05-001_BGC_projDescr_v2

JOB No:
VE52379

COORDINATE SYSTEM:
NAD 1983 UTM Zone 9N

amec foster wheeler

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2.6.4.2.1 Coastal Western Hemlock Submaritime Submontane – CWHws1

The CWHws1 variant is found in valley bottoms and on hillsides up to approximately 600 m elevation mainly in the Kitimat Valley. It is characterized by warm, moist summers with significant dry spells; however, winters are the coldest and driest of all the CWH subzones (Banner et al., 1993). The overstory consists of western redcedar, amabilis fir (*Abies amabilis*), western hemlock and Sitka spruce (*Picea sitchensis*). Seral species include red alder (*Alnus rubra*), black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), lodgepole pine (*Pinus contorta*), paper birch (*Betula papyrifera*) and trembling aspen (*Populus tremuloides*). Alaskan blueberry (*Vaccinium alaskaense*), red huckleberry (*Vaccinium parvifolium*), queen's cup (*Clintonia uniflora*) and rattlesnake-plantain (*Goodyera oblongifolia*) are common in the understory. A moss layer includes red-stemmed feathermoss (*Pleurozium schreberi*), step moss (*Hylocomnium splendens*), electrified cat's tail moss (*Rhytidiadelphus triquestrus*) and lanky moss (*Rhytidiadelphus loreus)*.

2.6.4.2.2 Coastal Western Hemlock Submaritime Montane – CWHws2

The CWHws2 variant occurs on mid-mountain slopes above the CWHws1 and above 600 masl. The CWHws2 has a shorter, cooler, wetter growing season, more snow, lower ecosystem productivity and less biological diversity (Banner et al., 1993). In the CWHws2, western redcedar and red alder are absent or scarce and there is more amabilis fir, subalpine fir, mountain hemlock and Sitka alder than in the CWHws1. An abundance of small twisted stalk (*Streptopus streptopoides*) and scarcity of red huckleberry are two other distinguishing features of the CWHws2. Typical ecosystems representing this variant are dominated by western hemlock and amabilis fir forests. The understory is typically poorly developed but may consist of amabilis fir regeneration, blueberries (*Vaccinium spp.*), bunchberry (*Cornus Canadensis*) and five-leaved bramble (*Rubus pedatus*). The moss layer is continuous and includes pipecleaner moss (*Rhytidiopsis robusta*), step moss and lanky moss.

2.6.4.2.3 Coastal Western Hemlock Very Wet Maritime Submontane – CWHvm1

The CWHvm1 variant occupies the western slopes of the Coast Mountains and Kitimat Ranges from sea level to 400 masl. In the study area, the CWHvm1 occurs at similar elevations as the CWHws1 but lies further south toward the municipality of Kitimat. The CWHvm1 has a wet, humid, mild, oceanic climate with relatively little snow and a long growing season (Banner et al., 1993). Major tree species include western hemlock, amabilis fir, western redcedar and Sitka spruce, and minor tree species include yellow-cedar (*Chamaecyparis nootkatensis*) and mountain hemlock. Seral species are typically red alder (*Alnus rubra*) and black cottonwood. Salal (*Gaultheria shallon*), deer fern (*Blechnum spicant*), and sword fern (*Polystichum munitum*) are present. Step moss (*Hylocomnium splendens*) and lanky moss are the dominant moss cover on mesic sites, which are characterized by having a moderate supply of water and average moisture condition for the respective BGC variant.

2.6.4.2.4 Coastal Western Hemlock Very Wet Maritime Montane – CWHvm2

The CWHvm2 variant lies above the CWHvm1 between approximately 400 masl and 800 masl (Banner et al., 1993). Because it occurs at higher elevations, the CWHvm2 has a cooler and shorter growing season, a much heavier snowpack, lower ecosystem productivity and less biodiversity than the CWHvm1. Yellow cedar and mountain hemlock occur more frequently and pipecleaner moss and leafy mosses (*Mnium* spp.) replace the step moss as the dominant moss cover.

2.6.4.2.5 Mountain Hemlock Moist Maritime Windward variant – MHmm1

The windward variant MHmm1 lies above the CWHvm2 in the Project area above 800 masl. In general, the MH BGC zone can be distinguished from the CWH zone by the dominance of mountain hemlock (*Tsuga mertensiana*) in the canopy and the regeneration layer on many site positions. The presence of yellow cedar (*Chameocyparis nootkatensis*) on wet sites along with deer fern (*Blechnum spicant*) and deer cabbage (*Fauria crista-galli*) distinguish the MHmm1 from the CWHvm2 variant. Forest productivity and diversity are limited by the severe high elevation climate that results in heavy snow, short growing seasons, wind exposure and cold and wet soils. Mesic sites typically occur on steep colluvial slopes with forests composed of mountain hemlock and amabilis fir. The understory is represented by blueberries, five-leaved bramble and scattered mountain heather. The continuous moss layer includes pipecleaner moss, heron's bill (*Dicranum spp.*) and lanky moss.

2.7 Environmental Program

The following sections outline the environmental program and provide descriptions of the key steps to be taken as the Project moves through the phases.

2.7.1 Environmental Desktop Overview Assessment – Identification Phase

The objective of the Project's Identification Phase was to compile the results of a desktop study for background information on the Project area with field investigations and First Nations engagement to determine early in the planning process if there were any environmental issues that would constrain or prevent a transmission line from running the length of the general Project area. The results also informed the evaluation of alternatives and selection of the provisional route. This phase was completed by AMEC Environment & Infrastructure (AMEC) during the spring of 2014 (AMEC, 2014). The report includes information on the following disciplines:

- Geotechnical and Geohazards;
- Vegetation;
- Wildlife;
- Fisheries and Aquatic Resources;
- Land Use and Visual Resources;
- Noise;
- Electric and Magnetic Field Issues; and
- Archaeology and Historical Heritage.

2.7.2 Environmental and Socio-economic Effects Report (ESER) – Definition Phase

No exclusion criteria that would prevent the construction of the Project were identified in the desktop overview assessment. Accordingly, the Project proceeded to the ESER stage.

Development of the ESER included field-based information gathering and baseline surveys, assessment of the potential environmental effects of the Project (provisional route), identification of avoidance/mitigation measures, discussion of the possibility of residual effects for each of the disciplines mentioned above and characterization of these residual effects. The information collected from background data (AMEC, 2014) was used to inform the fieldwork and support the assessment of all options. Details of the assessment for each discipline are provided in later sections of this report.

2.7.3 Construction Environmental Management Plan – Implementation Phase (i.e. Clearing/Construction Phase)

BC Hydro's standard procedure is to commence preparation a construction environmental management plan (CEMP) during detailed design of the Project. The CEMP will be finalized prior to commencement of the construction/clearing phase. In addition, contractors will be required to write site-specific environmental protection plans (EPPs) prior to commencing work. The CEMP will detail the permitting requirements, proposed mitigation measures and best management practices (BMPs) to be implemented during Project construction. The CEMP will also incorporate First Nations feedback, as appropriate, from ongoing discussions and consultation. The purpose of the CEMP will be to:

- Describe environmental considerations and potential effects of construction;
- Provide measures to effectively avoid or minimize environmental effects during construction;
- Provide measures to effectively avoid or minimize areas of concern to First Nations, e.g. archaeological sites, traditionally used areas for harvesting plants and fishing areas;
- Address conditions required in regulatory approvals/permits, relevant legislation and regulations; and
- Identify and define roles and responsibilities for environmental management for the Project so they are clearly understood.

The CEMP will provide:

- An overarching prescription for completing on-site work in an environmentally sound way (to be supplemented by EPPs as appropriate);
- A mechanism for incorporating environmental considerations and permit conditions into contract documents; and
- A framework for discussion of environmental issues at Project tender briefings with the contractor.

The details of the CEMP will depend on all of the following:

- The scale and complexity of the Project;
- Environmental issues, proposed mitigation measures and approvals identified in the Project planning phase and regulatory process;

- Any additional environmental and socio-economic issues identified following Project planning; and
- Issues raised by the First Nations, local communities, regulatory authorities and key stakeholders in ongoing engagement activities.

Generally, the BC Hydro Project Manager, or delegate (e.g. BC Hydro Environmental Manager), BC Hydro Construction Manager and the contractor will be responsible for ensuring that the CEMP has been reviewed and understood by all personnel involved with the Project. The construction contractor will be issued a copy of the CEMP; the construction contractor will then be asked to read the CEMP, whether he/she understands the content and to confirm that he/she understands his/her roles and responsibilities in environmental protection to the designated Environmental Monitor. The construction contractor will then be responsible for preparing and implementing site-specific EPPs, which will detail how the CEMP will be implemented.

Prior to the commencement of any clearing/construction activities, the contractor will hold an environmental orientation for all staff. During clearing/construction, tailgate/tailboard meetings will be held regularly so that environmental issues can be discussed (among other issues) with the BC Hydro Field Construction Manager, Environmental Monitor and the construction crew to ensure that environmental risks have been identified and adequately addressed. The Environmental Monitor will review the contents of the CEMP and EPPs with the crew during the tailgate meetings, perform a site walk-through, and work with staff to implement appropriate mitigation measures throughout the Project clearing, construction and initial operations.

The CEMP and EPPs will address, at a minimum, the following issues:

- Environmental Protection Measures:
    - Ecological and environmental protection practices;
    - Fisheries and water quality;
    - Vegetation clearing and management;
    - Soil disturbance, erosion prevention and sediment control;
    - Wildlife;
    - Vehicles and equipment – fuelling and servicing; and
    - Fugitive dust control.
- Construction and Operation Procedures:
    - Water management plans; and
    - Water quality monitoring.
- Waste Management:
    - Garbage and general waste;
    - Construction and operation-related wastes;
    - Sanitary wastes;
    - Equipment-related wastes; and
    - Hazardous wastes.

- Environmental Spill Response Procedures and Equipment:
  - Spill contingency plan;
  - Spill response plan and contact list; and
  - Environmental incident reporting.
- Sediment and Erosion Control Measures:
  - Upland storm water management;
  - Site preparation;
  - Construction;
  - Watercourse and riparian corridor protection; and
  - Riparian corridor maintenance.

2.7.4 Operation/Maintenance Phase

During the Operations and Maintenance Phase, BC Hydro will manage this new transmission line as part of its province-wide maintenance and sustainment program. The program seeks to standardize maintenance so that it can be effectively carried out in a systematic and efficient way across the entire transmission system. For the purposes of environmental management during this phase of the project, the following key elements apply:

- Routine inspections to assess line condition, identify defective equipment, and monitor vegetation growth on the ROW.
- Implementation of the Integrated Vegetation Management Program (IVMP, BC Hydro, 2016).
- Standardized screening for maintenance work that has the potential of causing ground disturbance (Transmission Environmental Checklist).
- Tracking of environmentally sensitive sites and specific site prescriptions in BCH's enterprise GIS, and the referencing of this data and information during work planning, including:
  - Archaeological sites
  - Machine-free zones for sensitive areas
  - Riparian Vegetation Management Areas and Stream Inventory
  - Key access information, including access barriers and routes not to be used for maintenance and operations.
- Training programs for BCH staff for environmental awareness and procedures.
- BC Hydro's Protocol Agreement for Working in and Around Water with DFO and MOE.
- The Approved Work Practices published under the Protocol Agreement (e.g. AWPRV (BC Hydro 2003a and AWPWC (BC Hydro, 2014)).
- The application of Standard Operating Procedures that include aspects of routine environmental protection, including application of these SOPs to contractors.

- The points at which EMPs are prepared for maintenance activities (e.g. as laid out in the AWPWC).
- Internal environmental audits (part of BCH's Environmental Management System), identifying any corrective actions or process improvements for BCH's work programs.

2.7.5 Restoration and Closure Plan – Closure (Decommissioning) Phase

A Restoration and Closure Plan (RCP) will be finalized prior to the closure phase of the Project. The RCP will provide guidance and strategies to meet specific objectives. The objectives of the RCP may be to establish self-sustaining, native ecological communities that support identified land uses or vegetation VCs where required and practicable and identify First Nations botanical resources that may be used for planting material. It will be developed with guidance from regulators and in consultation with First Nations and relevant stakeholders.

2.8 Regulatory/Permitting Requirements

Table 2.8-1 presents a schedule of anticipated regulatory/permitting requirements for clearing/construction and/or operation/maintenance of the Project. BC Hydro will ensure that all required permits and approvals are secured and that all work meets statutory, regulatory and safety standards. As noted in the introduction, the Project does not require an environmental assessment under the BC *EAA* or the *CEA Act 2012.* This ESER will be used to support BC Hydro's application for a LOO, to provide information to aid in the consultation process with First Nations and to keep stakeholders and BC Hydro's customers informed.

Table 2.8-1: Anticipated Regulatory/Permitting Schedule

Approximate Date	Permit/Authorization/Notification (Ministry/Department)	Description/Notes
March 2016	Amendment to Temporary Use Permit (Ministry of Forests, Lands and Natural Resource Operations (FLNRO).	For input to final design and preparation for construction; to include completion of the centre line survey including building of helipads for access by helicopter in areas where there is no road access and to include forestry engineering activities related to the transmission line Right of Way (ROW) clearing boundary and access road layout and mapping.
	Roadway License Application (FLNRO).	For completion of bridge work on an existing unclassified road located within the TUP area, required in advance of construction.
	BC *Water Sustainability Act* Section 11 Notification (FLNRO).	May be required for work in or about a stream, for centre line survey works and/or preparatory bridge upgrade work planned for 2016.
April 2016	Supporting documentation for License of Occupation (LOO) application to be made available by BC Hydro to FLNRO and project review committee.	Includes environmental and socio-economic effects report (which will be shared in advance (February 2016) with First Nations who will have a chance to provide input prior to finalization); and LOO management plan covering project construction.
June – July 2016	Application for Licence of Occupation (LOO) and Statutory Right of Way (FLNRO) – Transmission Line ROW.	For Project work associated with construction of the transmission corridor starting early 2017, and Statutory Right of Way for long term occupation of the transmission corridor to be defined by legal survey at end of construction.
	Application for LOO (FLNRO) Roadway License.	For Project construction use of existing unclassified roads including required road upgrade work and for new roads outside of the transmission line ROW.
	Heritage Inspection and/or Alteration permit (if required) (FLNRO, Archaeology Branch).	Heritage inspection permit required to conduct additional archaeological assessment/inspection work, if required for specific areas during project construction; alteration permit may be required if any heritage/archaeological resources or sites are identified during inspections or Project-related work.
	Fisheries Act letter of advice (Department of Fisheries and Oceans (DFO)).	*Fisheries Act* notification or authorization may be required if project activities may affect fish or fish habitat that supports a commercial or Aboriginal fishery; to be determined in consultation with DFO.
July – August 2016	Additional permits/notifications as may be required (permitting TBD based on each individual crossing).	Additional permits/authorizations may be required based on detailed Project design; may include *Environmental Management Act* authorization for discharge of air emissions (if air curtain burners need to be used); *Transportation Act* industrial access permit; Timber marks; and/or Road Use Permits for Forest Service Roads.
Q4 2016	Occupant License(s) to Cut (OLTC).	More than one OLTC may be required; intent is to have concurrent (bunched) applications.
Q1 2017	Additional *Water Sustainability Act* section 11 notifications as required, and/or other required change approvals for construction.	Additional notifications expected for water crossings during construction.

Notes: **1.** Listed dates are approximations based on current information; if the schedule changes significantly an updated table will be provided to FLNRO and the project review committee.
2. This table covers the main anticipated permits/approvals for the project; additional permits, authorizations or approvals may be required and will be sought as appropriate, with notification to or consultation with First Nations as required.
3. While the Wildlife Act does not apply to BC Hydro, we are committed to avoiding or mitigating effects on wildlife wherever practicable, and an effects assessment will be provided in the environmental and socio-economic effects report. In certain instances, we may choose to apply for a Wildlife Salvage Permit “without prejudice” as we observe the same best practices as are normally required by such permits (e.g. relocation of amphibians prior to construction). If so, any such applications would be expected during summer 2016.
4. Re-zoning application for District of Kitimat lands is not included, as this will fall outside FLNRO and the project review committee process.

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3 METHODS

3.1 Traditional Use Studies

Traditional Use Studies (TUS) were received from Metlaktala, Kitselas and Haisla First Nations. Metlakatla and Kitselas First Nations prepared project specific TUS while Haisla First Nation provided two TUS prepared for different linear projects, namely The Pacific Northern Gas and Enbridge Pipeline Corridor. The TUS documents are:

- Kitselas First Nation Lakelse – Kitimat Valley Region TUOS: Final Report (Inglis, 2016);
- Metlakatla First Nation Traditional Use Study of BC Hydro's Proposed Terrace to Kitimate Transmission Line Project, Terrace, BC. (Kleanza, 2016);
- The Pacific Northern Gas Proposed Looping Pipeline Project within Haisla Traditional Territory (Powell, 2013); and
- Haisla Traditional Use and Occupancy of the Proposed Enbridge Pipeline Corridor from Beese through the lower Kitimat River Valley (Powell, date?).

The TUS documents were not available during the ESER preparation but were received when the ESER was being updated following the initial review from the above mentioned First Nations. Ideally, TUS information would be incorporated at the beginning of the assessment process because it feeds into the issues scoping and valued component selection process. Since the documents were not available at that time, the information presented in the TUS documents was reviewed to determine if the topics identified by the First Nations in their TUS had covered by the ESER. A separate addendum has been prepared summarizing this review. The scope of the traditional use addenda is to consider traditional use information and identify mitigation measures in relation to traditional use. Specifically, the availability of tradionally used resources, access to traditional use areas, and sensorial experience of traditional use will be considered in relation to the Project. Mitigation measures identified in the ESER that would also mitigate traditional use have also been identified.

3.2 Previous Terrace to Kitimat Transmission Line Studies

Information regarding the local ecological, socio-economic and archaeological components of the study area was reviewed. A literature review included several historical references prepared for BC Hydro in 1990 in support of a similar proposed Project.

The historical reports reviewed are:

1. Kitimat Substation to Skeena Substation 287 kV Transmission Line. Draft Preliminary Environmental Route Evaluation Report No. ER-90-06 (BC Hydro, 1990);
2. Land Use / Socio-Economic Component, Skeena–Kitimat 287 kV Transmission Line Environmental Studies (BC Hydro, 1990);
3. Kitimat–Skeena 287 kV Transmission Line Project Recreation and Visual Assessment (Durante and Partners, 1990);
4. BC Hydro Proposed 287 kV Transmission Line Kitimat to Terrace, Preliminary Environmental Assessment of Fish and Wildlife Values (Hazelwood, 1990);
5. Environmental Impact Report for Skeena–Kitimat 287 kV Transmission Line Forestry Studies (Hugh Hamilton Ltd., 1990);
6. Terrain Analysis: Geotechnical and Environmental Consideration for the Skeena–Kitimat Transmission Line (Maynard, 1990); and
7. Archaeological Overview Kitimat–Skeena 297 kV Transmission Line Project Report (Arcas, 1990).

3.3 Land and Resource Management Plan

A concordance table for General Resource Management Direction and Resource Management Zone Direction is provided in **Appendix A**. The concordance table links the Kalum LRMP and SRMP objectives with the relevant section of the ESER. The concordance table identifies which objectives are included in the assessment, rationale as to the inclusion or exclusion and the discipline to which it applies.

3.4 Assessment Methods

The analysis of potential Project effects was completed for each discipline (biophysical and socio-economic study topics), and the details are presented in subsequent sections by discipline. Each discipline-specific assessment incorporates the following steps:

- Describe existing conditions;
- Define spatial boundaries for the identification of potential Project effects;
- Define temporal boundaries for the identification of potential Project effects;
- Conduct issues scoping;
- Select valued components (VCs) based on existing conditions, study boundaries, issues scoping, and information provided by First Nations through ongoing consultation and engagement processes;
- Identify potential Project effects on each VC and propose measures to avoid or mitigate those effects; and
- Determine if residual effects may remain after implementation of avoidance/mitigation measures and, if so, characterize those residual effects.

3.4.1 Existing Conditions

The existing conditions were characterized to cover all relevant seasonal and temporal variations and clearly describe the existing pre-Project condition. Where information was limited or not available, specific field studies were undertaken to supplement existing data. This information enables the identification of potential Project-VC interactions and potential effects.

Existing information was assembled from a number of sources, including, but not limited to:

- Government policies and LRMPs applicable to the Project area;
- Published reports and studies relevant to each discipline and the Project area;
- Publicly available cultural, ecological or community knowledge relevant to each discipline, including data presented in previous environmental assessments of projects in the area; and
- Information relevant to each VC obtained by BC Hydro during consultation and engagement with First Nations, the public and other stakeholders.

3.4.2 Spatial Boundaries

Each VC was assessed based on a distinct discipline study area or zone of influence. Spatial study areas considers the physical extent of the Project, the extent of the potential direct and indirect effects, the movement of wider-ranging species and the extent of ecosystems, economic systems and social networks that are potentially affected by the Project. Beyond these boundaries, the Project was anticipated to have negligible potential effects.

The Project footprint is the smallest spatial boundary; it is the area where temporary and permanent clearing and construction associated with the Project will occur. It is also known as the transmission line row and access road clearing area.

The Local Study Area (LSA) is typically an area larger than the project footprint within which all or most potential Project effects are expected to occur. The LSA includes the engineering study area, a buffer around the engineering boundary, and a buffer around new and reconstruction roads. The size of the LSA is specific to each discipline and discussed in each section.

3.4.3 Temporal Boundaries

The assumptions for the temporal boundaries used for the assessment of the effects for each phase of the Project are as follows:

- The clearing/construction phase duration was assumed to total approximately three years, starting immediately on receipt of the required permits. The clearing/construction phase would consist of clearing for access roads, transmission line and associated facilities (i.e. crane pad areas); constructing access roads; and assembling and stringing the transmission line.
- The operation/maintenance phase is scheduled to extend for a long term (>40 years). Therefore, the duration of the phase is undefined but will extend to closure phase.

- The start and duration of the closure phase is unknown; however, a restoration and closure plan will be prepared prior to any de-construction or removal of works in accordance with all applicable regulations and guidelines at that time.
- The post-closure phase will begin immediately after completion of the closure phase based on discussions with regulators and consultation with First Nations.

3.4.4 Issues Scoping

Issues scoping is a process of compiling and analyzing available information to identify issues and concerns surrounding the specific Project development. Scoping enables areas of concern to be included within the assessment process, while focusing the assessment on those issues that are most relevant. Potential issues may be raised by First Nations, community members, government agencies, land users, special interest groups or technical leaders in various fields. The issues identified through issues scoping are used to inform the selection of VCs, determination of spatial boundaries and methodologies for the assessment.

Issues scoping included:

- Consultation with First Nations;
- Meetings and correspondence with the LRMP Planning Implementation Committee
- Public open houses conducted by BC Hydro in Terrace and Kitimat; and
- Reviewing publicly available information from other projects, particularly linear projects in the region (e.g. Pacific Trails Pipeline, Northwest Transmission Line).

3.4.5 Valued Component Selection

VCs provide the foundation for the assessment of potential effects. There are three steps in the selection of appropriate VCs.

Step 1 – Identify Candidate VCs:

- Is the component present in the Project area?
- Does the Project have the potential to interact with and adversely affect the component?
- Does a legally binding government requirement exist to protect the component?
- Does the component reflect a legislative or regulatory requirement or government management priority?
- Does the component pertain to First Nations interests, including asserted or established Aboriginal rights or treaty rights?
- Is the component itself of particular concern or value to First Nations, the public or government?
- Is the component particularly sensitive or vulnerable to disturbance?

Step 2 – Evaluate Candidate VCs:

- Can the potential effects of the Project on the VC be meaningfully measured and monitored? Is the candidate VC better represented by another VC?
- Can the potential effects on the candidate VC be effectively considered with the assessment of another VC?
- Is information about the candidate VC needed to support the assessment of potential effects on another VC?

Step 3 – Select VCs for this assessment:

- Selection of VCs should consider any relevant information provided in Project-specific consultation with First Nations and any feedback provided by stakeholders
- Each VC selected should be clearly defined and the rationale for selection or exclusion of each candidate VC should be clearly articulated.

3.4.6 Potential Effects

Potential Project effects are assessed qualitatively, semi-quantitatively, or quantitatively as appropriate to the VC. When describing effects, quantitative data are used wherever possible. Qualitative data are applied when available and reliable. When data are lacking, best professional judgement is used to determine the extent of the potential effects.

3.4.6.1 Project Activities

When identifying potential effects, the Project components and activities that could affect each VC for all four phases of the Project are considered. The activities are presented in **Table 3.3-1**.

Table 3.4-1: Project Activities

Project Phase	Project Component	Activities
Clearing/Construction	New Access Roads	Land clearing (cutting trees and removing vegetation) for new access roads
		Helicopter logging
		Skidding – ground logging
		Grubbing
		Cutting and Filling
		Blasting
		Ditching
		Grading
		Constructing new culverts
		Constructing new bridges
	Road Upgrades	Widening (may include blasting)
		Constructing new culverts or replacing existing culverts
		Constructing new bridges or replacing existing bridges
		Constructing EW ditches or widening existing ones
		Brushing
		Grading
	Ancillary Facilities	Preparing staging areas for equipment
		Constructing crane pads
		Installing surface infrastructure (e.g. trailers, temporary offices)
		Piling of wood waste
	Transmission Line and Structures	Land clearing (cutting trees and removing vegetation) – ROW
		Helicopter logging
		Skidding – ground logging
		Grubbing
		Blasting
		Foundation excavating

Project Phase	Project Component	Activities
		Dewatering of holes and excavation pits
		Foundation concrete pouring
		Assembling and installing structures
		Stringing the line
		Managing construction waste
		Servicing construction equipment
Operation/Maintenance	Access Roads	Maintaining permanent access roads
		Maintaining ditches
		Monitoring and controlling/maintaining vegetation and invasive plants
	Transmission Line and Structures	Site rehabilitation
		Erosion control maintenance
		Transmission line maintenance
		Monitoring and control/maintenance of vegetation and invasive plants along ROW
Closure	Access Roads	Removing aggregate and gravel
		Loosening up of compacted dirt
		Recontouring
		Revegetation (seeding and /or planting)
	Transmission Line and Structures	Disassembling of structures/equipment
		Construction of crane pads
		Removing foundations (if required)
		Loosening up of compacted soil
		Recountouring
		Revegetation (seeding and /or planting)
Post-Closure	Access Roads	Monitoring of restoration/revegetation results
	Transmission Line and Structures	Monitoring of restoration/revegetation results

3.4.6.2 Potential Effects

Given the Project components and activities (**Table 3.3-1**) above, the following overarching potential effects were identified for further evaluation as appropriate in each discipline section:

- Alteration of land cover: Project-related direct loss or alteration of vegetation, soils, ecosystems, wildlife habitat, stream crossings, land use and disturbance to archaeological or heritage sites or trails.
- Access Roads: Project-related increased human/predation access and increases in vehicle and helicopter traffic.
- Emissions: Project-related fugitive dust, greenhouse gas emissions, air quality changes and the potential for health and safety implications for workers and community residents.
- Sensory Disturbance: Project-related noise, vibration, visual quality changes and aesthetics of the Project from sensitive viewpoints and the potential effects on the quality of life in affected communities.
- Site Contamination: Project-related spills of fuel or other substances, herbicide use and changes to water quality.
- Economic Development: Project-related direct, indirect and induced employment and business opportunities and procurement of goods and services (i.e. increased opportunities for local suppliers/contractors).
- Community Development: Project-related changes to demographics, physical and social service infrastructure, recreation and tourism and to other land use activities.

3.4.7 Proposed Mitigation

Proposed mitigation measures are based on the approach described in the Environmental Mitigation Procedures (BC MOE, 2014c), which defines mitigation as any action taken to avoid, minimize, restore on-site, or offset the adverse effects of a project or activity. Mitigation is a hierarchical process where all feasible measures at one level are considered before moving to the next.

Following description of the potential effects for each VC, BMPs and/or additional mitigation measures are identified and described. Those effects, if any, remaining after the application of all described mitigation measures are considered as the residual effects of the Project. The assessment describes the technically and economically feasible (i.e. practicable) measures proposed to mitigate to an acceptable level potential adverse effects of the Project on selected VCs.

Standard mitigation, BMPs, EMPs, EPPs, contingency plans, emergency response plans and other general practices proposed to be implemented will be described. This description will clearly indicate what VCs and/or potential adverse effects are addressed by these measures.

Mitigation measures must be practicable and applicable to the proposed infrastructure and activities. The likelihood of mitigation success is considered for each VC. The probability of success is based on professional experience with similar mitigation measures applied elsewhere, scientific literature and professional judgement. If the success of mitigation is unknown, in that it has not been tried elsewhere in similar circumstances, it will be identified as such. The characterization of residual effects (if any) is based on the probability of mitigation success.

3.4.8 Residual Effects

Residual effects are characterized qualitatively, semi-quantitatively or quantitatively as appropriate to the VC. When describing residual effects, quantitative data are used whenever possible. Qualitative data are applied when available and reliable. When data are lacking, scientific literature, federal, provincial or local management objectives and professional judgement are used. The determination of a residual effect is based on the likelihood of an effect's occurrence after effective and feasible mitigation measures are implemented.

Residual Project effects that may remain after the application of effective and feasible mitigation are characterized for each applicable VC using the following criteria:

- Direction is defined as the degree to which an effect on a valued component will worsen or improve as the action proceeds (i.e. adverse, positive, neutral).
- Context refers to the ability of the VC to accept change. For example, the effect of a project may be greater if it occurs in areas that are ecologically sensitive with little resilience to imposed stresses.
- Magnitude refers to the severity of the effect. Magnitude is relative and is assigned based on professional judgement. Magnitude combines the overall effect of Project activities on the VC, combining the rating criteria measured against the threshold for the indicator. The threshold may be a numeric guideline (e.g. water quality criteria), or based on experience from similar projects, or professional judgement based on weight of evidence).
- Geographic Extent refers to the area over which the predicted effect is expected to occur. The geographic extent of effects can be site-specific, local or regional.
- Duration refers to the length of time the effect lasts and can be defined as short term or long term.
- Frequency refers to how often an effect is expected to occur and may be described as frequent or infrequent or may be quantified.
- Reversibility refers to the ability of the VC to return to its original state once the stressor is removed. Effects can be reversible, irreversible or partially reversible.

The manner in which these criteria are further defined and applied to VCs for each discipline is set out in **Table 3.3-2** and **Table 3.3-3**. Magnitude and geographic extent are more specific for each discipline. Those criteria are provided in **Table 3.3-4** and **Table 3.3-5**.

Key steps in the process include characterization of residual effects, and comparison against thresholds or land use objectives and trends.

A summary of the characterization of each residual effect is provided. Residual effects, if any, which may require further discussion with regulators and consultation with First Nations, are identified. Other mechanisms for dealing with those residual effects, such as through environmental management plans and/or monitoring plans are identified as appropriate.

Table 3.3-2 shows the criteria for environment disciplines (fish and aquatic resources, vegetation and wildlife).

Table 3.4-2: Environment Rating Criteria for Characterizing Residual Effects

Criteria	Rating Term	Definition
Direction	Positive	Beneficial change
	Neutral	No change
	Adverse	Non-beneficial change
Context	Low	VC has strong resilience to stress. The VC has not been affected by other projects, activities or natural changes. No listed species or ecosystems identified.
	Medium	VC has a moderate resilience to stress. The VC has been affected by other projects or activities or by natural changes but still has capacity to assimilate more changes. Presence of Blue-listed species or ecosystems.
	High	VC has a low resilience to stress. The VC has been severely affected by other projects or activities or by natural changes. Presence of Red-listed or *SARA*-listed species or ecosystems.
Duration	Short term	Effect lasts during construction only.
	Medium term	Effect lasts during construction and operation.
	Long term / permanent	Effect lasts beyond closure and/or is permanent.
Frequency	Once	Effect occurs once during construction, operation or closure.
	Intermittent	Effect occurs occasionally or periodically over the life of the Project.
	Continuous	Effect occurs continuously during any or all phases.
Reversibility	Reversible	Effect is reversed after the activity ceases.
	Partially Reversible	Effect is partially reversed after the activity ceases.
	Irreversible	Effect will not be reversed when the activity ceases.

Notes: VC = Valued Component; Red-listed = plant species and ecological communities that are Extirpated, Endangered or Threatened; Blue-listed = plant species and ecological communities that are of Special Concern; *SARA*-listed = Plant species at risk are listed federally under Schedule 1 of the *Specie at Risk Act* (*SARA)*
Magnitude is another criteria, and is described in **Table 3.3-4**.

Table 3.3-3 shows the criteria for social disciplines (socio-economic, non-traditional land use, and archaeology and historical heritage) that will also consider direction as a criterion for the characterization of residual effects. Direction could be positive, neutral or adverse.

Table 3.4-3: Social, Economic and Non-Traditional Land Use Rating Criteria for Characterizing Residual Effects

Criteria	Rating Term	Definition
Direction	Positive	Beneficial change
	Neutral	No change
	Adverse	Non-beneficial change
Context	Low	VC has strong resilience to stress
	Medium	VC has a moderate resilience to stress
	High	VC has a low resilience to stress
Duration	Short term	Effect lasts during construction only
	Medium term	Effect extends throughout operations and maintenance
	Long term / permanent	Effect lasts beyond closure and/or is permanent
Frequency	Once	Effect occurs once during any phase of the Project
	Intermittent	Effect occurs occasionally or periodically over the life of the Project
	Continuous	Effect occurs continuously during any or all phases
Reversibility	Reversible	Effect is reversible within part of a whole generation after the effect ceases (VC- and effect-dependent)
	Partially Reversible	Effect is partially reversed after the activity ceases
	Irreversible	Effect is not reversible over the timescales listed

Table 3.4-4: Criteria Rating for Magnitude for Characterizing Residual Effects

Magnitude	Wildlife	Vegetation	Fish and Fish Habitat	Visual Resources	Non-Traditional Land Use	Social & Economic	Archaeology	Contaminants
Negligible	No detectable change from existing condition.	No detectable change from existing condition.	No detectable change from existing condition.	Change cannot be captured by the human eye	0%–1% change from existing conditions not causing a noticeable change in land use	No detectable change from existing conditions	No detectable change from existing condition	Little or no portion of the site affected
Low	A measurable change but within the range of natural variation	A measurable change but within natural variation. <10% reduction in area from existing condition.	Differs from mean existing value, but is within range of natural variation, and below guideline or threshold	Visible but distant views from the background zone. Effects limited to color and contrast.	1%–10% change from existing condition slightly affecting land use	Effect that occurs might or might not be detectable but is within the normal range of variability	A measurable change (<10% of site area or site features), within the range of natural disturbance to sites	A small portion (<20%) of the site is contaminated
Medium	A measurable change outside the range of natural variation but less than high	10%–20% reduction in area from existing condition.	Differs from mean existing value; approaches limits of natural variation but is below or equal to guideline or threshold	Closer views from the middleground and foreground zones. Individual project components becomes apparent.	10%–20% change from existing condition notably affecting land use	Effect is unlikely to pose a serious risk or benefit to the VC or to represent a management challenge	A measurable change outside the range of natural disturbance but a substantial area (>50% of site area or site features) remains intact	A significant portion (>20%) of the site is contaminated
High	Differs substantially from existing conditions or beyond a guideline or threshold value. i.e. >20% change of density, abundance or distribution for listed species and >30% change of density, abundance or distribution for all other species	Differs substantially from existing condition i.e. >20% reduction in area from existing condition.	Differs substantially from existing condition; is outside range of natural variation and beyond guideline or threshold	Proximate and distinctly visible. Project components evident in the viewshed.	>20% change from existing condition severely affecting or totally impeding land use	Effect is likely to pose a serious risk or benefit to the selected VC; if adverse, represents a management challenge	Substantial reduction from existing condition; <10% of site area or site features) remains intact	The entire project area is affected

Notes: VC = Valued Component; % = percent; <= less than; > = greater than.

Table 3.4-5: Criteria Rating for Geographic Extent for Characterizing Residual Effects

Rating Criteria	Wildlife	Vegetation	Fish and Fish Habitat	Visual Resources	Non-Traditional Land Use	Social & Economic	Archaeology	Contaminants
Site-specific	Effect is closely linked to the footprint but does not extend far outside of it); many wildlife effects that extend into the LSA are referred to as local.	Effect is confined to project footprint i.e. transmission or access road ROW.	Effects confined to the Project site.	Effects confined to the viewshed surrounding an observation point	Effects occurs within 100 m^2	Not applicable	The effect is confined to the project site	The effect is confined to the project site
Local	Effect is prevalent in the LSA; landscape effects are prevalent when the LSA tends to match with watersheds or larger units.	Effect is confined to the LSA.	Effects confined to the LSA: Local population; linear scale <100 km.	Observation point with view of the Project located in the foreground distance zone	Effect occurs within LSA	Effect is confined to the LSA	Effects on a site or sites (restricted to areas of direct physical disturbance within the LSA)	Effects on a site or sites (restricted to areas of direct physical disturbance within the LSA)
Regional	Effect is prevalent into the regional area (e.g. population effects on animals with ranges beyond the LSA).	Effect occurs into the regional area.	Effects confined to the regional area, affecting multiple populations or species	Observation point with view to the Project located in the middle ground and background distance zones	Effect extends beyond the land use tenures and dispositions	Effect extends beyond the LSA	Not applicable	Not applicable

Notes: LSA = Local Study Area; m^2 = square metre; ROW = right-of-way; < = less than.

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4 FISH AND AQUATIC RESOURCES

The provisional transmission line route and associated access roads cross numerous watercourses and waterbodies, including rivers, streams, and wetlands. Clearing/construction, operation/maintenance or closure activities at these watercourse crossings for either the transmission line route or access roads could potentially affect fish and aquatic resources. Potential effects on fish and aquatic resources can include changes in sediment, contaminants and nutrient concentrations; changes in water temperature, food supply and habitat quality; and potentially, the direct mortality of fish.

There are BMPs to avoid or minimize harm to fish, fish habitat and aquatic resources. These BMPs include those developed by BC MOE, Fisheries and Oceans Canada (DFO) and BC Hydro specifically for transmission line clearing/construction, operation/maintenance and closure (**Section 4.6.2.6**).

This section of the ESER discusses potential effects of different components and activities required for clearing/construction, operation/maintenance and closure of TKTP on fish, fish habitat and aquatic resources. It describes mitigation measures proposed to avoid or minimize effects on fish, fish habitat and aquatic resources and their likely effectiveness. It concludes with a characterization of any remaining residual effects after mitigation.

4.1 Introduction

The objectives of the fish and aquatic resource assessment were to:

- Identify areas where sensitive fish habitat and/or species may exist in the study area based on a desktop review and site reconnaissance field survey;
- Provide an overview of fish presence and fish habitat quality at each of the provisional transmission line and access road stream crossings;
- Provide descriptions of the existing riparian vegetation quality and function for the transmission line and access road stream crossings;
- Determine the fish-bearing status of watercourses and/or waterbodies that will require new or upgraded access road crossings;
- Assess the potential effects of the transmission line route and access roads on fish, fish habitat and other aquatic resources;
- Provide recommendations to mitigate potential adverse effects of the Project on fish and fish habitat and other aquatic resources; and
- Determine if any residual effects may remain after mitigation as a result of the Project.

4.2 Regulatory Setting

Protection of fish and fish habitat in Canada is regulated by the federal government under the *Fisheries Act* and administered by DFO. The federal government also takes responsibility for management of anadromous fish species. Management responsibilities for freshwater fish and their habitat in streams and lakes are shared with the Government of BC.

Amendments to the *Fisheries Act* came into force in November 2013. These amendments effectively shift the *Act* from the protection of fish habitat to the protection of commercial, recreational and Aboriginal fisheries. Section 35(1) of the *Fisheries Act* now prohibits "serious harm to fish that are part of a commercial, recreational, or Aboriginal fishery, or to fish that support such a fishery." "Serious harm" is defined as "the death of fish or any permanent alteration to, or destruction of, fish habitat."

Key sections of the *Fisheries Act* relevant to the Project include:

- Section 32, which prohibits destroying fish by any means other than fishing;
- Section 35(1), which prohibits any work, undertaking, or activity that results in serious harm to fish (i.e. death of fish or permanent alteration or destruction of fish habitat) other than if authorized under section 35(2);
- Section 36(3), which prohibits the deposition of deleterious substances of any type into water frequented by fish; and
- Section 37(1), which details the information required to determine whether a permanent alteration or destruction of fish habitat or the deposition of deleterious substances into water frequented by fish will occur and if measures can be implemented to prevent these from occurring or to mitigate their effects.

New policy and regulations were developed by DFO to support the changes to the *Fisheries Act*. The Fisheries Protection Policy released in November 2013 intended to ensure consistency with the federal government's shift in focus to the protection of commercial, recreational and Aboriginal fisheries (DFO, 2013a).

In addition to the *Fisheries Act*, species designated as Endangered, Threatened or Special Concern are regulated by the federal *Species at Risk Act (SARA)*. This legislation is designed to prevent the extinction of species that are Threatened or Endangered due to human activities and to prevent species of Special Concern from becoming Threatened or Endangered. Species listed on Schedule 1 of *SARA* are legally protected by the *Act*. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recommends species for inclusion in Schedule 1, but the federal government makes the final decision about additions.

The Province of British Columbia has also enacted legislation and various regulations to protect aquatic resources upon which fish depend. The principal provincial legislation regulating work in and around BC waters is the *Water Sustainability Act (2014)*. Under the *Water Sustainability Act*, “changes in and about a stream,” means:

- Any modification to the nature of the stream, including any modification to the land, vegetation, natural environment or flow of water within the stream; or
- Any activity or construction within the stream channel that has or may have an impact on a stream or a stream channel.

Work in or near streams may require either an approval or a notification under Section 11 of the *Water Sustainability Act*. An approval is a written authorization for changes in and about a stream for complex projects, such as the diversion of flows. For works that do not involve any diversion of water, that may be completed within a short period of time and that will have minimal effect on the environment or third parties, a notification is typically sufficient. Many of the works likely associated with the Project would fall under the notification category.

4.3 Issues Scoping

Issues scoping for fish and aquatic resources was completed by reviewing the following sources of information:

- Provincial and federal legislation and regulations that may apply;
- Kalum LRMP (Government of BC, 2002);
- Kalum SRMP (Government of BC, 2006);
- Values and concerns of community working groups obtained from meetings and conference calls between February 2014 and October 2015;
- First Nations values, concerns and feedback obtained from meetings and conference calls between February 2014 and July 2015;
- BC Conservation Data Centre (BC CDC) for fish species of conservation concern in the Project area;
- Initial desktop review (AMEC, 2014); and
- Previous BC Hydro transmission line projects, including the BC Hydro proposed 287 kV transmission line from Kitimat to Terrace (Hazelwood, 1990).

Common issues identified from the above sources include:

- Potential destruction or alteration of fish habitat during construction of watercourse crossings for either the transmission line or access roads;
- Potential surface water quality changes from sedimentation or contaminants;
- Riparian vegetation clearing potentially leading to changes in fish habitat;
- Potential blockage of fish passage due to the construction of access roads;
- Potential effects on fish species of conservation concern; and
- Increased recreational access to aquatic resources.

These issues are discussed in the effects assessment below.

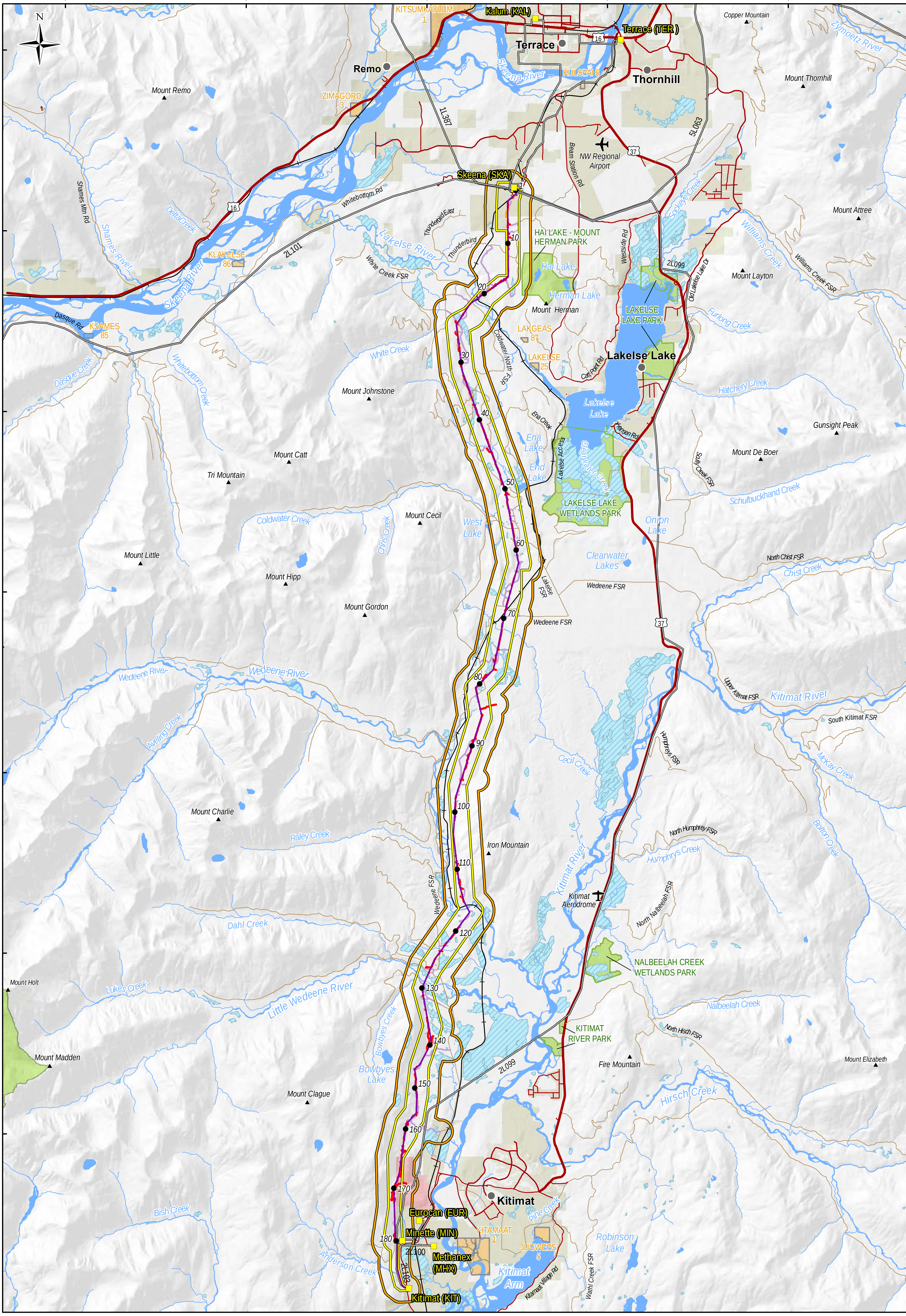
4.4 Spatial Boundaries

All watercourses that run parallel to or are crossed by the provisional transmission line route are part of the Alwyn Creek Watershed, Lakelse River watershed, the Kitimat River watershed or the Anderson Creek Watershed. The Lakelse River and Alwyn Creek flow into the Skeena River. The Kitimat River and Anderson Creek flow directly to the Pacific Ocean. The majority of the provisional transmission line route is within the Lakelse River Watershed and the Kitimat River Watershed. Both of these watersheds provide habitat to various sportfish species: Coho salmon spawn in tributary streams in both watersheds, while coastal cutthroat trout and rainbow trout are resident and, like coho salmon, are widespread throughout both watersheds. Descriptions of these watersheds are available in the desktop overview (AMEC, 2014). All potential effects to fish and fish habitat would occur within these two watersheds.

Spatial boundaries for the fish and aquatic resource effects report include the LSA in which all or most of the potential Project effects are expected to occur. The LSA is 500 m from the engineering boundary and encompasses the transmission line from its northern terminus at the SKA substation to its southern terminus at the KIT substation (**Figure 4.4-1**). Within this LSA, the transmission line route crosses the following named tributaries from north to south:

- Lakelse River;
- Coldwater Creek;
- Cecil Creek;
- Wedeene River;
- Little Wedeene River; and
- Anderson Creek.
-

For access roads located outside the transmission line LSA, the spatial boundaries encompass an area approximately 500 m on either side of the measured centre line of all access roads required for construction and maintenance of the transmission line (**Figure 4.4-1**).



Legend

- Populated Place
- Existing Substation
- Existing Transmission Line
- Highway
- Arterial
- Local Road
- Forest Service Road
- Railway
- Watercourse
- Waterbody
- Wetland
- Park
- First Nation Reserve
- Private Parcel
- Sandhill Private Parcel

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary
- Fisheries / Vegetation/ Non-Traditional Land Use Local Study Area

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
DataBC Data
Distribution Service
Open Government License
(http://www.data.gov.bc.ca/)

CLIENT: Prepared for BC Hydro		PROJECT: Terrace to Kitimat Transmission Project (TKTP)		
TITLE: Fish and Aquatic Resources, Vegetation and Non-Traditional Land Use Local Study Area		DATE: September, 2016	ANALYST: MY	QA/QC: RS
		Figure 4.4-1		
		GIS FILE: 08-03-015_project_study_area_v4		
		JOB No: VE52379		
		COORDINATE SYSTEM: NAD 1983 UTM Zone 9N		

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4.5 Fish and Aquatic Studies

4.5.1 Methods

4.5.1.1 Desktop Overview

A desktop environmental overview was conducted to gather information on fish, fish habitat and aquatic resources in the Local Study Area (AMEC, 2014). This review was completed to identify sensitive habitats and fish species presence and to identify any existing or potential issues affecting these habitats and fish species. Based on this overview (AMEC, 2014), potential issues for fish and aquatic resources from clearing/construction, operation/maintenance, closure and post-closure of the Project were found to include potential effects on river crossings, riparian clearing and species of conservation concern. Each of these issues was given moderate risk rating. Further details about information sources reviewed and the results of the desktop overview are available in AMEC (2014).

4.5.1.2 Field Surveys

Field surveys were conducted to confirm results of the desktop overview. Field surveys were carried out in the LSA for the transmission line and access roads between June 15 and June 29, 2015, May 9 and May 14, 2016 and June 27 and July 7, 2016. This report describes the sites assessed based on the October 2015 transmission route alignment and the December 2015 access road alignment. In total, 60 transmission line sites and 116 access road sites were visited and assessed based on these alignments (**Figure 4.4-1**, **Appendix B.1**).

4.5.1.2.1 Transmission Line Watercourse Crossings

Prior to the field surveys, streams to be assessed were identified using 1:20,000 Terrain Resources Inventory Mapping (TRIM). Geographic Information System (GIS) mapping software was employed to assign sample site numbers to locations where the provisional transmission line route crossed a mapped stream. Each site was given a unique number for identification and was targeted for survey.

In 2016, LiDAR streams were added to the FWA atlas streams previously assessed in 2015. LiDAR streams were derived from the 2013 LiDAR acquired for the project. The derivation process considered features such as slope, depressions, gullying and channels to predict were streams were likely to occur. In collaboration with the layout team, the LiDAR streams were ground truthed and classified by forestry personnel in keeping with the Fish Stream Identification Guidebook. If stream classification was not straightforward, then these sites were selected for additional field surveys by a qualified professional. Amec Foster Wheeler aquatic biologists completed the assessment in 2016 to classify these sites.

All sites that could be accessed along roadways, existing BC Hydro ROWs or Crown land were assessed at, or as close as possible to, the provisional transmission line route. Sites were accessed by 4x4 truck, by all-terrain vehicle (ATV), by foot or by a combination of all three.

Field surveys followed the methods outlined in Reconnaissance (1:20,000) Fish and Fish Habitat Inventory Standards and Procedures (Resources Inventory Standards Committee (RISC), 2001c).

This method collects habitat information from discrete stream segments by measuring a suite of data over sites approximately 100 m long. It is particularly useful for describing the stream's morphology, flow pattern, stream bed and bank characteristics, instream and overhead cover, and habitat availability and quality, and by documenting any past disturbances. Information included:

- Stream name;
- Site number, UTM and length;
- Site access method;
- Date, time, agency (organization) who conducted the survey, and crew initials;
- Channel measurements (i.e. bankfull width and wetted width in metres);
- Percent gradient;
- Stage or amount of water passing through the channel (e.g. low, medium and high);
- Total cover defined as any structure in the wetted channel or within 1 m above the water surface that provides hiding, resting or feeding places for fish and rated as none (no cover exists), trace (cover exists over <5% of the site), moderate (cover exists over 5-20% of the site, abundant (cover exists over more than 20% of the site).
- Stream cover amount (none, trace, sub-dominant and dominant) of overhanging vegetation, large woody debris, small woody debris, boulders, undercut banks and instream vegetation;
- Percent crown closure;
- Bank characteristics (left bank and right bank shape, texture, riparian vegetation stage);
- Flood signs;
- Channel morphology (riffle-pool, cascade-pool, step-pool and large channel);
- Dominant and sub-dominant bed material (fines, gravel, cobble, boulder and bedrock);
- Disturbance indicators that result in changes in sediment supply or discharge;
- Channel pattern (e.g. straight, sinuous, irregular wandering, irregular meandering, etc.);
- Presence of islands or bars;
- Coupling, which is the potential of sediment on the hill slopes to enter a stream channel;
- Confinement, which is the ability of the channel to migrate laterally between slopes; and
- Site features that may affect fish or fish habitat (e.g. bridge, waterfalls and fishways).

Habitat quality for salmonids was rated at watercourse crossings along the transmission route. The Reconnaissance 1:20,000 method produces overall ratings of none, poor, fair, good, and excellent for fish habitat quality and habitat suitability for each life history (i.e. spawning, rearing, over-wintering, and migration) of salmonid fish species. The habitat suitability ratings are defined in **Table 4.5-1**. These ratings were based on habitat variables measured during the

Reconnaissance 1:20,000 survey. Specifically, the following were considered when assigning habitat quality ratings:

- The available habitat at each site as documented by the field assessment;
- Watershed characteristics, including distances and connectivity to receiving fish-bearing waters and level of anthropogenic disturbances;
- Water quality parameters measured at the site, including temperature, pH and conductivity; and
- Fish assemblages documented as present historically or captured during sampling.

Table 4.5-1: Summary of Habitat Quality Ratings and Descriptions

Habitat Quality Rating	Description
Excellent	Available habitat is considered to be high quality for the life stage of the species under consideration. There are no limitations to productive capacity identified for the life stage of the species under consideration.
Good	Available habitat has slight limitations for life stage of species under consideration.
Moderate	There is available habitat for the life stage of the species under consideration but it may not me the most desirable habitat.
Poor	There are severe limitations present for the life stage of species under consideration. Habitat is considered low quality in overall productive capacity.
None	Habitat quality is negligible in capability to support life stage of species under consideration.

Watercourse crossings that did not have fish presence information were sampled for fish in the same location where the Reconnaissance (1:20,000) Fish and Fish Habitat Inventory was conducted. Fish sampling was conducted by minnow trapping and/or single pass electro-fishing (**Photo 4.5-1**) without block nets in accordance with the BC MFLNRO Fish Collection Permits #SM15-167880 and #SM16-226420 and DFO Licences #XR 57 2015-Amendment 1 and XR 59 2016.

Site survey and fisheries sampling information in the field was recorded on electronic tablets using the standard site and fish data cards criteria. All field data were downloaded at the end of the each day to a secure site and reviewed by a second biologist in the office for quality assurance.

Fish stream classification was determined using mean channel width and slope gradient criteria as described in the *Forest Practices Code Fish – Stream Identification Guidebook* (BC MOE, 1998). Fisheries presence or absence for those streams where historical information was not available was assessed based on fish sampling and habitat quality. Default fish-bearing status was assigned to creeks where habitat conditions may allow for seasonal fish presence even though fish were not observed or captured during the survey.

Photo 4.5-1: Electro-fishing at Site #TL17, 24 July 2015

Photographs of sites were taken and riparian assessments were conducted at sites where a visible channel was present. Riparian information collected included dominant tree species, tree height and diameter, stream aspect, canopy cover, shrub species, adjacent land use and the stability of the banks along the river. Information collected from riparian data was used to rank (low, medium, high) the riparian's ability to provide large woody debris, cover, food and nutrients and to stabilize the stream bank. This method of ranking is similar to those outlined in Riparian Assessment and Prescription Procedures (Koning, 1999). Riparian assessments were conducted using this method at all visible channel sites with the exception of one site due to scheduling constraints. For this site, riparian information was obtained from photos collected at the site and from the basic riparian characteristics assessed during the fish and fish habitat survey.

4.5.1.2.2 Access Roads Watercourse Crossings

Similar to transmission line watercourse crossings, streams crossed by access roads were identified using 1:20,000 TRIM layer maps employing GIS mapping software. Each site was given a unique number for identification. Any additional unmapped watercourses that may be found during the design phase will be classified by qualified forestry personnel in keeping with the Fish Stream Identification Guidebook. If classification is not straightforward and further investigation is required in order to determine stream class and/or fish-bearing status, appropriate survey and/or sampling will be completed by an appropriately qualified professional. Such classification will enable identification of appropriate management and/or mitigation measures for the unmapped watercourse.

In 2016, LiDAR streams were added to the FWA atlas streams previously assessed in 2015. Sites from the LiDAR streams were selected for additional field surveys in collaboration with road design engineers. Sites requiring additional field surveys were those associated with proposed new roads, culverts, bridge crossing and road upgrades for a total of 116 sites for the December 2015 access road design. Access roads where only maintenance (i.e. grading) will occur were not included in this assessment as maintenance activities are not expected to alter instream or riparian habitat in or along the watercourse.

Watercourses crossed by access roads were surveyed using the same methodology as transmission line watercourse crossings with the addition of a culvert or bridge inspection using procedures similar to those described in Fish Passage – Culvert Inspection Procedures (Parker, 2000) and Field Assessment for Determining Fish Passage Status of Closed Bottom Structures (BC MOE, 2011). Culvert or bridge inspections were conducted to determine if fish passage was possible. Measurements included gradient, water depth in the culvert and in pools, crossing structure shape and dimensions. Photos and comments regarding existing barriers to fish passage were collated.

4.5.2 Existing Condition

4.5.2.1 Watershed Characteristics

The provisional transmission line route LSA crosses through four watersheds: Alwyn Creek, Lakelse River, Kitimat River and Anderson Creek. **Table 4.5-2** provides summary information for these four watersheds. The Kitimat River watershed is the largest of the four watersheds within the study area.

Table 4.5-2: Summary Information for Watersheds Crossed by the Local Study Area

Watershed	Total Watershed Size (km^2)	Total Area Crossed by the LSA (km^2)	Mainstem Length (km)	Mean Annual Flow – Mainstem (m^3/s)
Lakelse River	589	36	20	20
Kitimat River	2,054	63	75	118
Alwyn Creek	33	3	13	-
Anderson Creek	41	3	15	0.69

Notes: km = kilometre; km^2 = square kilometres; m^3/s = cubic metres per second; LSA = Local Study Area; "-" indicates no data.

Source: Gottesfeld and Rabnett (2007), Luzi and Orwin (2014) and Government of Canada, 2015a.

Named tributaries of the Kitimat River (based on the Freshwater Atlas (FWA)) crossed by the transmission line that occur within the LSA are listed in **Table 4.5-3** from largest to smallest based on stream order. This includes the Wedeene River, the largest order river within the study area. Other named watercourses include the Little Wedeene River and Cecil Creek. In the Lakelse River watershed, the transmission line route crosses the Lakelse River and Coldwater Creek; the

Lakelse River is the larger of the two. Anderson Creek is the only named tributary crossed by the transmission line route in the Anderson Creek Watershed. There are no named watercourses crossed in Alwyn Creek Watershed. No reconstruction or new access road watercourse crossing sites were identified at any named watercourses.

Table 4.5-3: Named Rivers and Creeks in the Local Study Area Crossed by the Transmission Line Route

Tributary	Watershed	Stream Order
Wedeene River	Kitimat	6
Lakelse River	Lakelse	5
Little Wedeene River	Kitimat	5
Anderson Creek	Anderson	5
Coldwater Creek	Lakelse	4
Cecil Creek	Kitimat	3

Source: DataBC, 2008.

4.5.2.2 Fish Habitat

4.5.2.2.1 Transmission Line Route

Table 4.5-4 summarizes the frequency of streams as classified by the Forest Practices Codes for the transmission line watercourse crossings. This classification is based on its fish-bearing status and average channel width. Of the 60 transmission-line crossing sites sampled, 48 had a visible channel (80%), 9 had no visible channel or were non-classified drainages (15%), and 3 were wetlands (5%). Average channel widths ranged from less than one metre for small, unnamed watercourses to 43.3 m for the Lakelse River.

Table 4.5-4: Frequency of Different Classified Streams along the Transmission Line Route

Watercourse Crossings	Total
Named Fish-bearing Streams (S1, S2)	6
Unnamed Fish-bearing Streams (S2, S3, S4)	32
Fish-bearing Wetland Crossing	1
Unnamed Non-fish-bearing Streams (S5, S6)	10
Non-classified Drainage / No Visible Channel Crossings	9
Non-fish-bearing Wetland Pond Crossings	2
Total Stream Crossings	**60**

Notes: Stream classifications are based on average channel width.
Fish-bearing: S1 = >20 m, S2 = >5 m – 20 m, S3 = 1.5 m – 5 m, S4 <1.5 m.
Non-fish-bearing: S5 >3 m, S6 <3 m.

Six (10%) of the watercourses sampled were large, named, fish-bearing watercourses classified as S1 (>20 m channel width) or S2 (>5 m to 20 m channel width). Thirty-two (53%) were unnamed, fish-bearing streams classified as S2 (>5 m to 20 m channel width), S3 (1.5 m to 5 m channel width) or S4 (<1.5 m channel width). One site was a wetland site that was classified as fish-bearing (2%). Ten (17%) were classified as non-fish-bearing S5 (>3 m channel width) or S6 (<3 m channel width) watercourses. Another nine (15%) of the stream crossing sites were non-classified drainages or had no visible channel. Two crossing sites (3%) were wetland pond complexes. Detailed descriptions of channel morphology, water quality parameters (temperature, pH, specific conductivity and turbidity) and fish habitat quality ratings are provided in **Appendix B.2** for each watercourse crossing surveyed.

4.5.2.2.1.1 Named Watercourse Crossings

Table 4.5-5 summarizes salmonid habitat quality ratings in named watercourses in the study area according to important life stages for fish including spawning, rearing, migrating and overwintering. Discussion of fish habitat is provided for each named tributary in the following sections. In most cases, habitat quality in named streams was rated as good or excellent for all salmonid life stages. The only moderate quality rating was for migration in Anderson Creek. Poor ratings were assigned for rearing and overwintering habitat quality in Coldwater Creek.

Table 4.5-5: Summary of Habitat Quality for Salmonids in Named Watercourses along the Transmission Route

Named Watercourse Crossings	Stream Order	Habitat Quality			
		Spawning	Rearing	Migrating	Overwintering
Wedeene River	6	Good	Good	Good	Excellent
Lakelse River	5	Excellent	Excellent	Excellent	Good
Little Wedeene River	5	Good	Excellent	Excellent	Good
Anderson Creek	5	Good	Good	Moderate	Good
Coldwater Creek	4	Good	Poor	Good	Poor
Cecil Creek	3	Excellent	Excellent	Good	Excellent

Wedeene River

The Wedeene River (Site#TL22) is the highest order tributary in the LSA (order 6) and is classified as an S1. It has a riffle-pool morphology and an average channel width of 39.7 m. Habitat quality was rated from good to excellent quality for all life stages of salmon and trout, including coho salmon and cutthroat trout (**Table 4.5-5**). The dominant cover for fish was boulders with good spawning and rearing habitat along the margins. Deep pools for overwintering were observed for cutthroat trout and there was adequate refuge for migrating coho salmon and no barriers to prevent passage. The banks were sloped and composed of gravel and cobble substrates.

The riparian area along the river consisted of mature mixed coniferous and deciduous forest. The dominant tree species was western redcedar (*Thuja plicata*) with red alder (*Alnus rubra*) subdominant. The dominant tree height in the riparian zone was 25 m with a diameter at breast height (DBH) of 25 cm. Riparian habitat quality was rated as high for large woody debris and bank stability and medium for small organic debris and stream shading.

Lakelse River

The Lakelse River (Site#TL8) is the second largest order tributary in the LSA (order 5) and is classified as an S1. It has a riffle-pool morphology and an average channel width of 43.3 m. The river has good to excellent habitat quality for all life stages of salmon and trout (**Table 4.5-5**, **Photo 4.5-2**). The dominant cover for fish was large woody debris but there was a variety of cover available for all life stages, including pools, overhanging vegetation and undercut banks. There were no observed barriers to migration. Spawning gravel was abundant within the survey area. During June surveys, redds were observed throughout the river. The banks were undercut and composed of fines and gravel.

The riparian area along the river consisted of mature mixed coniferous and deciduous forest. Trees were dominated by western hemlock (*Tsuga heterophylla*) with red alder subdominant. Dominant tree height was 55 m, with a DBH of 120 cm. Riparian habitat quality was rated as good for large woody debris, medium for small organic debris and bank stability and low for stream shading due to its larger width.

Photo 4.5-2: Site#TL8 Lakelse River showing large woody debris, spawning gravels, and riparian habitat, July 27, 2015

Little Wedeene River

The Little Wedeene River (Site#TL25) is classified as an S1 stream. It has a riffle pool morphology and an average channel width of 42.8 m. Habitat quality was rated as good to excellent for all life stages of salmon and trout (**Table 4.5-5**). The dominant cover for fish was boulders, while subdominant cover was deep pools for overwintering. There were no barriers to migration and suitable spawning substrate for salmon and trout species was present. The banks were sloping in shape and composed of cobbles and gravel.

The riparian vegetation along the river was composed of mature coniferous forest. Western hemlock was the dominant tree species, with Sitka x white spruce hybrids (*Picea* sp.) subdominant. Dominant tree height was 40 m with a DBH of 50 cm. Riparian habitat quality was rated as high for large woody debris and bank stability and medium for small organic debris and stream shading.

Anderson Creek

Anderson Creek (Site#TL41) is a 5th order tributary of the Kitimat River and was classified as an S2. It has a riffle pool morphology and an average channel width of 18.4 m. Habitat quality was rated as moderate to good for all stages of salmon and trout (**Table 4.5-5**). The dominant cover type for fish was boulders with a variety of cover types for rearing and deep pools for overwintering. At the crossing location, there was good habitat for spawning with suitable substrate throughout. Sections of the left bank have been historically modified and reinforced with concrete, pieces of which have fallen into the channel. The right bank is sloped and dominated by cobbles.

Upstream from the crossing location, a 30 m high falls prevents upstream migration for fish. A fish ladder was present 200 m downstream of the site, providing passage for large salmon during high flows.

The riparian vegetation on the left bank was a young deciduous forest dominated by red alder, while the right bank riparian was mixed forest of deciduous and coniferous trees. Dominant tree height was 25 m with a DBH of 30 cm. Riparian habitat quality was rated as high for large woody debris and bank stability and medium for small organic debris and stream shading.

Coldwater Creek

Coldwater Creek (Site#TL13) is a 4th order stream classified as an S1. It has a riffle-pool morphology and an average channel width of 21.8 m. Fish habitat quality was rated as poor for rearing for fry and juveniles because of the fast flowing water, limiting rearing to the margins where stream flow was slower and cover was provided by overhanging vegetation (**Table 4.5-5**). The dominant cover for fish in the stream channel was boulders. Overwintering habitat was also rated as poor due to lack of deep pools. Migration potential was good because there were no fish passage barriers and abundant boulders created refuges for adult fish. Spawning habitat was available along the margins of the creek where substrates were smaller and flows were slower. There was also a dry side channel that contained adequate substrates for spawning when water levels are higher. The banks at this watercourse crossing were sloped and composed of cobbles.

The riparian vegetation along the creek was a mature forest with mixed coniferous and deciduous trees. Western hemlock was the dominant species, with red alder subdominant. The dominant tree height was 45 m with a DBH of 80 cm. Riparian habitat quality was rated as good for large woody debris and bank stability, medium for small organic debris and low for stream shading.

Cecil Creek

Cecil Creek (Site#TL15) is a 3rd order stream classified as an S2. It has a riffle-pool morphology and an average channel width of 9.4 m. Fish habitat quality was rated as good to excellent for all salmonid and trout life stages (**Table 4.5-5**). There was a variety of cover types for rearing fish with the dominant cover provided by large woody debris. Deep pools provided overwintering habitat. There were no barriers to migration for juvenile or adult fish. Suitable substrates for spawning were observed in riffles and pool tail outs. During stream surveys, schools of salmon parr were observed in the margins of the stream and in pools behind large woody debris. The banks provided cover and fish habitat due to their undercut shape.

The riparian vegetation was a mature forest with mixed coniferous and deciduous trees. The dominant tree species was western hemlock, with red alder subdominant. The dominant tree height was 55 m with a DBH of 100 cm. Riparian habitat quality was rated as good for large woody debris and medium for small organic debris, stream shading, and bank stability.

4.5.2.2.1.2 Unnamed Fish-bearing Watercourse Crossings

A total of 33 unnamed fish-bearing sites were identified along the provisional transmission line route. Classifications for the streams ranged from S2 to S4, and one wetland site (**Table 4.5-4**).

In general, the unnamed fish-bearing streams were small and shallow, with moderate gradients. Average channel width was 3.8 m with an average bankfull depth of 0.5 m. Mean residual pool depth was 0.2 m. The average stream gradient was 4.6%.

Riffle-pool morphology was the most common habitat type, followed by step-pool and large channel morphologies. The most common dominant channel bed substrate was fines (<0.2 cm in diameter), followed by cobbles (6.4 cm–25.6 cm in diameter), gravels (0.2 cm–6.4 cm in diameter), and then boulders (>25.6 cm in diameter). Stream banks were generally sloping, with undercut banks and vertical banks also present. Bank composition was dominated by fine materials with gravels, cobbles, boulders and bedrock also present.

Cover available for fish was rated as abundant (cover exists over more than 20% of the site) at 25 sites and moderate (cover exists over 5% to 20% of the site) at the remaining eight sites. The most common dominant cover was overhanging vegetation, followed by small and large woody debris.

Habitat ratings for spawning, rearing, migrating and overwintering varied widely between streams. Two-thirds (21 out of 33 sites) of the streams had no spawning habitat. Rearing habitat was present at all sites; however, the majority (17 out of 33 sites) were rated as poor. Only two of the 33 streams had no migrating habitat. Eighteen of the 33 streams had overwintering habitat; the remaining 15 streams had no overwintering habitat. The distribution of various habitat ratings for unnamed fish-bearing streams crossed by the transmission line is presented in **Table 4.5-6** and for each stream in **Appendix B2**.

Table 4.5-6: Fish Habitat Ratings for Unnamed Fish-bearing Transmission Line Crossing Sites

Unnamed Fish-bearing Transmission Line Crossing Sites		Habitat Quality Rating				
		Excellent	Good	Moderate	Poor	None
Fish-bearing (S2 – S4 and fish-bearing wetland) n = 33	Spawning	3	2	4	3	21
	Rearing	4	5	7	17	0
	Migrating	3	4	1	23	2
	Overwintering	1	4	4	9	15

Notes: Stream classifications are based on average channel width.
Fish-bearing: S1 = >20 m, S2 = >5 m – 20 m, S3 = 1.5 m – 5 m, S4 <1.5 m.

Riparian habitat quality ratings for the 33 unnamed fish-bearing watercourses along the transmission line route are presented in **Table 4.5-7**. These streams generally rated as high to medium for the four aspects of riparian habitat measured. Low riparian habitat ratings were only assigned to three streams, because of poor bank stability and a lack of stream shading. Riparian vegetation generally consisted of mature mixed wood forest, dominated by western hemlock, red alder, western redcedar and hybrid spruce.

There were no ratings for riparian vegetation given for Site#TL40 in the field. However, photo interpretation and fish, and fish habitat assessment indicated that the riparian vegetation comprised dense shrubs and deciduous trees with stable banks, indicating good stream shading and inputs of small organic debris and the potential for large woody debris.

Table 4.5-7: Riparian Habitat Ratings for Unnamed Fish-bearing Transmission Line Crossing Sites

Unnamed Fish-bearing Transmission Line Crossing Sites		Riparian Quality Rating		
		High	Medium	Low
Fish-bearing (S2 – S4 and fish-bearing wetland) n = 32	Large Woody Debris	29	3	0
	Small Organic Debris	31	1	0
	Stream Shading	23	8	1
	Bank Stability	27	3	2

Notes: Stream classifications are based on average channel width.
Fish-bearing: S1 = >20 m, S2 = >5 m – 20 m, S3 = 1.5 m – 5 m, S4 <1.5 m.

4.5.2.2.1.3 Unnamed Non-fish-bearing Watercourse Crossings

Ten streams with defined channels along the transmission line route were rated as non-fish-bearing and classified as S5 or S6 (**Table 4.5-4**). Of these ten streams, two consisted of disconnected low-gradient channels, four were located upstream of a permanent barrier to fish passage, and four were high-gradient (>20%) watercourses that were not passable by fish.

The low-gradient streams (Sites TL-18 and 85A) were characterized by scoured channel reaches that were disconnected from downstream fish-bearing streams. Downstream sections of these streams were characterized by disconnected, shallow pools, subsurface water flows and abundant instream vegetation. Fish passage up to the surveyed reaches was not possible due to the lack of continuous flow connectivity. Fish habitat was not present for any life stage at the crossing sites.

The four high-gradient streams were rated as non-fish-bearing due to steep, impassable gradients and the absence of sufficient water depth. One of the sites (Site TL39) was dry at the time of survey, while very low levels of flowing water were present at the remaining three sites (Sites TL20A, TL21A, and TL32). Scour patterns and the absence of channel substrates indicate that these streams likely contain large volumes of water only during high-energy storm events. Fish passage would likely not be possible during these events due to high flow velocities and large vertical drops. At all of these sites, the mean stream gradient was greater than 30% and the streams was therefore impassable to fish under all flow conditions.

Riparian habitat quality was assessed at these ten unnamed non-fish-bearing watercourses along the transmission line route (**Table 4.5-8**). Habitat was generally rated as medium to high for the four aspects of riparian habitat. A low rating was only assigned to one stream for large woody debris. Riparian vegetation generally consisted of mature mixed wood forest, dominated by western hemlock, with red alder and western redcedar subdominant.

Table 4.5-8: Riparian Habitat Ratings for Unnamed Non-fish-bearing Transmission Line Crossing Sites

Unnamed Non-fish-bearing Transmission Line Crossing Sites		Quality Rating		
		High	Medium	Low
Non-fish-bearing (S5 – S6) n = 10	Large Woody Debris	8	1	1
	Small Organic Debris	9	1	0
	Stream Shading	8	2	0
	Bank Stability	8	2	0

Notes: Stream classifications are based on average channel width.
Non-fish-bearing: S5 >3 m, S6 <3 m.

4.5.2.2.1.4 Non Visible Channels and Non Classified Drainages

Six crossing sites along the provisional transmission line route were rated as non-visible channels. At these sites, no evidence of flowing water or a scoured channel was observed. Three sites were rated as non-classified drainages, where continuously-scoured channel sections do not extend for 100 m. Riparian habitat quality was not assessed at any non-visible channel or non-classified drainage crossing sites along the transmission line route.

4.5.2.2.1.5 Wetlands

Two sites were classified as non-fish-bearing wetland sites (Sites TL73 and 24A). These sites were classified as wetlands based on the abundance of hydrophytic plants, subsurface water seepage, decaying organic substrates, and the absence of scouring water flows. Neither wetland supported fish habitat at or near the crossing sites.

4.5.2.2.2 Access Roads

Table 4.5-9 summarizes the frequency of streams as classified by the Forest Practices Code along the access roads required for construction of the transmission line. Each watercourse was classified based on its average channel width and fish-bearing status. Of the 116 access road crossing sites sampled, 54 had a visible channel (47%). Sixty-one sites were non-classified drainages or had no visible channel (52%). The remaining single site was classified as a wetland (1%).

The average channel widths ranged from 0.4 m for small, unnamed S6 watercourses to 10.1 m for an S2 stream. Forty-two (36%) of the watercourses sampled were unnamed fish-bearing streams classified as S2, S3, S4, NCD, or wetland. Fourteen sites (12%) were unnamed non-fish-bearing streams. Forty-two (36%) had no visible channel and 18 (16%) were non-fish-bearing NCDs. Detailed channel morphology is provided in **Appendix B.2** for each surveyed watercourse crossing.

Table 4.5-9: Frequency of Different Classified Streams for Access Roads

Watercourse Crossings	Total
Unnamed Fish-bearing Streams (S2, S3, S4)	40
Fish-bearing Wetland Crossing	1
Fish-bearing Non-classified Drainage	1
Unnamed Non-fish-bearing Streams (S5, S6)	14
Non-fish-bearing Non-classified Drainage / No Visible Channel Crossings	60
Total Stream Crossings	**116**

Notes: Stream classifications are based on average channel width.
Fish-bearing: S1 = >20 m, S2 = >5 m – 20 m, S3 = 1.5 m – 5 m, S4 <1.5 m.
Non-fish-bearing: S5 >3 m, S6 <3 m.

4.5.2.2.2.1 Unnamed Fish-bearing Watercourse Crossings

A total of 42 unnamed fish-bearing drainages will be crossed by access roads. Of these 42 sites, 5 were classified as S2, 21 were S3, 14 were S4, 1 site was a wetland drainage and 1 was a non-classified drainage.

Overall, these streams were small and shallow. Average channel width was 2.6 m with an average bankfull depth of 0.6 m. Mean residual pool depth was 0.2 m. The average stream gradient was 5.9%. Riffle-pool morphology was most common, followed by step-pool, cascade-pool, and large channel morphologies. The most common dominant channel bed substrates were fines (<0.2 cm in diameter), followed by gravels (0.2 cm–6.4 cm in diameter), cobbles (6.4 cm–25.6 cm in diameter) and boulders (>25.6 cm in diameter). Stream banks were generally sloping, although undercut and vertical banks were also present. Bank composition was dominated by fine materials, with gravels and boulders also present.

Stream cover for fish was rated as abundant at 30 sites, moderate at 11 sites and absent at one site. The most common dominant cover was provided by overhanging vegetation, followed by small and large woody debris.

Habitat ratings for spawning, rearing, migrating and overwintering varied widely between streams. A summary of habitat ratings for unnamed fish-bearing streams is presented in **Table 4.5-10** and is also available for each stream in **Appendix B2**. Spawning habitat was present at more than half of the surveyed sites. Where spawning habitat is absent, it was generally due to a lack of suitable gravel-sized substrate for salmon and trout. Rearing habitat was present at all sites. It was commonly rated as moderate or poor because low flow conditions in many of the streams would limit the available habitat for rearing. Migrating and overwintering was generally poor or absent owing to low flows and a lack of deep pools for holding or overwintering.

Table 4.5-10: Fish Habitat Ratings for Unnamed Fish-bearing Access Road Crossing Sites

Unnamed Fish-bearing Access Road Crossing Sites		Habitat Quality Rating				
		Excellent	Good	Moderate	Poor	None
Fish Bearing Drainages n = 42	Spawning	3	4	9	9	17
	Rearing	5	5	16	16	0
	Migrating	2	6	8	24	2
	Overwintering	1	3	5	18	15

Riparian habitat quality ratings for 42 unnamed fish-bearing watercourses along the access road routes are presented in **Table 4.5-11**. Riparian habitat was generally rated as high to medium for the four aspects of riparian habitat. A low rating was only assigned to one stream because it had poor bank stability. Riparian vegetation generally consisted of mature mixed wood forest, dominated by western hemlock and red alder, with hybrid spruce and western redcedar subdominant.

Table 4.5-11: Riparian Habitat Ratings for Unnamed Fish-bearing Access Road Crossing Sites

Unnamed Fish-bearing Access Road Crossing Sites		Quality Rating		
		High	Medium	Low
Fish-bearing (S1 – S4) n = 42	Large Woody Debris	28	14	0
	Small Organic Debris	36	6	0
	Stream Shading	28	14	0
	Bank Stability	30	11	1

Notes: Stream classifications are based on average channel width.
Fish-bearing: S1 = >20 m, S2 = >5 m – 20 m, S3 = 1.5 m – 5 m, S4 <1.5 m.

4.5.2.2.2.2 Unnamed Non-fish-bearing Watercourse Crossings

A total of 14 unnamed streams with defined channels along the access road routes were non-fish-bearing and rated as S5 or S6 depending on channel width. Of the 14 sites, five were low-gradient channels with no fish access and/or disconnected channels including one shallow groundwater seep. The remaining nine were located upstream of a permanent barrier to fish passage, and were high-gradient (>20%) watercourses that were not passable by fish.

One stream (Site#RD124) consisted of a broad, deep channel bordered by bog wetland vegetation. Habitat suitable for fish was not present. A historical road crossing, located downstream of the study reach, was a complete barrier to fish passage. The crossing site was therefore rated as non-fish-bearing.

Site#RD138 consisted of a shallow groundwater seep and a poorly defined, intermittent channel. Flow depths were not adequate to support fish, and fish access to the crossing site was prevented by the lack of a continuous, scoured channel.

The other low-gradient sites, RD 135R_321, 1218R_2775 and Rd133/1064 BR_2926 were characterized by scoured channel reaches that were disconnected from downstream fish-bearing streams. Downstream sections of these streams were characterized by disconnected, shallow pools, and subsurface water flows. Fish passage up to the surveyed reaches was not possible due to the lack of continuous flow connectivity. Fish habitat was not present for any life stage at the crossing sites.

The nine high-gradient streams were rated as non-fish-bearing due to steep, impassable gradients or permanent barriers. Two of the sites (Site Branch 13C_2855 and 1218R_2775) were dry at the time of survey. Fish passage would likely not be possible during high flow events due to high flow velocities and large vertical drops. The remaining sites contained water but had permanent fish barriers (chutes, cascades or falls) downstream from the crossing location. At all of these sites, the mean stream gradient was greater than 20% and the streams was therefore impassable to fish under all flow conditions.

Riparian habitat quality ratings for the 14 unnamed non-fish-bearing watercourses along the access road routes are presented in **Table 4.5-12**. Riparian habitat was generally rated as medium to high for the four aspects of riparian function. There was only one site (Wedeene FSR_2873) with low LWD rating because the riparian had been previously cleared and there were no large trees for LWD recruitment. Riparian vegetation was dominated by western hemlock, and red alder with subdominant western redcedar.

Table 4.5-12: Riparian Habitat Ratings for Unnamed Non-fish-bearing Access Road Crossing Sites

Unnamed Non-fish-bearing Access Road Crossing Sites		Quality Rating		
		High	Medium	Low
Non-fish-bearing (S5 – S6) n = 14	Large Woody Debris	13	1	0
	Small Organic Debris	13	1	0
	Stream Shading	12	2	0
	Bank Stability	10	4	0

Notes: Stream classifications are based on average channel width.
Non-fish-bearing: S5 >3 m, S6 <3 m.

4.5.2.2.2.3 Non Visible Channels and Non Classified Drainages

Sixty sites were classified as non-fish-bearing non-visible channels or non-classified drainages (**Table 4.5-9**). Of these sites, forty-two sites were rated as non-visible channels. At these sites, no evidence of flowing water or a scoured channel was observed. None of these crossing sites provided habitat for fish. The remaining eighteen sites were rated as non-classified drainages, where continuously-scoured channel sections do not extend for 100 m. In many cases, they were drainage ditches for existing access roads.

Riparian habitat quality was not assessed at any non-visible channel or non-classified drainages crossing sites along the access roads.

4.5.2.3 Fish Presence

A total of 23 fish species are known to be present in the Lakelse and Kitimat River watersheds (**Table 4.5-13**). All five Pacific salmon species are present and distributed throughout the Lakelse and Kitimat River watersheds. There have been many observations of various sportfish species in tributaries that intersect the provisional route transmission line, including rainbow trout, coastal cutthroat trout, Dolly Varden, and mountain whitefish. Most of these fish species are likely to be present in the provisional transmission line LSA if suitable habitat is available with a few exceptions. For example, eulachon spend the majority of their lives in the marine environment, spawning in the lower reaches of the Skeena River and the Kitimat River. Therefore, they are not expected to be encountered further upstream due to lack of suitable habitat. Confirmed fish species present at crossings along the provisional transmission line LSA are presented in the section below.

Table 4.5-13: Summary of Fish Species that may be Present within the Main Watersheds of the Local Study Area

Common Name	Scientific Name	Lakelse Watershed	Kitimat River Watershed
Atlantic salmon	*Salmo salar*	X	-
Brook trout	*Salvelinus fontinalis*	X	-
Bull trout	*Salvelinus confluentus*	X	-
Chinook salmon	*Oncorhynchus tshawytscha*	X	X
Chum salmon	*Oncorhynchus keta*	X	X
Coastrange sculpin	*Cottus aleuticus*	X	X
Coho salmon	*Oncorhynchus kisutch*	X	X
Coastal cutthroat trout	*Oncorhynchus clarki clarki*	X	X
Dolly Varden	*Salvelinus malma*	X	X
Eulachon	*Thaleichthys pacificus*	X	X
Largescale sucker	*Catostomus macrocheilus*	X	-
Longnose sucker	*Catostomus*	X	-
Mountain whitefish	*Prosopium williamsoni*	X	-
Northern pikeminnow	*Ptychocheilus oregonensis*	X	-
Pacific lamprey	*Entosphenus tridentata*	-	X
Peamouth chub	*Mylocheilus caurinus*	X	-
Pink salmon	*Oncorhynchus gorbuscha*	X	X
Prickly sculpin	*Cottus asper*	X	X
Rainbow trout	*Oncorhynchus mykiss*	X	X

Common Name	Scientific Name	Lakelse Watershed	Kitimat River Watershed
Redside shiner	*Richardsonius balteatus*	X	-
River lamprey	*Lampetra ayresii*	X	-
Sockeye salmon	*Oncorhynchus nerka*	X	X
Threespine stickleback	*Gastersteus aculeatus*	X	X

Source: BC MOE, 2015a

4.5.2.3.1 Transmission Line Watercourse Crossings

Out of the 23 potential fish species, 15 have been either observed historically or were captured during 2015 field surveys at watercourse crossings along the provisional transmission line route (**Table 4.5-14**). The most common fish species are coho salmon and coastal cutthroat trout (**Photo 4.5-3**), which were confirmed to be present at 28% and 18%, respectively, of the 60 watercourse crossings assessed. The next most common fish species was rainbow trout (present at 15% of the watercourse crossings). The least common fish species observed were two sculpin species (Pacific staghorn sculpin and coastrange sculpin) and mountain whitefish; each sculpin species and mountain whitefish was present at <2% of the surveyed watercourse crossings. Specific crossing information and a summary of the fish captured during the 2015 and 2016 field surveys are presented in, respectively, **Appendix B.2** and **Appendix B.3**.

Table 4.5-14: Summary of Fish Presence at Watercourse Crossings along the Transmission Line Route

Fish Species Historically Observed or Captured during 2015 or 2016 Surveys	Total Number of Watercourse Crossings Confirmed Present	Percentage of Total Watercourse Crossings Confirmed Present (%)
Coho salmon	17	28
Coastal cutthroat trout	11	18
Rainbow trout	9	15
Dolly Varden	7	12
Pink salmon	5	8
Chinook salmon	5	8
Chum salmon	4	7
Lamprey	3	5
Steelhead	3	5
Sculpins (general)	2	3
Sockeye salmon	2	3
Slimy sculpin	1	3
Pacific staghorn sculpin	1	2
Coastrange sculpin	1	2

Fish Species Historically Observed or Captured during 2015 or 2016 Surveys	Total Number of Watercourse Crossings Confirmed Present	Percentage of Total Watercourse Crossings Confirmed Present (%)
Mountain whitefish	1	2
Unknown[1]	2	3

Note: [1]Fish observed during sampling but not captured or were historically not identified to species.

Source for historical information: BC MOE FISS, 2015a

Photo 4.5-3: Coastal cutthroat trout captured at Site#TL19, July 23, 2015

4.5.2.3.2 Access Road Watercourse Crossings

Out of the 23 potential fish species, six have been either observed historically or were captured during the 2015 or 2016 field surveys at the 116 surveyed access road watercourse crossings (**Table 4.5-15**). The most common fish species was coho salmon and coastal cutthroat trout each present at 8% and 7%, respectively, of the watercourse crossings. Rainbow trout were the next most common and were each present at 6% of the watercourse crossings. Dolly Varden and steelhead were each present at 2% of the watercourse crossing sites. A single lamprey, threespine stickleback and unidentified salmonid fish was observed but not captured at 1% of the watercourse crossings assessed. Specific crossing information and a summary of the fish captured during the 2015 and 2016 field surveys are presented in **Appendix B.2** and **Appendix B.3**, respectively.

Table 4.5-15: Summary of Fish Presence at Watercourse Crossings along the Access Roads Watercourse Crossing Sites in the Local Study Area

Fish Historically Observed or Captured during 2015 Surveys	Total Number of Watercourse Crossings	Percentage of Total Watercourse Crossings (%)
Coho salmon	9	8
Coastal cutthroat trout	8	7
Rainbow trout	7	6
Dolly Varden	2	2
Lamprey	1	1
Threespine stickleback	1	1
Unknown[1]	1	1

Note: [1]Fish observed during sampling but not captured.

Source for historical information: BC MOE FISS, 2015a

4.5.2.4 Federally and Provincially Listed Fish Species

Species of conservation concern in the Lakelse and Kitimat watersheds include the following provincially Blue-listed species: bull trout, coastal cutthroat trout and eulachon (**Table 4.5-16**). Of these fish species, only coastal cutthroat trout were observed or captured in the LSA. Bull trout have historically been observed in the Skeena River watershed but were not found in the LSA or at any watercourse crossing along the transmission line route or access road routes. Bull trout are suspected to be present throughout the Lakelse watershed and its tributaries, though there is uncertainty whether the identified fish are bull trout or Dolly Varden (Skeena Fisheries Commission (SFC), 2003). Eulachon have historically been observed in the lower reaches of the Kitimat River but have not been observed in the study area.

Chinook salmon, coho salmon, sockeye salmon, and threespine stickleback each have Blue-listed populations within the province, but none occurs within the LSA.

There are two exotic fish species that have been reported in the Lakelse and Kitimat watersheds: Atlantic salmon and brook trout. Neither of these fish species was reported at any of the watercourse crossings within the LSA.

Table 4.5-16: Species of Conservation Concern in the Lakelse and Kitimat Watersheds

Species Name	Scientific Name	COSEWIC Status	BC Status	Comment
Atlantic salmon	*Salmo salar*	Not at risk	Exotic	Reported in the Kitimat River watershed. Not reported or observed at any watercourse crossing within the study area.
Brook trout	*Salvelinus fontinalis*	Not at risk	Exotic	Reported in the Kitimat River watershed. Not reported or observed at any watercourse crossing within the study area.
Bull trout	*Salvelinus confluentus*	Special Concern	Blue	Reported in the Skeena River Watershed. Not observed or reported in any of the watercourse crossings

Species Name	Scientific Name	COSEWIC Status	BC Status	Comment
				of the transmission line or access roads.
Coastal cutthroat trout	*Oncorhynchus clarki*	Not at risk	Blue	Located in the Lakelse River Watershed. Captured and observed at watercourse crossings.
Eulachon	*Thaleichthys pacificus*	Endangered / Special Concern	Blue	Reported in the outlet of the Kitimat River but not in the study area. Not present in any of the watercourse crossings of the transmission line or access roads.

Notes: BC MOE = British Columbia Ministry of Environment (BC MOE status includes Red (Extinct, Endangered or Threatened), Blue (Special Concern), Yellow (Not at Risk));
COSEWIC = Committee on the Status of Endangered Species in Canada (COSEWIC status includes Extinct, Endangered, Threatened, Special Concern and Not at Risk);
SARA = Species at Risk Act, 2002.

Source: Fisheries Information Summary System (BC MOE, 2015a); *SARA* Registry (Government of Canada, 2015c); COSEWIC (2015) and BC Species and Ecosystem Explorer (BC MOE, 2015b).

4.6 Fish and Aquatic Effects Assessment

4.6.1 Valued Component Selection

Fish and aquatic resource VCs (**Table 4.6-1**) were selected for this Project by:

- Considering the importance of different fish species present and the importance of their habitat for continued ecosystem function;
- Determining federally and provincially listed species by searching COSEWIC and BC CDC websites;
- Considering the regulatory requirement to identify any and all potential “serious harm to fish,” including any permanent alteration or destruction of fish habitat, which may require authorization under Section 35(2) of the *Fisheries Act*;
- Considering the sensitivity of a species or its habitat to disturbances caused by activities required for clearing/construction, operation/maintenance and closure of the Project;
- Determining if a species is an indicator (a species whose absence or abundance reflects a specific environmental condition) and/or umbrella species (a species that indirectly protects many other species within the ecological community);
- Considering the cultural, social and/or economic importance of a species or habitat feature to local communities and First Nations including direct feedback provided by these groups about the Project; and
- Confirming that there is a reasonable likelihood that a potential VC would be affected by the Project prior to mitigation.

Coastal cutthroat trout and coho salmon have been selected as VCs for this ESER (**Table 4.6-1**). Coastal cutthroat trout was selected as a VC because it is a Blue-listed species found throughout the study area, it is a stream resident and it provides a valuable recreational fishery. Coho salmon was selected as a VC because it is common in the study area, it has a prolonged juvenile rearing stage in streams and it provides important recreational, commercial and Aboriginal fisheries. The wide distribution and extended stream residency of cutthroat trout and coho salmon make them suitable for long-term monitoring over time and space to detect potential changes resulting from the Project. Additionally, their need for cold-water streams with clean gravel substrates for spawning and abundant pools with cover for rearing and overwintering makes them suitable “umbrella species” whose habitat requirements and sensitivities to potential changes to fish habitat caused by TKTP can serve to represent other salmonid species found within the Project area. Mitigation measures designed to protect cutthroat trout and coho salmon will similarly protect other fish species using these streams.

Bull trout is a Blue-listed species and species of Special Concern under COSEWIC in the Lakelse Watershed. It was not selected as a VC because there were no observations of bull trout identified during the desktop review and none were captured during the field survey. They are assumed to be protected by mitigation designed for the more common coastal cutthroat trout as they have similar cold-water stream habitat requirements.

Eulachon is also a Species of Conservation Concern and is an important cultural species for local First Nations. However, eulachon was not selected as a VC because it does not spawn in any of the streams and rivers potentially crossed by TKTP or contained within the LSA.

Other salmonid fish species such as Chinook salmon, chum salmon, pink salmon, sockeye salmon, rainbow trout/steelhead and Dolly Varden and other smaller fish species (sculpin species) were not included as VCs. This is because coastal cutthroat trout and coho salmon were assumed to act as appropriate umbrella and indicator species for these other fish species. They are umbrella species because protecting coastal cutthroat trout and coho and their habitat is assumed to protect the other species that have similar habitat requirements or life-history strategies. They are indicator species because they are sensitive to changes in environmental conditions. Coastal cutthroat trout are sensitive to changes in water temperature and sedimentation and are dependent on small, cold streams. Coho salmon, the most common fish in the study area, are sensitive to changes in water quality, to flow during spawning and to the abundance and depth of pools in winter.

Table 4.6-1: Summary of Potential Valued Components for Fisheries and Aquatic Resources Assessment

Possible VC	VC Final List	Reason for Consideration	Reason for Exclusion or Inclusion
Fish habitat	Included	Permanent alteration or destruction of fish habitat is considered to cause "serious harm to fish" by the *Fisheries Act*.	Changes in fish habitat can occur directly (e.g. loss of habitat from sedimentation) or indirectly (changes in temperature). Therefore, an assessment of potential effects on fish habitat is necessary to develop mitigation measures to reduce, eliminate or offset any potential effects.
Bull trout	Excluded	This is a Blue-listed fish species and species of Special Concern under COSEWIC in the study area.	Bull trout has been reported in the Lakelse watershed but not in any of the streams or rivers potentially crossed by the Project ROW. It can be represented by the more common coastal cutthroat trout.
Coastal cutthroat trout	Included	This is a Blue-listed fish species found throughout the study area.	The coastal cutthroat trout occurs throughout the study area. It has been reported in the Lakelse and Kitimat River watersheds. It can act as an umbrella species to represent other cold-water sport fish and spring spawners. It can act as an indicator species because it is sensitive to changes in environmental conditions.
Eulachon	Excluded	This is a provincially and federally listed species. It is highly valued by local First Nations.	Eulachon occurs mostly in estuaries of the Skeena River (Gottesfeld and Rabnett, 2007) and Kitimat River. It moves short distances up lower coastal freshwater streams (Gottesfeld and Rabnett, 2007).It is not a suitable VC because the Project is unlikely to affect these estuaries or the lower section of the Kitimat River.
Coho salmon	Included	This species is one of the most widespread fish species recorded in the study area. Salmon is highly valued by people, including local First Nations.	Coho salmon is the most ubiquitous fish species captured during historical field surveys and is represented in all sizes of streams in the study area, including small headwater tributaries. It can also act as an umbrella species to represent other salmonids found within the Project area (i.e. pink salmon, chum salmon, sockeye salmon and chinook salmon). It is a valued recreational fish species. It can act as an indicator species because it is sensitive to changes in environmental conditions.
Chum salmon	Excluded	Salmon is highly valued by people, including local First Nations.	Chum salmon is present in the Lakelse and Kitimat River watersheds. Migration downstream begins immediately following fry emergence. It can be represented by the more common coho salmon, selected as a VC. Also, chum salmon fry spend less time in streams as juveniles than coho fry, which makes coho the better umbrella species for juvenile salmonids.
Chinook salmon	Excluded	Salmon is highly valued by people, including local First Nations.	Small populations exist in the Lakelse and Kitimat River watersheds. It can be represented by the more common coho salmon.

Possible VC	VC Final List	Reason for Consideration	Reason for Exclusion or Inclusion
Pink salmon	Excluded	Salmon is highly valued by people, including local First Nations.	Lakelse River is a major pink salmon–producing area. It can be represented by the more common coho salmon.
Sockeye salmon	Excluded	Salmon is highly valued by people, including local First Nations. It is an important commercial species in the Skeena River watershed.	Sockeye salmon is present in the Lakelse and Kitimat River watersheds. Sockeye fry reside in the Lakelse Lake, which is outside the study area. It can be represented by the more common coho salmon.
Dolly Varden	Excluded	Valued recreational and Aboriginal fish species.	Dolly Varden is present in the Lakelse and Kitimat River watersheds. It can be represented by the more common coastal cutthroat trout and coho salmon.
Rainbow trout / steelhead	Excluded	Valued recreational and Aboriginal fish species.	Rainbow trout / steelhead is present in the Lakelse and Kitimat River watersheds. Steelhead trout has multiple run times in the Lakelse River watershed. It can be represented by coastal cutthroat trout and coho salmon.

Notes: COSEWIC = Committee on the Status of Endangered Wildlife in Canada; ROW = right-of-way; VC = Valued Component.

Fish habitat has also been selected as a VC (**Table 4.6-1**). Fish habitat is a dynamic interaction between physical, chemical and biological parameters in streams and lakes. These parameters include substrate (e.g. sand, gravel, cobbles) and cover types (e.g. large woody debris, instream vegetation), habitat type (i.e. pools, riffles and glides), riparian vegetation, water quality (e.g. water temperatures and conductivity), and quantity of flow. Surface water quality and quantity are also important to fish community health and ecological function. For these reasons, fish habitat is included as a VC for this assessment.

4.6.2 Potential Effects and Proposed Mitigation

The potential effects of the Project during the clearing/construction, operation/maintenance and closure phases on the fish and aquatic resources VCs are presented in **Table 4.6-2**. These potential effects include, the destruction or alteration of habitat (including direct mortality to fish), surface water quality changes (including increased total suspended solids), riparian vegetation clearing, blockage of fish passage and increased access for fishing. Destruction or alteration of habitat can include losses or changes to spawning, rearing, migrating and overwintering habitat. There are no anticipated potential effects post-closure because there will not be any remaining structures or project activities that may affect fish or fish habitat.

Table 4.6-2: Potential Environmental Effects of the Project on Fish and Aquatic Resources

Project Phase with Potential Effects	Project Activity with Potential Effects	Potential Effect on Fish and Aquatic Resources
Clearing / Construction	Installation of culverts and bridges for new road access. Staging areas for equipment and the use of explosives.	Destruction or alteration of habitat and direct mortality to fish
	Construction vehicles in the vicinity of watercourses or crossing watercourses, land clearing for new access roads and transmission line. Blasting, grading, skidding and logging.	Surface water quality changes (i.e. change to fish habitat)
	Clearing of vegetation near watercourses for the ROW and along new access roads.	Loss of riparian vegetation/habitat
	Installation of culverts and bridges for new road access.	Blockage of fish passage
	Construction of new access roads and cleared ROWs.	Increased fishing pressure and fish mortality due to increased access
Operation / Maintenance	Maintenance clearing of vegetation along roads and transmission line ROWs.	Destruction or alteration of habitat
	Increased sediment and erosion from maintenance of roads and transmission line ROWs.	Surface water quality changes (i.e. change to fish habitat)
	Maintenance clearing of vegetation near watercourses for access roads and ROWs.	Loss of riparian vegetation/habitat
	Maintained access roads and ROWs.	Increased fishing pressure/fish mortality due to increased access

Project Phase with Potential Effects	Project Activity with Potential Effects	Potential Effect on Fish and Aquatic Resources
Closure	Removal of culverts and bridges to deactivate road access. Staging areas for equipment.	Destruction or alteration of habitat and direct mortality to fish however, removal may allow for the re-establishment of natural channel processes, such as scour and deposition
	Construction vehicles in the vicinity of watercourses or crossing watercourses.	Surface water quality changes
	Clearing of vegetation near watercourses near the ROW for decommissioning activities.	Loss of riparian vegetation/habitat
	Removal of culverts and bridges to deactivate road access.	Temporary blockage of fish passage

Note: ROW = right-of-way.

4.6.2.1 Destruction or Alteration of Habitat and Fish Mortality

Aquatic habitat may be destroyed or altered as a result of the Project clearing/construction, operation/maintenance, closure and post-closure activities for both the provisional transmission line and access roads. The destruction and alteration of habitat could result in the loss of habitat features such as rearing and overwintering pools or spawning gravels. This could result in fewer spawning, rearing and/or overwintering opportunities for fish and, therefore, lower production of fish. More adversely would be the loss or reduction of habitat critical for the sustainability of specific populations. Direct mortality to fish, eggs or larvae can also occur as part of these activities and are discussed together as part of the destruction or alteration of habitat.

For the transmission line, disturbance to habitat may be caused by clearing/construction vehicles or machinery in the vicinity of aquatic habitat (e.g. laydown areas). Destruction and alteration of habitat can occur following clearing of trees and vegetation along watercourses, leading to changes to available cover or bank stability of the stream (DFO, 2010a). The use of explosives near watercourses may cause compressive shock waves that may damage fish organs or kill fish, eggs and larvae (DFO, 2010b). During operation/maintenance, habitat alterations may occur as a result of having maintenance vehicles in the area and the clearing of vegetation near watercourses. During closure, habitat may be altered by machinery in the vicinity of aquatic habitat while lines, poles or stream crossings are removed. These activities could also cause deposition of sediment into streams, altering spawning, and egg incubation success.

For access roads, disturbance to habitat may be caused by clearing/construction vehicles or machinery in the vicinity of aquatic habitat and in particular, during watercourse crossings construction and removal that can cause physical disturbance to streams or cause direct mortality of fish, eggs or larvae. Instream works could also result in direct fish mortalities by entrainment or impingement of fish on pump screens required for diversion of water around instream construction (DFO, 2010c; 2010d). The construction of culverts and bridges can also constrict watercourses and alter fish habitat (DFO, 2010e). During operation/maintenance, habitat alterations may occur as a result of the use and maintenance of watercourse crossings and the maintenance of vegetation near watercourses. During closure and decommissioning, removal of culvert and bridges could cause physical disturbance to habitat or direct mortality of fish (DFO, 2010f).

Overwintering and spawning habitat are likely the limiting habitats found at sites along the transmission line: 45% of sites had no suitable overwintering habitat and 64% of sites had no suitable spawning habitat. Similar limitations are apparent at streams crossed by the access roads (overwintering and spawning habitats were absent at 36% and 40% of these sites, respectively). Therefore, loss or alteration of overwintering (i.e. deep pools) and/or spawning (i.e. gravels with upwellings) habitat at these sites may have a more substantial effect on local fish populations than loss or alteration of rearing or migrating habitat as a result.

Coho salmon prefer slow moving waters for rearing and overwintering, such as backwaters, side-channels, pools and margins of the stream. They use cut banks, large woody debris, and root wads for cover. Juvenile coho salmon use mainstem pools to rear and overwinter. Any reduction in available cover and/or pools caused by clearing/construction, operation/maintenance and closure phase activities of the transmission line and access roads is most likely to adversely affect coho salmon.

Coastal cutthroat trout are particularly sensitive to habitat changes because they generally spawn rear and overwinter in small tributaries. Therefore, the potential effects of transmission line and access road clearing/construction, operation/maintenance and closure activities on cutthroat trout in these small streams may be amplified if there is no or limited suitable habitat elsewhere or if the buffer widths between these activities and these small streams are inadequate.

4.6.2.2 Surface Water Quality Changes

Water quality in streams inhabited by fish may change through the introduction of suspended solids or deleterious substances. The Project has the potential to increase the amount of total suspended solids introduced into local watercourses through increased erosion caused by disturbing stream banks during access road and transmission line clearing/construction and by blasting rocky terrain near streams. Increased sediment-laden run-off may also result from clearing the ROW of trees and vegetation (DFO, 2010a; 2010b; 2010c; 2010e; 2010f, 2010g). When vehicles required for clearing/construction, operation/maintenance or closure are on site, deleterious substances such as fuel oil and grease may enter watercourses. In addition, herbicide use may be required to remove weed species from the ROW during operation/maintenance.

Sediments and deleterious substances both could reach the water directly or be carried by surface run-off if disturbances and spills are not properly contained in the study area. Addition of these substances to local waterbodies has the potential to cause acute and/or chronic effects to fish. Salmonids, including coho salmon and coastal cutthroat trout, are particularly sensitive to sedimentation, which can reduce the amount of habitat available for spawning and rearing and result in egg mortality. It can also reduce benthic invertebrate production, which is the main food source for coho salmon and cutthroat trout in streams. .

Changes in surface water quality could reduce the quantity and quality of suitable fish habitat in fish-bearing watercourses identified along the transmission route (39 sites) and at access roads (42 surveyed sites). Clean, silt-free substrates are important for salmon and trout spawning, for providing interstitial spaces used as cover for rearing fish and for maintenance of diverse invertebrate populations that are food for fish. Increased sedimentation input into streams could cause the reduction or loss of these functions. In the named fish-bearing streams along the transmission line route, six sites had suitable spawning gravels for salmon and trout. Fines were the most common dominant substrate in 21 unnamed fish-bearing watercourses along the transmission line route and at 22 sites along the access roads. Therefore, sedimentation would have less of an effect on habitat quality in these watercourses.

Optimal coastal cutthroat trout habitat is characterized by clear, cold water with silt-free rocky substrate with stable temperature regimes (Hickman and Raleigh, 1982). Suitable incubation substrate size is 0.3 cm to 8 cm in diameter (Hickman and Raleigh, 1982). Changes to sediment in streams could reduce suitable habitat for coastal cutthroat trout spawning and egg incubation by filling in interstitial spaces or smothering eggs.

Coho salmon are common in many headwater streams within the study area (AMEC, 2014). Gravel and small rubble substrate with low amounts of fine sediments is optimum for survival, growth and development of coho salmon embryos and alevins (McMahon, 1983). Many of the unnamed fish-bearing watercourses could lose spawning and rearing substrates due to increased sedimentation. Additionally, increases in fine sediments could reduce the survival and growth of coho embryos and alevins already in the gravels.

4.6.2.3 Loss of Riparian Vegetation

Some riparian vegetation clearing would be required during clearing/construction of the transmission line and access roads. Regular riparian vegetation maintenance would be required during the operation/maintenance phase of the Project as well. Clearing for equipment access and laydowns may be required during the closure phase. There is no vegetation clearing anticipated for post-closure.

Riparian vegetation is important because it provides shade, cover and food production for streams (DFO, 2010a). In addition, riparian vegetation stabilizes stream banks, helping minimize disturbance to streams and preventing bank erosion (DFO, 2010a).

Loss of riparian vegetation as a result of clearing could reduce riparian function and the services it provides for streams. Specifically, loss of riparian vegetation could:

- Reduce large woody debris inputs that are important for stream morphology and for providing cover for fish;
- Reduce small organic debris inputs that introduce nutrients and organic litter into streams and are important for benthic invertebrate production;
- Reduce stream shade that helps to reduce summer temperatures; and
- Reduce overhanging vegetation that provides cover for fish and provides bank stability that limits erosion and sedimentation.

Riparian habitat in fish-bearing streams along the provisional transmission line route and access roads was rated as having high quality for the majority (>59%) of the riparian function indicators assessed (**Table 4.6-3**).

Because of its high quality for most riparian functions, any riparian vegetation clearing at any of the watercourse crossings along the provisional transmission line route and at any of the access roads will likely reduce the quality of localized riparian habitat. However, its effect on fish would likely be limited spatially because the clearing would not extend beyond the immediate stream crossings location. Riparian corridors for transmission lines could be up to 120 m wide to ensure transmission line security and integrity. The corridor for access roads will have a maximum clearing width of 20 m.

Table 4.6-3: Summary of Sites for Fish-bearing Streams (S1–S4) Rated with High Riparian Function within the Local Study Area

Riparian Function Indicator	Transmission Line			Access Roads		
	No. of Sites with High Quality Rating	Total No. of Sites Assessed	Percentage (%)	No. of Sites with High Quality Rating	Total No. of Sites Assessed	Percentage (%)
Large Woody Debris	35	39	90	28	42	67
Small Organic Debris	31	39	79	36	42	86
Stream Shading	23	39	59	28	42	67
Bank Stability	31	39	79	30	42	71

Loss of riparian vegetation at non-fish-bearing watercourse crossings has the potential to reduce food and nutrients to fish and fish habitat downstream. This effect is expected to be limited to those streams where the fish-bearing and non-fish-bearing sections are closer together. However, these non-fish-bearing streams are typically smaller than fish-bearing streams in the study area. The loss of riparian vegetation in smaller streams is likely to have a more pronounced effect than at larger streams.

A well-vegetated riparian area (30 m wide, 80% of which is either well vegetated or has stable rocky stream banks) provides good quality cutthroat trout habitat (Hickman and Raleigh, 1982). Therefore, any reduction of riparian vegetation to less than 80% coverage within 30 m of streams could potentially reduce habitat quality for cutthroat trout at the crossing.

Riparian vegetation appears to be one of the most important factors influencing production of aquatic and terrestrial insects as food for coho salmon (McMahon, 1983). In particular, deciduous trees and shrubs are ideal for the amount of terrestrial insects and leaf litter they produce. For rearing coho salmon, ideal vegetation canopy is between 50% and 75% cover (McMahon, 1983). Pools with riparian canopy are ideal for coho salmon during summer low flows (McMahon, 1983). Substantial loss of riparian vegetation, in particular deciduous trees and shrubs, could result in reduction in habitat quality or reduced food production for coho salmon.

4.6.2.4 Blockage of Fish Passage

Instream works during the clearing/construction and closure phases of the transmission line or access roads could potentially block the upstream passage of adult coho salmon and coastal cutthroat trout and the downstream passage of fry, juveniles and adults. Unless bridges and culverts are appropriately designed, installed and removed, road crossings can cause bank erosion, bank slumping or debris jams and can create velocity or vertical drop barriers (DFO, 2010e; 2010f; 2010h). Barriers to fish passage could result in changes in fish distributions, interrupt critical spawning and overwintering migrations and reduce annual recruitment by lowering overwintering survival and spawning success.

Coastal cutthroat trout have anadromous and freshwater resident life histories. Downstream smolt movement of anadromous cutthroat trout occurs in the spring and adult re-entry into streams occurs in the fall but can occur as early as June (Hickman and Raleigh, 1982; McPhail, 2007). In the Skeena River watershed, cutthroat trout exhibit considerable variation in spawn timing, though they normally spawn from mid-May to mid-June (SFC, 2003). Stream residents have similar spawning times. Once fry emerge, they may spend as long as four years in their original streams (SFC, 2003). Once in rearing areas, coastal cutthroat trout may make minor migrations to access preferred food sources and appropriate overwintering habitats (SCF, 2003). Prevention of fish passage during these times could reduce coastal cutthroat trout populations by denying them access to spawning, rearing and overwintering habitats.

Fish passage is important to both adult and juvenile coho salmon. Adult coho salmon return to natal streams to spawn in the fall and juvenile smolts travel to the sea in the spring one or two years later. Adult coho salmon have a maximum jumping height of 2.2 m (Bjornn and Reiser, 1991) but their ability to jump this height is predicated on having a sufficiently deep plunge pool (>1 m deep) below the vertical barrier. Obstruction of fish passage during key migration periods due to improperly designed, installed or removed watercourse crossings could reduce coho populations in the study area by limiting access to important upstream spawning habitat or by preventing downstream migration of juveniles to the ocean.

4.6.2.5 Increased Fishing Pressure due to Increased Access

Linear projects have the potential to create or increase access to fishing areas. New or improved access along the ROW may lead to better access to watercourses along the transmission line corridor and the access roads. As a result, fishing pressure on coastal cutthroat trout and coho salmon may be increased, leading to increased mortality, stress or injury to fish and, if severe enough, reduction in local populations.

The Lakelse River has nine sport fish species, the Wedeene River has seven sport fish species, Coldwater Creek and Little Wedeene River each contain five sport fish species, Anderson Creek has four and Cecil Creek has three sport fish species (AMEC, 2014) (**Table 4.6-4**). Therefore, these streams are likely of interest to recreational anglers living in Terrace and Kitimat.

Coastal cutthroat trout were confirmed present in 11 of the 60 transmission line watercourse crossings and at 8 of the 116 access road watercourse crossings. Increased access to these streams could increase fishing pressure on coastal cutthroat trout, resulting in a reduction of the population.

Coho salmon were confirmed present in 17 of the 60 transmission line watercourse crossings and at 9 of the 116 access road watercourse crossings. Increased access to these streams could increase fishing pressure on coho salmon, which could result in fewer adults that are available to spawn, potentially leading to a reduction in the population.

Table 4.6-4: Summary of Sport Fish Species Present in Named Watercourses in the Local Study Area

Watercourse	CO	CH	CM	CCT	DV	MW	PK	RB/ST	SK	Total
Lakelse River	X	X	X	X	X	X	X	X	X	9
Coldwater Creek	X	X	X	-	X	-	X	X	-	6
Cecil Creek	X	-	-	X	X	-	-	-	-	3
Wedeene River	X	X	X	X	X	-	X	X	-	7
Little Wedeene River	X	X	-	X	-	-	X	X	-	5
Anderson Creek	X	X	-	-	-	-	X	-	X	4

Notes: Dash (-) indicates absence. CO = coho salmon; CH = Chinook salmon; CM = chum salmon; CCT = coastal cutthroat trout; DV = Dolly Varden; MW = mountain whitefish; PK = pink salmon; RB/ST = rainbow trout/steelhead; SK = sockeye salmon.

Public access is already possible to all of the named and unnamed fish-bearing streams along the transmission line corridor and access roads required for clearing/construction, operation/ maintenance and closure of TKTP. Currently, the Wedeene FSR provides vehicle access to all streams between the Onion Lake turn-off and the town of Kitimat. These include, from south to north, Anderson Creek, Little Wedeene River, Wedeene River and Cecil Creek. Similarly, the Wedeene FSR provides vehicle access to the Lakelse FSR at the Onion Lake turn-off. The Lakelse FSR currently provides vehicle access to all streams north of the Onion Lake turn-off to the Lakelse River. These include, from south to north, Coldwater Creek and the Lakelse River.

Clearing/construction and operation/maintenance of the transmission line and access roads may improve the existing access to these streams and rivers if measures are not implemented to control access.

Public access at closure and post-closure is likely to decrease compared to clearing/construction and operation/maintenance phases, as access roads are expected to be decommissioned and culverts and bridges removed. However, access trails and the transmission line ROW will still allow potential access to anglers by ATV or hiking until vegetation is restored along the reclaimed ROWs.

4.6.2.6 Proposed Mitigation

Potential effects on fish and aquatic resources due to transmission lines and access roads are reasonably well understood. Because of this, numerous BMPs, (including standard BMPs developed and used by BC Hydro), guidelines and mitigation measures to avoid or reduce potential serious harm to fish from transmission lines are available. Documents that provide recommendations for reducing the likelihood of serious harm to fish, including the permanent alteration or destruction of fish habitat, from linear developments include:

- Standards and Best Practices for Instream Works (British Columbia Ministry of Water, Land and Air Protection (BC MWLAP), 2004);
- A User’s Guide to Working In and Around Water (BC MOE, 2009);
- Fish Stream Crossings Guidebook (BC MFLNRO, 2012c);

- Reduced Risk In-stream Work Windows and Measures: Skeena Region (BC MOE, 2005);
- Measures to Avoid Causing Harm to Fish and Fish Habitat: Project Planning (DFO, 2013b);
- Measures to Avoid Causing Harm to Fish and Fish Habitat: Erosion and Sediment Control (DFO, 2013b);
- Measures to Avoid Causing Harm to Fish and Fish Habitat: Shoreline Re-vegetation and Stabilization (DFO, 2013b);
- Measures to Avoid Causing Harm to Fish and Fish Habitat: Fish Protection (DFO, 2013b);
- Measures to Avoid Causing Harm to Fish and Fish Habitat: Operation of Machinery (DFO, 2013b);
- Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (Wright and Hopky, 1998);
- Integrated Vegetation Management Plan For BC Hydro Transmission and Distribution Power Line Corridors (BC Hydro, 2016);
- Approved Work Practices for Water Crossing Installation, Maintenance and Deactivation (BC Hydro 2014);
- Approved Work Practices for Managing Riparian Vegetation: A Guide to Incorporating Riparian Environmental Concerns into the Management of Vegetation in BC Hydro's Transmission and Distribution Corridors (BC Hydro , 2003a); and
- Approved Work Practices for Managing Riparian Vegetation (AWPRV) A Field Guide (BC Hydro 2003b).

Measures included in these guidelines and BMPs are generally effective for avoiding or reducing serious harm to fish if implemented correctly and adapted as necessary to local site conditions. From these sources, mitigation measures to avoid or reduce effects to fish and aquatic resources during clearing/construction, operation/maintenance and closure of TKTP have been selected and are summarized in **Table 4.6-5**. Descriptions of the mitigation measures specific to the five potential effects on fish and aquatic resources are provided below.

Table 4.6-5: Summary of Mitigation Measures for Potential Effects

Project Phase	Potential Effect	Valued Component Potentially Effected	Mitigation Measures	Likelihood of Mitigation Success
Clearing / Construction	Destruction or alteration of habitat	• Fish habitat • Coastal cutthroat trout • Coho salmon	• No instream work will occur in any of the fish-bearing watercourses to be crossed by the transmission line except at designated access road watercourse crossings. • Structures will be placed outside of watercourses and RVMAs wherever practicable and the line stringing will be completed via equipment from outside of RVMAs. • Helicopters will be used to string the transmission line at the Lakelse River, Wedeene River and Little Wedeene River crossings, thus avoiding the use of heavy land-based machinery. • There will be no use of explosives in watercourses. • Existing roads or cut lines will be used whenever possible; • Designing and constructing approaches so that they are perpendicular to watercourses where practicable; • Installing open-bottom structures (i.e. clear-span bridges, arch pipes and wood box culverts) over fish-bearing streams, where practicable; • Ensuring that all bridge and culvert abutments are above the high water mark on fish-bearing streams so that they do not constrict channel flow; • Where stream gradient, stream channel width, substrate and fish habitat criterion are met, installing embedded closed-bottom structures (i.e. corrugated pipes) at fish-bearing streams, where practicable; • Avoiding instream works on fish-bearing streams where practicable. Where instream works are required it will be minimized in space, frequency and duration; • Performing work in the dry or when water is frozen to the bottom on fish-bearing streams, where practicable; • Conducting instream works, if necessary, within BC MOE's instream work windows, where practicable, to reduce the risk of harm to fish and fish habitat.	• High

Project Phase	Potential Effect	Valued Component Potentially Effected	Mitigation Measures	Likelihood of Mitigation Success
			• If instream construction is required on fish bearing streams, isolating the work areas whenever possible and completing a fish salvage prior to construction; • Placement of screens over pump intakes in isolated work areas that require pumping water across the work site, in such a manner as to prevent entrainment of fish; • If one-time fording is required on fish-bearing streams, limiting it to one location and one crossing (over and back) for each piece of equipment required to facilitate construction on the opposite side. If additional movement of equipment is required then a temporary crossing structure will be used to protect the streambed and banks; • Installing constructed fords, if required, on low-volume roads, tracks and trails and where there is no sensitive fish habitat as assessed by a qualified professional; • Removal of any temporary structures after completion of the work if the crossing is not required for maintenance activities • Instream work will be avoided, where practicable, in all-fish-bearing creeks and-non-fish-bearing creeks that are directly connected to fish bearing creeks and have potential to release significant amounts of sediment into fish bearing creeks. However, if instream works are required for the Project clearing/construction, operation/maintenance or closure activities, they would be scheduled, whenever possible, to occur within BC MOE's preferred instream work windows to reduce the risk of harm to fish and fish habitat (BC MOE, 2005); • If both spring and fall spawning species are present in the stream, resulting in a small work window or no work window, then site-specific mitigation plans will be developed by a qualified professional as part of the CEMP and/or EPPs, and will consider guidance or feedback provided by BC MFLNRO conditions. Work will be guided by the site-specific mitigation plans under the guidance and supervision of a qualified professional. This person would have the authority to stop work	

Project Phase	Potential Effect	Valued Component Potentially Effected	Mitigation Measures	Likelihood of Mitigation Success
			if the site-specific mitigation plans are not implemented or not maintained by the contractor.	
Operation / Maintenance	Destruction or alteration of habitat	• Fish habitat • Coastal cutthroat trout • Coho salmon	• Grading roads, whenever practicable, in such a manner as to avoid sediment being directed into watercourses. • Any large-scale maintenance activities that may alter instream fish habitat such as dredging or the placement of new riprap or fills below the high water mark will require regulatory approval prior to the work being conducted.	• High
Closure	Destruction or alteration of habitat	• Fish habitat • Coastal cutthroat trout • Coho salmon	• Implementing those mitigation measures identified during clearing/construction where applicable; • Restoring stream banks to natural contours; • Replanting or seeding to stabilize disturbed areas; and • Preventing sedimentation by working in the dry when practicable. Habitat features will be restored and the resulting channel will be stabilized before water is re-introduced into the stream channel.	• Moderate
Clearing / Construction	Surface water quality changes	• Fish habitat • Coastal cutthroat trout • Coho salmon	• No ground-based machinery tracks or vegetation clearing within 200 m of each side of the Lakelse River; • No ground-based machinery tracks within the RVMA of the Wedeene and Little Wedeene Rivers. • Except for construction of stream crossings, no ground-based machinery tracks within the RVMA of all other fish-bearing stream crossings, unless site-specific mitigation plans are developed to allow machinery encroachment into the RVMA; • Using site-specific RVMA clearing prescriptions for high value, sensitive fish bearing streams during the layout stage; • Conserve low growing vegetation within RVMAs wherever practicable; and • No intentional de-stumping or grubbing in the RVMAs • Avoidance of use of explosives in or near fish bearing watercourses, especially ammonium nitrate–based explosives	• High

Project Phase	Potential Effect	Valued Component Potentially Effected	Mitigation Measures	Likelihood of Mitigation Success
			• Use of appropriate containment and setbacks from water bodies for refueling or servicing of heavy machinery during clearing/construction, operation/maintenance and closure • No herbicides will be used in RVMAs except when dealing with noxious weed control issues and as specified in IVMP (BC Hydro, 2016). • Using existing roads or cut lines whenever possible; • Designing and constructing approaches so that they are perpendicular to watercourses, where practicable; • Using inert and clean materials for road construction at stream crossing locations, where practicable; • Instream works will be avoided on fish-bearing streams where practicable. Where instream works are required it will be minimized in space, frequency and duration; • Except for construction of the stream crossing itself, no land-based machinery within the RVMA of fish-bearing stream crossings, unless site-specific mitigation plans are developed to minimize ground disturbance, erosion and stream siltation; • Performing work in the dry or when water is frozen to the bottom in fish-bearing streams, where practicable; • Using constructed fords, if required, during the driest periods of the year whenever possible in order to avoid unnecessary disturbance of the channel or suspension of sediments; • If one-time fording is required on fish-bearing streams, it will be limited to one location and one crossing (over and back) for each piece of equipment required to facilitate construction on the opposite side. If additional movement of equipment is required then a temporary crossing structure will be used to protect the streambed and banks, • Using coarse aggregates with low clay content for surfacing on access roads during construction, where practicable; • In rare cases where natural revegetation is insufficient, actively revegetating riparian areas at stream crossings with appropriate seed mixes that will maximize bank stability;	

Project Phase	Potential Effect	Valued Component Potentially Effected	Mitigation Measures	Likelihood of Mitigation Success
			• Developing a Project-wide construction phase Erosion and Sediment Control Plan (ESCP) and site-specific mitigation measures consistent with the ESCP using a qualified professional. This ESCP may include the use of common erosion and sediment control measures such as: o Silt fencing; o Weed free hay bales; o Mulch; o Temporary sediment ponds; and/or o Filter fabric and coco-matting. • Development of an emergency spill response plan by a qualified professional, fluency with this plan by the contractor and its employees, and maintenance of all equipment necessary to implement this plan at each stream crossing if and when required.	
Operation / Maintenance	Surface water quality changes	• Fish habitat • Coastal cutthroat trout • Coho salmon	• Active revegetation of riparian areas at all stream crossings with appropriate seed mixes that will maximize bank stability and minimize maintenance to protect the transmission line during operation/maintenance; • No herbicides will be used in RVMAs except when dealing with noxious weed control issues and as specified in the IVMP (BC Hydro, 2016). • Use of appropriate containment and setbacks from water bodies for refueling or servicing of heavy machinery; • Grading of roads, when practicable, in such a manner as to avoid materials from being directed into the watercourse; • Maintaining as much existing vegetation as practicable to allow for filtering of sediment.	• Moderate

4.6.2.7 Mitigation of Destruction or Alteration of Fish Habitat and Mortality of Fish

4.6.2.7.1 Transmission Line

No instream work will occur in any of the fish-bearing watercourses to be crossed by the transmission line except at designated access road watercourse crossings. This is because some new access road watercourse crossings will be parallel to the transmission line. Mitigation related to access road watercourse crossings is discussed in the following section. There are no anticipated instream works that will occur in any of the named watercourse crossings at any time or place (i.e. Lakelse River, Wedeene River, Little Wedeene River, Coldwater Creek, Cecil Creek and Anderson Creek).

Structures will be placed outside of watercourses and RVMAs wherever practicable and the line stringing will be completed via equipment from outside of RVMAs. Helicopters will be used to string the transmission line at river crossings such as the Lakelse River, Wedeene River and Little Wedeene River crossings, thus avoiding the use of heavy land-based machinery. These rivers have high value fisheries and such a measure would avoid any effects to these fisheries and the habitat upon which they depend.

Should explosives be used to clear land for structure foundations, the protection of fish and fish habitat from explosives will be mitigated by implementing appropriate setback distances from watercourses. These setback distances from the centre of detonation of a confined explosive to fish habitat will be based on guideline criteria for the substrate type at the site. This will vary anywhere from 2 m to 150 m depending on the weight of the explosive charge used and the type of fish habitat (i.e. spawning) (Wright and Hopky, 1998). Where the potential for adverse effects is high, blasting mats will be placed over top of holes to minimize scattering of debris into high value streams. There will be no use of explosives in watercourses.

4.6.2.7.2 Access Roads

The destruction and alteration of fish habitat and fish mortality during the clearing/construction phase for access roads will be avoided or mitigated by following BC Hydro's Approved Work Practices for Water Crossing Installation, Maintenance and Deactivation (AWPWC) (BC Hydro, 2014) and applicable sections in the Fish Stream Crossing Guidebook (FSCG) (BC MFLNRO, 2012c). These may include but are not limited to:

- Using existing roads or cut lines whenever possible;
- Designing and constructing approaches so that they are perpendicular to watercourses where practicable;
- Avoiding the use of explosives in watercourses;
- Installing open-bottom structures (i.e. clear-span bridges, arch pipes and wood box culverts) over fish-bearing streams, where practicable;
- Ensuring that all bridge or culvert abutments are above the high water mark on fish-bearing streams so that they do not constrict channel flow;

- Where stream gradient, stream channel width, substrate and fish habitat criterion are met, installing embedded closed-bottom structures (i.e. corrugated pipes) at fish-bearing streams, where practicable;
- Avoiding instream works on fish-bearing streams where practicable. Where instream works are required it will be minimized in space, frequency and duration;
- Performing work in the dry or when water is frozen to the bottom on fish-bearing streams, where practicable;
- Conducting instream works, if necessary, within BC MOE's preferred instream work windows, where practicable, to reduce the risk of harm to fish and fish habitat (**Table 4.6-6**);
- If instream construction is required on fish-bearing streams, isolating the work areas whenever possible and completing a fish salvage prior to construction;
- Placement of screens over pump intakes in isolated work areas that require pumping water across the work site, in such a manner as to prevent entrainment of fish;
- If one-time fording is required on fish-bearing streams, limiting it to one location and one crossing (over and back) for each piece of equipment required to facilitate construction on the opposite side. If additional movement of equipment is required then a temporary crossing structure will be used to protect the streambed and banks;
- Installing constructed fords, if required, on low-volume roads, tracks and trails and where there is no sensitive fish habitat as assessed by a qualified professional; and
- Removal of any temporary structures after completion of the work if the crossing is not required for maintenance activities.

Instream work will be avoided, where practicable, in all fish-bearing creeks andall non-fish-bearing creeks that are directly connected to fish-bearing creeks and have potential to release significant amounts of sediment into fish-bearing creeks. However, if instream works are required for Project clearing/construction, operation/maintenance or closure activities, they would be scheduled, whenever possible, to occur within BC MOE's preferred instream work windows to reduce the risk of harm to fish and fish habitat (**Table 4.6-4**; BC MOE, 2005). If both spring and fall spawning species are present in the stream, resulting in a small work window or no work window, then site-specific mitigation plans will be developed by a qualified professional as part of the CEMP and/or EPPs, and will consider guidance or feedback provided by BC MFLNRO. Work will be guided by the site-specific mitigation plans under the guidance and supervision of a qualified professional. This person would have the authority to stop work if the site-specific mitigation plans are not implemented or not maintained by the contractor.

The destruction and alteration of fish habitat and fish mortality during operation/maintenance of access roads will be minimized by grading roads, whenever practicable, in such a manner as to avoid sediment being directed into watercourses. Such measures are also outlined in BC Hydro's AWPWC (BC Hydro, 2014). Any large-scale maintenance activities that may alter instream fish habitat such as dredging or the placement of new riprap or fills below the highwater mark will require regulatory approval prior to the work being conducted.

Table 4.6-6: Instream Work Window Guidelines for Streams in the Skeena Region

Fish Presence	Window of Least Risk
Chinook salmon	June 1 to July 15
Coho salmon	June 15 to September 1
Pink salmon	May 15 to August 1
Chum salmon	May 15 to July 10
Sockeye salmon	June 1 to July 20
Dolly Varden	June 1 to August 31
Bull trout	June 1 to August 31
Steelhead	August 15 to January 31
Rainbow trout	August 1 to January 31
Coastal cutthroat trout	August 1 to January 31

Source: BC MOE, 2005.

During closure and decommissioning, when removing existing crossing structures on fish-bearing streams, work will be completed in a manner that avoids or minimizes serious harm to fish and fish habitat and that returns the area to stable pre-disturbance conditions. This will include those mitigation measures listed for clearing/construction as well as:

- Restoring stream banks to natural contours;
- Replanting or seeding to stabilize disturbed areas; and
- Preventing sedimentation by working in the dry when practicable. Habitat features will be restored and the resulting channel will be stabilized before water is re-introduced into the stream channel.

4.6.2.8 Mitigation of Surface Water Quality Changes

Mitigation measures to avoid or minimize changes to surface water quality that could adversely affect coastal cutthroat trout, coho salmon and their habitat include those to prevent erosion and sedimentation and those to prevent the release of deleterious substances, such as fuel, grease, oil or herbicides, into fish-bearing and non-fish-bearing watercourses and waterbodies.

4.6.2.8.1 Transmission Line

Measures that will be implemented to avoid or minimize erosion and sedimentation or the introduction of deleterious substances to watercourses along the provisional transmission line route during clearing/construction include:

- No ground-based machinery tracks or vegetation clearing within 200 m of each side of the Lakelse River;
- No ground-based machinery tracks within the RVMA of the Wedeene and Little Wedeene Rivers. The RVMA extends 15 m away from the waterbody's top-of-bank. The top-of-bank for streams, rivers and other fisheries-sensitive zones are identified from the following features: the upper elevational extent of gravel or cobble point bars on the inside of meander bends (active floodplain formation); well defined points of undercutting

or bank erosion; a marked change in vegetation such as change between unvegetated gravel bars and terrestrial shrub and herbaceous species as well as visible signs of erosion at tree roots; visible change in the size distribution of surface sediments such as the change from sand to gravel or fine gravel to cobble; prominent changes in slope between the banks of the stream channel and adjacent floodplain areas and lines of sediment, lichen, or mosses on stable substrates and bedrock plants (BC Hydro, 2003);

- Except for construction of stream crossings, no ground-based machinery tracks within the RVMA of all other fish-bearing stream crossings, unless site-specific mitigation plans are developed to minimize ground disturbance, erosion and stream siltation;
- Using site-specific RVMA clearing prescriptions for high value, sensitive fish-bearing streams during the layout stage;
- Conserve low growing vegetation within RVMAs wherever practicable; and
- No intentional de-stumping or grubbing in the RVMAs (more details about RVMAs and riparian vegetation is provided in **Section 4.6.2.10**);
- Using rig mats or suitable puncheon materials if heavy equipment must enter an RVMA;
- Avoidance of use of explosives in or near fish-bearing watercourses, especially ammonium nitrate–based explosives during clearing/construction;
- Use of appropriate containment and setbacks from waterbodies for refueling or servicing of heavy machinery during clearing/construction, operation/maintenance and closure;
- Storage of all fuels, lubricants, herbicides and other potentially deleterious substances in appropriate containers outside of the RVMAs during clearing/construction; and
- Development of an emergency spill response plan by a qualified professional, fluency with this plan by the contractor and its employees, and maintenance of all equipment necessary to implement this plan at each stream crossing if and when required; and
- No herbicides will be used in RVMAs except when dealing with noxious weed control issues and as specified in the IVMP (BC Hydro, 2016).

Measures that will be implemented to avoid or minimize erosion and sedimentation and the introduction of deleterious substances to watercourse and waterbodies along the provisional transmission line route during operation/maintenance include:

- Active revegetation of riparian areas at all stream crossings with appropriate seed mixes that will maximize bank stability and minimize maintenance to protect the transmission line during operation/maintenance;
- Use of appropriate containment and setbacks from watercourse and waterbodies for refueling or servicing of heavy machinery;
- Development of an emergency spill response plan by a qualified professional, fluency with this plan by the contractor and its employees, and maintenance of all equipment necessary to implement this plan at each stream crossing if and when required; and
- No herbicides will be used in RVMAs except when dealing with noxious weed control issues and as specified in the IVMP (BC Hydro, 2016).

During closure and decommissioning when removing existing structures, work will be completed in a manner that prevents or minimizes erosion and sediment entry into nearby watercourses and facilitates the area to return to pre-Project or otherwise desired conditions. This will include applicable mitigation measures during clearing/construction listed above and:

- Restoring stream banks to natural contours;
- Replanting or seeding to stabilize disturbed areas; and
- Preventing sedimentation by working in the dry when practicable. Habitat features will be restored and the resulting channel will be stabilized before water is re-introduced into the stream channel.

4.6.2.8.2 Access Roads

Measures that will be implemented to avoid or minimize erosion and sedimentation during clearing/construction of the access roads at watercourse crossings are described in the AWPWC (BC Hydro 2014) which cites sections of the FSCG (BC MFLNRO, 2012c). These include but are not limited to:

- Using existing roads or cut lines whenever possible;
- Designing and constructing approaches so that they are perpendicular to watercourses, where practicable;
- Using inert and clean materials for road construction at stream crossing locations, where practicable;
- Instream works will be avoided on fish-bearing streams where practicable. Where instream works are required it will be minimized in space, frequency and duration;
- If instream works are required in non-fish-bearing streams that are directly connected to fish bearing waters and have the potential to release significant amounts of sedimentation into the fish bearing waters, the downstream receiving environment will be isolated to prevent sedimentation of fish-bearing waters;
- Except for construction of the stream crossing itself, no land-based machinery within the RVMA of fish-bearing stream crossings, unless site-specific mitigation plans are developed to minimize ground disturbance, erosion and stream siltation;
- Performing work in the dry or when water is frozen to the bottom in fish-bearing streams, where practicable;
- Using constructed fords, if required, during the driest periods of the year whenever possible in order to avoid unnecessary disturbance of the channel or suspension of sediments;
- Using coarse aggregates with low clay content for surfacing on access roads during construction, where practicable;
- If one-time fording is required on fish-bearing streams, it will be limited to one location and one crossing (over and back) for each piece of equipment required to facilitate

construction on the opposite side. If additional movement of equipment is required then a temporary crossing structure will be used to protect the streambed and banks,

- In rare cases where natural revegetation is insufficient, actively revegetating riparian areas at all stream crossings with appropriate seed mixes that will maximize bank stability;
- Developing a Project-wide construction phase Erosion and Sediment Control Plan (ESCP) and site-specific mitigation measures consistent with the ESCP using a qualified professional. This ESCP may include the use of common erosion and sediment control measures such as:
  - Silt fencing;
  - Weed free hay bales;
  - Mulch;
  - Temporary sediment ponds; and/or
  - Filter fabric and coco-matting.
- Regularly inspecting erosion and sediment control measures during construction using an independent, third party environmental monitor. This person would have the authority to stop work if erosion and sediment control measures recommended in the ESCP and site-specific mitigation measures are not implemented or not maintained by the contractor or are not working as intended.

Measures that will be implemented to avoid or minimize introduction of deleterious substances to watercourses and waterbodies during clearing/construction of access roads include:

- Development of an emergency spill response plan by a qualified professional, fluency with this plan by the contractor and its employees, and maintenance of all equipment necessary to implement this plan at each stream crossing if and when required;
- Use of appropriate containment and setbacks from waterbodies and watercourses for refueling or servicing of heavy machinery; and
- Avoidance of use of explosives in or near fish bearing watercourses, especially ammonium nitrate-based explosives.

Measures to avoid and minimize introduction of sediment and deleterious substances into watercourses and streams along access roads during operation/maintenance, include but are not limited to:

- Grading of roads, when practicable, in such a manner as to avoid materials from being directed into the watercourse;
- Maintaining as much existing vegetation as practicable to allow for filtering of sediment; and
- Use of appropriate containment and setbacks from waterbodies and watercourses for refueling or servicing of heavy machinery.

During closure and decommissioning, when removing existing crossing structures and returning the area to stable pre-Project or otherwise desired conditions, work will be completed in a manner that prevents or minimizes erosion and sedimentation and the release of deleterious substances into watercourses. This will include those mitigation measures during clearing/construction listed above and:

- Restoring stream banks to natural contours;
- Replanting or seeding to stabilize disturbed areas; and
- Preventing sedimentation by working in the dry when practicable. Habitat features will be restored and the resulting channel will be stabilized before water is re-introduced into the stream channel.

4.6.2.9 Mitigation of Loss of Riparian Vegetation/Habitat

4.6.2.9.1 Transmission Line

Riparian vegetation management along the Lakelse River is defined within the Kalum LRMP. It includes prohibition of tree removal of any tree within 200 m of the river banks on either side of the river (i.e. within Subzone 1). BC Hydro will observe this riparian management prescription at the Lakelse River crossing by:

- Using 60 m high structures on either side of the Lakelse River. Such structures will minimize the need to remove any old growth trees within Subzone 1; and
- Using a helicopter to string the transmission line across the Lakelse River. This will avoid the need for land-based heavy machinery that would otherwise require trees to be removed to access the river.

Clearing standards during the clearing/construction phase for all other watercourses other than the Lakelse River are determined by qualified professional. These requirements strive to strike a practicable balance between meeting construction, safety and post-construction vegetation management requirements while minimizing environmental effects and costs. Clearing requirements will be optimized to minimize potential Project effects on fish and fish habitat, coastal cutthroat trout and coho salmon during the clearing/construction phase of the Project. Preliminary structure locations have been optimized, where practicable, to minimize potential Project effects on watercourses.

Measures that will be implemented to avoid or minimize loss of riparian vegetation/habitat include, but are not limited to:

- Clearly defining RVMAs other fish-bearing and non-fish-bearing watercourses other than the Lakelse River and waterbodies along the provisional transmission line corridor;
- Clearly flagging and marking RVMAs in the field prior to work;
- RVMAs will be 15 m from the top-of-bank on both sides of all fish-bearing and non-fish-bearing watercourses;
- All RVMAs will have clearing standards that includes such things as:

  - Using only handheld equipment for felling timber;
  - No intentional grubbing or uprooting of tree stumps;
  - Falling trees in such a manner as to not intentionally damage existing vegetation that is to be conserved;
  - Falling trees away from watercourses and waterbodies so as not to damage banks, where practicable;
  - Removing timber and woody debris from the RVMA by reaching in with equipment from adjacent areas or using a helicopter or other yarding techniques that will minimize damage to banks;
  - Leaving existing large woody debris in watercourses where safe to do so;
  - Placing debris removed from streams at least 5 m from the high water mark in such a manner that it does not re-enter the watercourse or waterbody;
  - Retaining the maximum amount of low growing vegetation that has a normal mature height of less than 3 m and conifers less than 2 m, where practicable;
- Tracking of environmentally sensitive sites, including RVMAs, in BC Hydro's enterprise GIS mapping system, and the referencing of this data and information during work planning, so that long-term implementation of riparian management prescriptions and their limits can be followed during operations/maintenance; and
- Except for construction of stream crossings, no ground-based machinery tracks within the RVMA of fish-bearing streams, unless site-specific mitigation plans are developed to allow machinery encroachment into the RVMA.

Seven wetlands or streams have been identified that harbour multiple vegetation, fisheries and wildlife VCs. These wetlands and streams are shown in **Appendix C.5**. Customized RVMA clearing prescriptions will be developed for these sites to minimize disturbance during the clearing/construction phase. If practicable, site-specific prescriptions will be implemented at these sites for the operation/maintenance phase of the Project. Site-specific prescriptions may reduce potential Project effects on these VCs at these sites during the operation/maintenance phase and facilitate a return to existing conditions during the post-closure phase. During operation/maintenance, qualified professional(s) will prepare prescriptions for these seven sites that use site-specific details, as necessary, to identify multi-year management objectives (BC Hydro, 2003a, 2003b).

For all other watercourses, management of riparian vegetation during the operations/maintenance phase will be conducted according to the Approved Work Practices for Managing Riparian Vegetation (BC Hydro, 2003a) and the Approved Work Practices for Managing Riparian Vegetation (AWPRV) A Field Guide (BC Hydro, 2003b). These work practices minimize disturbance during vegetation maintenance activities. Mitigation measures outlined in this document include, but are not limited to:

- Clearly defining RVMAs on fish-bearing and non-fish-bearing watercourses and waterbodies along the provisional transmission line corridor;
- Ensuring RVMAs will be a minimum of 15 m from the top-of-bank on both sides of all fish-bearing and non-fish-bearing watercourses;

- Clearly flagging and marking RVMAs prior to work;
- Tracking of environmentally sensitive sites, including RVMAs, in BC Hydro's enterprise GIS mapping system, and the referencing of this data and information during work planning, so that long-term implementation of riparian vegetation management prescriptions and their limits can be followed during operation/maintenance;
- Maintaining as much existing shrub and tree vegetation with the RVMA as practicable;
- Prohibiting heavy equipment or machinery within the RVMAs;
- Prohibiting grubbing or uprooting of tree stumps within the RVMAs;
- Removing vegetation debris to above the high water mark for temporary storage and outside of the RVMA for long-term disposal; and
- Creating planting standards in riparian ecosystems that may be compromised as a result of vegetation maintenance requirements. The planting standard will be designed to maintain riparian zone function such as bank stability, shading, and input of organic debris.

During the closure phase, riparian vegetation will be allowed to regenerate or BC Hydro will actively plant self-sustaining vegetation following site-specific planting standards that are designed to maintain riparian zone function.

4.6.2.9.2 Access Roads

Mitigation measures that will be implemented to avoid or minimize effects on coastal cutthroat trout, coho salmon and their habitat from clearing of riparian vegetation/habitat during clearing/construction of access roads are identified in the AWPWC (BC Hydro, 2014) and FSCG (BC MFLNRO, 2012c) and include but are not limited to:

- Using existing roads or cut lines whenever possible;
- Designing and constructing water crossing approaches so that they are perpendicular to watercourses, where practicable;
- Retaining as much understory vegetation as possible within the RVMA of the stream crossing;
- Felling trees in such a manner as to not intentionally damage existing vegetation;
- Where safe to do so, leaving existing large woody debris in streams unless removal is necessary for the crossing. All debris removed from the stream will be placed in such a manner as to prevent it from re-entering the waterbody. Wherever possible this placement will be at least 5 m from the high water mark. The high water mark of a stream is normally the top of the stream channel, typically identified as the highest point of typical seasonal scour demarked by the lack of vegetation (BC Hydro, 2014);

- Except for construction of the stream crossing itself, no ground-based machinery tracks within the RVMA of all other fish-bearing stream crossings, unless site-specific mitigation plans are developed to minimize ground disturbance, erosion and stream siltation; and
- Falling any road side hazard trees away from watercourses and waterbodies where practicable and removing them in such a manner as to not damage banks.

During operation/maintenance of access roads, the AWPWC (BC Hydro, 2014) and relevant section in the FSCG (BC MFLNRO, 2012c) will be followed and riparian vegetation will be maintained in such a manner as to provide sediment and erosion control and bank stability. During closure, similar mitigation measures as identified during clearing/construction will apply. In addition, BC Hydro will restore stream banks to natural contours and replant or seed to stabilize disturbed areas as identified in the AWPWC (BC Hydro, 2014).

4.6.2.10 Mitigation of Blockage of Fish Passage

Blockage of upstream and downstream fish passage during the clearing/construction of watercourse crossings will be prevented by:

- Designing and constructing approaches so that they are perpendicular to watercourses, where practicable;
- Installing open-bottom structures that allow the upstream passage of fish (i.e. clear-span bridges, arch pipes and wood box culverts) over fish-bearing streams, where practicable;
- Ensuring that all bridge or culvert abutments are above the high water mark on fish-bearing streams so that they do not constrict channel flow;
- Adhering to instream work windows for each fish species known to be present in the watercourse, where practicable;
- Ensuring that any isolation works in non-fish-bearing streams, if required, do not restrict the downstream flow of water to fish-bearing streams;
- Removing temporary crossing structure after construction is complete if the crossing is not required for maintenance activities;
- Tracking of environmentally sensitive sites, including RVMAs, in BC Hydro's enterprise GIS mapping system, and the referencing of this data and information during work planning, so that long-term implementation of riparian vegetation management prescriptions and their limits can be followed during operation/maintenance; and
- Including structures to prevent channel erosion and debris build-up upstream of stream crossings if required and where practicable.

If working within the preferred instream work windows is not possible, then site-specific mitigation plans will be developed by a qualified professional and will incorporate feedback or guidance from BC MFLNRO as appropriate. Work will be guided by the site-specific mitigation plans under the guidance and supervision of a qualified monitor. This person would have the authority to require action or stop work if the site-specific mitigation plans are not implemented or not maintained by the contractor.

During operation/maintenance, blockage of fish passage will be mitigated by measures described in the AWPWC (BC Hydro, 2014), which include:

- Regularly inspecting watercourse crossings and correcting any observed blockages;
- Operating any maintenance machinery above the high water mark, where practicable; and
- Adhering to fish timing windows, where practicable, if instream maintenance is required. Those instream mitigation measures as defined during clearing/construction may also apply.

Blockage of upstream and downstream fish passage at access roads during closure and decommissioning will be prevented by those measures outlined during clearing/construction and by removing any watercourse crossings not required and restoring stream banks to their natural contours.

4.6.2.11 Mitigation of Increased Fish Pressure due to Increased Access

Mitigation to prevent increased fishing pressure due to increased access along linear developments is difficult to implement. This is because persistent anglers will always try to use any new linear development to access what they believe will be a high value fishing experience, either because of the expectation of high catch rates, low angler densities or both. Modern ATVs help facilitate this access, particularly to sites deemed too far to walk. .

Despite these limitations, mitigation measures to limit increased fishing pressure along the transmission line and access roads exist. These measures include:

- Using existing corridors to the maximum extent possible. This measure limits the creation of new access points to streams and rivers along the transmission line corridor;
- Decommissioning any access roads not necessary for operation/maintenance after construction of the transmission line; and
- Removing temporary crossing structures along the access roads if they are not required for maintenance activities.

During operation/maintenance, low growing vegetation will generally be allowed to regrow along the transmission line route within acceptable heights under the transmission line. Upon decommissioning, vegetation will be allowed to regrow naturally and reclaim the landscape.

BC MFLNRO and DFO are responsible for the management of freshwater and anadromous fish populations in BC, respectively. Fishing regulations are currently in place for most trout and salmon species, including cutthroat trout and coho salmon, in the Lakelse and Kitimat River watersheds (BC MOE, 2015c). Either of these government entities can impose restrictions on daily or possession limits for cutthroat trout or coho salmon, increase fishing closure periods and/or institute closure areas on specific streams and rivers if populations decrease along the transmission line corridor or the access roads. The effect of any such changes to fishing regulations would be to limit the number of fish taken by individual anglers. However, they would not limit the number of anglers wishing to fish streams and rivers along the ROWs. Such mitigation measures cannot be implemented by BC Hydro directly.

4.6.2.12 Preparation of Environmental Management Plans

BC Hydro will prepare a CEMP outlining how construction of the Project will minimize effects on riparian vegetation and fish habitat and avoid causing serious harm to fish. Contractors will be required to develop EPPs pursuant to the CEMP requirements. These site-specific plans will identify any unique site conditions (e.g. highly rated fish habitat or riparian habitat) that may require unique construction methods and may therefore require additional mitigation measures or tailoring of existing mitigation to avoid or reduce effects to fish and aquatic resources. In addition, these site-specific plans, along with BC Hydro's approved work practice documents and the IVMP (BC Hydro, 2016) will be reviewed and approved by BC Hydro prior to commencement of the phase of the Project to which they are relevant.

BC Hydro will require that all employees and contractors read and understand how to implement the CEMP and the site-specific fish and aquatic management plans before commencing work. To check compliance with the CEMP and site-specific EPPs, it is recommended that appropriately qualified construction monitors observe all watercourse crossings during the construction and decommissioning of the Project. These monitors should have the authority to recommend if, when and where additional mitigation may be necessary and to stop work if prescribed mitigation measures are not being implemented or are being implemented incorrectly.

A Restoration and Closure Plan (RCP) will be finalized prior to the closure phase of the Project. Contractors will be chosen, in part, based on their ability to fulfill the objectives of the RCP. Contractors will in turn use the RCP to provide them with guidance and strategies to meet these objectives. The objectives of the RCP in general may be to establish self-sustaining, non-invasive ecological communities that support identified land uses or fish and aquatic resource VCs where required and practicable.

Development and implementation of the RCP will include:

- Consulting with First Nations;
- Describing the responsibilities of the contractor(s) and BC Hydro;
- Describing the requirement for an environmental monitor and a summary of their roles, work practices, and reporting and communication responsibilities;
- Describing scenarios where revegetation may take place (e.g. stream crossing and riparian ecosystems). This section may also provide detailed revegetation plans for each scenario;
- Describing scenarios where silvicultural practices may be used to accelerate forest succession; and
- Describing anticipated timeframes for completion of revegetation stages, including quantifiable targets and how these targets will be monitored.

4.6.3 Residual Effects

Residual effects on coastal cutthroat trout, coho salmon and their habitat due to permanent alteration of destruction of habitat, surface water quality changes and blockage of fish passage are not expected to occur during clearing/construction, operation/maintenance, closure and post-closure phases of TKTP. This is because the various BMPs and mitigation measures described above and those specifically developed for the stream, rivers and their fisheries listed above are well-understood and established, technically feasible, and suitable for the site conditions and species known to be present at stream crossings along the transmission line corridor and the access roads. They are also widely used throughout BC and are known to be effective when correctly implemented. Those residual effects that remain after mitigation are discussed in the following sections. **Table 4.6-7** presents the specific rationales for the assessment of residual effects after mitigation for each of these effects.

Table 4.6-7: Residual Effects

Potential Effect	Valued Component	Residual Effect (yes/no)	Rationale
Permanent alteration, destruction of habitat and mortality of fish	• Fish habitat • Coastal cutthroat trout • Coho salmon	No	• Following and properly implementing BC Hydro's AWPWC (BC Hydro, 2014) and applicable measures outlined in the FSCG (BC MFLNRO, 2012 c) and DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat (2013b), including Project Planning and Operation of Machinery, will prevent serious harm to fish, any permanent alteration to habitat or destruction of fish habitat. These measures are known to be effective at mitigating or preventing serious harm to fish. Designing structures outside of RVMAs and planning activities to avoid sensitive spawning habitats and operating machinery on land above the high water mark will minimize disturbance to banks and beds of waterbodies and avoid serious harm to fish and fish habitat. • Site-specific EPPs for all employees and contractors will include the mitigation measures and BMPs discussed in this report, which are widely accepted as being effective when properly followed, implemented, monitored and adaptively managed.
Surface water quality changes	• Fish habitat • Coho salmon • Coastal cutthroat trout	No	• Applying DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat during stream crossings and BC Hydro's AWPWC the FSCG (BC MFLNRO, 2012c) will minimize the effects of Project activities on surface water quality (DFO, 2013b). This includes the implementation and proper installation, monitoring and adaptive management of sediment and erosion control. • Site-specific EPPs for all employees and contractors will include the mitigation measures and BMPs discussed in this report, which are widely accepted as being effective when properly followed, implemented, monitored and adaptively managed. • Implementation of AWPRV (BC Hydro, 2003) and the IVMP (BC Hydro, 2016) will reduce the likelihood of changes to surface water quality. These are well-established set of practices and BC Hydro is experienced in implementing it.
Loss of riparian vegetation/habitat	• Fish habitat • Coho salmon • Coastal cutthroat trout	Yes	• BC Hydro will have to clear some vegetation within riparian areas to maintain the safety and security of the transmission line. Depending on the quality of the existing vegetation (i.e., no low-lying shrubs, herbs or grasses), there may be residual effects to fish and fish habitat after clearing/construction until vegetation is re-established in the RVMAs. Mitigation will minimize residual effects to avoid serious harm to fish and fish habitat. • To reduce the effects, RVMAs will be implemented and maintained to help minimize changes to riparian vegetation (BCH-BCTC, 2003) but some vegetation will still have to be cleared. • Riparian vegetation at the Lakelse River will have a 200 m riparian buffer to maintain riparian function. • As much low growing vegetation as possible will be retained within the RVMAs. • Stumps and root wads will be left in place in RVMAs to help retain bank stability but shade will reduced.

Potential Effect	Valued Component	Residual Effect (yes/no)	Rationale
			• By avoiding ground disturbance within the RVMA, bank stability can be maintained and erosion of soil into the watercourses can be prevented. • Site-specific EMPs at watercourse crossings for all employees and contractors will include mitigation measures and BMPs as discussed in this report, that are widely accepted as being effective when properly followed, implemented, monitored and adaptively managed. • Using appropriate clearing standards within RVMAs will help maintain bank stability and reduce damage to existing vegetation and any vegetation that will remain.
Blockage of fish passage	• Coho salmon • Coastal cutthroat trout	No	• The mitigation measures and BMPs while constructing watercourse crossings as identified in the AWPWC (BC Hydro, 2014) and FSCG (BC MFLNRO, 2012c) are widely accepted as being effective when properly followed, implemented, monitored and adaptively managed. They are industry standard and are suitable for streams to be crossed. • DFO's Measures to Avoid Causing Harm to Fish or Fish Habitat outlines procedures to ensure that construction and closure activities such as installation or removal of bridges and culverts do not result in fish passage blockage (DFO, 2013b). These measures are widely used and accepted as being effective when properly followed and implemented. • Standards and Best Practices for Instream Works outlines culvert design and operational requirements for properly installing culverts that allow for fish passage (BC MWLAP, 2004; BC Hydro, 2014). These measures are widely used and accepted as being effective when properly followed and implemented.
Increased fishing pressure (and fish mortality) due to increased access	• Coho salmon • Coastal cutthroat trout	Yes	• The clearing and construction of the transmission line ROW and new access roads may improve access to the Lakelse River, Wedeene River and other small creeks and lead to increased trout and salmon fishing. . • Decommissioning of roads will help to reduce public access to trout and salmon streams upon closure of the transmission line but some individuals may still use the corridors for access. • BC Hydro cannot control the actions of determined individuals who, regardless of deterrents, may use Project-related access for fishing purposes.

Notes: AWPRV = Approved Work Practices for Managing Riparian Vegetation; AWPWC = Approved Work Practices for Water Crossing Installation, Maintenance and Deactivation; BCH-BCTC = BC Hydro and BC Transmission Corporation (now BC Hydro); BC MFLNRO = British Columbia Ministry of Forest, Lands and Natural Resources; BC MWLAP = British Columbia Ministry of Water, Land and Air Protection (now MOE); BMP = best management practices; DFO = Fisheries and Oceans Canada; EMPs = Environmental Management Plan; EPP = Environmental Protection Plan; FSCG = Fish Stream Crossing Guidebook; m = metre; ROW = right-of-way.

4.6.3.1 Loss of Riparian Vegetation/Habitat

Despite the mitigation measures described in preceding sections, residual effects on coastal cutthroat trout, coho salmon and their habitat are unlikely to be completely avoided due to riparian vegetation clearing. It is unavoidable that the Project will require the removal of some or all riparian vegetation at some watercourse crossings to maintain the security, integrity and safety of the transmission line. This may include the Wedeene River, Little Wedeene River, Anderson Creek, Cecil Creek, Coldwater Creek and other unnamed fish-bearing creeks.

At unnamed watercourse crossings, BC Hydro will avoid causing serious harm to fish by implementing the riparian vegetation management techniques and mitigation measures described in **Section 4.6.2.3**. However, these techniques may not fully prevent all possible effects to cutthroat trout, coho salmon and their habitat at these stream crossings where riparian vegetation removal or alteration is required. Removal of trees may reduce the input of large woody debris, reduce shading and potentially reduce bank stability. Importantly, however, these residual effects will be limited to the immediate stream crossing locations.

4.6.3.2 Increased Fishing Pressure due to Increased Access

Increased fishing pressure on coastal cutthroat trout and coho salmon due to increased access created by the new transmission line corridor and the new access roads is unlikely to be completely mitigated by the measures described above. While decommissioning of temporary access roads would make it more difficult for people to use these corridors, they cannot stop those anglers who are determined to get to these areas once the transmission line and access roads are built. This could remain the case even after the transmission line and access roads are decommissioned. Modern ATVs, utility terrain vehicles (UTVs), snowmobiles and dirt bikes can all be used by these anglers to travel along the transmission line ROW and access roads, even on rough decommissioned roads.

Reliance on decommissioned roads and changes in fishing regulations to protect trout and salmon species, including cutthroat trout or coho salmon populations, from increased angling pressure is unrealistic, as BC Hydro cannot control the actions of individual people. As a result, increased fishing pressure is considered a potential residual effect carried forward in this assessment.

4.6.4 Characterization of Residual Effects

4.6.4.1 Loss of Riparian Vegetation

Residual effects on coastal cutthroat trout, coho salmon and their habitat due to riparian vegetation clearing at access roads and along the provisional transmission line route are not expected to require further planning (**Table 4.6-8**).

For fish habitat, the residual effect is adverse and is characterized as follows:

- The context for fish habitat is medium in fish-bearing streams because of the sensitivity of salmonid spawning gravels to sedimentation, the importance of large woody debris inputs, food and nutrients inputs and instream cover and the importance of overhanging vegetation for shade, leaf litter and cover. Context is low for non-fish-bearing streams but overall context is defaulted to the higher of the two ratings.

- The geographic extent is site-specific because effects are restricted to fish habitat at the stream crossings.
- The duration is medium-term because the effects of riparian vegetation clearing are expected to end immediately after operation/maintenance is concluded and riparian vegetation has begun to recover. During closure and post-closure phases, there will be no more vegetation management required and vegetation will be allowed to grow back. A RCP will be developed and implemented as appropriate prior to decommissioning of the transmission line.
- The frequency is intermittent throughout clearing/construction and operation/maintenance phases because vegetation management will be required to maintain the safety and security of the transmission line every two to five years and access road crossings will remain for the life of the Project.
- The effect is reversible once riparian vegetation management activities are concluded at the end of operation/maintenance.
- The magnitude is low because riparian vegetation clearing will only occur within the transmission line ROW and at new access roads.

For coastal cutthroat trout, the residual effect of loss of riparian vegetation is characterized as follows:

- The context is rated as medium because coastal cutthroat trout are a provincially Blue-listed species and because they are dependent on cold-water streams with clean gravels for spawning and pools with abundant cover for rearing and overwintering.
- The geographic extent is site-specific because coastal cutthroat trout are territorial in all seasons except the winter and, therefore, only trout with territories immediately at the stream crossings would be affected.
- The duration is medium term because the effects of riparian vegetation clearing are expected to end immediately after operation/maintenance is concluded and riparian vegetation has begun to recover. During closure and post-closure phases, there will be no more vegetation management required and vegetation will be allowed to grow back. A RCP will be developed and implemented as appropriate prior to decommissioning of the transmission line.
- The frequency is intermittent throughout clearing/construction and operation/maintenance phases because vegetation management will be required to maintain the safety and security of the transmission line every two to five years and access road crossings will remain for the life of the Project.

- The effect is reversible once riparian vegetation management activities are concluded at the end of operation/maintenance.
- The magnitude is negligible because riparian vegetation clearing will only occur within the transmission line ROW (120 m) and at new access roads (20 m), which is a small proportion of the total riparian vegetation along those watercourses.

For coho salmon, the residual effect is adverse and is characterized the same as for coastal cutthroat trout with one exception: coho salmon are not Blue-listed in BC and the context for coho salmon is therefore rated as low instead of medium, Table 4.6-8.

Table 4.6-8: Characterization of Residual Effects on Fish and Aquatic Resources due to Riparian Vegetation Clearing

Valued Component	Direction	Context	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
Fish Habitat	Adverse	Medium	Low	Site-specific	Medium term	Intermittent	Reversible
Coastal cutthroat trout	Adverse	Medium	Negligible	Site-specific	Medium term	Intermittent	Reversible
Coho salmon	Adverse	Low	Negligible	Site-specific	Medium term	Intermittent	Reversible

4.6.4.2 Increased Fishing Pressure due to Increased Access

Residual effects on coastal cutthroat trout and coho salmon due to increased fishing pressure (and therefore mortality) caused by increased access are not expected to require further planning (**Table 4.6-9**).

The residual effect is adverse and characterized as follows:

- Context for coastal cutthroat trout is medium because it is a provincially Blue-listed species. Context for coho salmon is low because it is not Blue- or Red-listed in BC and is a ubiquitous species in the study area.
- Geographic extent is local because the potential effect of increased fishing pressure is limited to the local populations that reside in the streams and rivers crossed by the transmission line and access roads.
- Duration is long term because increased access may extend beyond closure once the transmission line ROW and access roads are built. However, the effect is expected to diminish over time as vegetation becomes re-established along these corridors making travel by powered vehicles more difficult but not impossible.
- Frequency is continuous because anglers can use the access provided by the transmission line corridor and the access roads as soon as they are built and for as long as they remain on the landscape. Frequency would only be limited by fishing closures as described in existing fishing regulations (BC MOE, 2015c). For coho salmon, frequency would only be limited by the presence of adult spawners in fall.

- The effect is irreversible: Once the transmission line corridor and access roads are built, they will effectively remain useable to recreational anglers in Terrace and Kitimat.
- Magnitude is negligible because:
  - All of the fish-bearing streams and rivers along the west side of the Kitimat River Valley that would be crossed by the transmission line corridor and the access roads are currently accessible to anglers in Terrace and Kitimat via the Wedeene FSR and Lakelse FSR or other active or decommissioned roads.
  - Clearing/construction of the transmission line and access roads will not create additional recreational anglers in Terrace or Kitimat. The populations of both towns is not expected to increase because of the Project nor will the Project require a large influx of workers to build and/or maintain.
  - Fishing regulations exist to protect cutthroat trout and coho salmon populations in all streams and rivers within the Kitimat River Valley (BC MOE, 2015c).

Table 4.6-9: Characterization of Residual Effects on Fish and Aquatic Resources due to Increased Fishing Pressure Caused by Increased Access

Valued Component	Direction	Context	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
Coastal cutthroat trout	Adverse	Medium	Negligible	Local	Long term	Continuous	Irreversible
Coho salmon	Adverse	Low	Negligible	Local	Long term	Continuous	Irreversible

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5 VEGETATION

5.1 Introduction

The clearing of vegetation and construction of roads during the clearing/construction phase is anticipated to have the largest adverse effect on vegetation VCs in the LSA. In some cases, these effects will make a return to existing conditions unlikely. Integrated vegetation management will prevent vegetation VCs from returning to existing conditions during the operation/maintenance phase. Adverse Project effects during the closure phase will be limited to activities surrounding the dismantling and removal of structures and lines and will likely be relatively negligible. During the initial post-closure phase, early-seral plant communities will be susceptible to colonization by populations of invasive plant species. However, most populations of invasive plant species will become extinct in the post-closure phase as early-seral plant communities are replaced by mid- to late-seral plant communities.

5.2 Regulatory Setting

Hydro Power and Authority Act

This Act defines the roles, responsibilities and powers of BC Hydro. It also lists which other provincial legislation applies to BC Hydro. While some provincial enactments do not apply, BC Hydro considers the spirit and intent of relevant legislation whenever possible in developing project plans and EMPs and in completing this ESERs and is committed to avoiding or minimizing environmental and socio-economic effects whenever practicable.

Forest Act

The Lieutenant Governor-in-Council may designate any Crown land in a provincial forest as a “wilderness area” under Section 6 of the *Forest Act*. This section also states that wilderness areas may be cancelled or their boundaries amended. Wilderness areas are not formally protected from development under this Act.

Land Act

Select patches of old growth forests are protected by the *Land Act*.

Species at Risk Act

The federal *Species at Risk Act* (*SARA)* categorizes species as threatened, endangered, extirpated or of special concern. *SARA* prohibits a number of activities related to species listed in Schedule 1, including killing or harming the species, as well as the destruction of critical habitat. Critical habitat is identified in recovery strategies, if available. Species placed on Schedule 1 of *SARA* receive full regulatory protection on federal lands. The risk category is recommended by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). However, there may be a considerable time lag between when COSEWIC ranks plant species at risk and when they are added to Schedule 1 of *SARA*.

Although *SARA* applies only to federal lands, provincial practice and BC Hydro policy (BC Hydro, 2011) encourages proponents to consider *SARA* even when the project is not under federal jurisdiction.

5.2.1 Other Legislation Informing Guidelines, Standards, and Work Practices

The following Acts do not apply to BC Hydro. However, BC Hydro has developed guidelines, standards and work practices that reflect the spirit and intent of these Acts. Guidelines and BMPs for the management of invasive plants can be found in “Best Practices for Managing Invasive Species on Utility Operations” (Invasive Species Council of British Columbia, 2014).

Wildlife Act

The *Wildlife Act* protects certain ecological communities, such as riparian ecosystems on Crown land, as wildlife habitat. This act does not apply to BC Hydro but the authority observes the spirit and intent of the act whenever practicable, and works with regulators and through consultation with First Nations and stakeholders to avoid or minimize potential effects on wildlife, as part of its environmental planning process for projects.

Community Charter Act

Schedule 1 of the *Community Charter Act* lists several invasive plant species. This *Act* is not applicable to BC Hydro but guidance may be applied.

Forest and Range Practices Act

The *Forest and Range Practices Act* (*FRPA*) specifies “identified wildlife,” which includes one plant species and several ecological communities at risk. Identified wildlife are not legally protected but are provided conservation management and planning recommendations as part of Wildlife Habitat Areas (WHAs). The regulations address invasive plant species and riparian ecosystems on Crown land and contain an order establishing provincial non-spatial old growth objectives.

Weed Control Act

The *Weed Control Act* imposes a duty on all land occupiers, including utility companies, to control noxious weeds listed in Part I or II of Schedule A of the *Act* (Invasive Species Council of British Columbia, 2014).

5.3 Issues Scoping

Potential vegetation issues were identified using the following sources:

- Desktop literature review and information gathering from published information and publicly available datasets (AMEC, 2014);
- BC Species and Ecosystem Explorer—an online search tool that provides links to detailed information and tabular summaries of threatened and endangered species and ecosystems in BC (BC CDC, 2015a);
- BC CDC—non-sensitive and sensitive masked occurrences data (Data BC, 2015b);

- COSEWIC;
- *SARA* Registry (Government of Canada, 2015c);
- Kalum LRMP (Government of BC, 2002);
- Kalum SRMP (Government of BC, 2006);
- Kitimat Substation to Skeena Substation 287 kV Transmission Line, Draft Preliminary Environmental Route Evaluation Report (BC Hydro, 1990);
- Environmental Impact Report for Skeena – Kitimat 287 kV Transmission Line Forestry Studies (Hugh Hamilton Ltd., 1990);
- Notes from meetings and conference calls with potentially affected First Nations, which took place between February 2014 and October 2015; and
- Notes from meetings and conference calls with community members and stakeholders, which took place between February 2014 and October 2015.

Vegetation issues identified the following candidate VCs: First Nations botanical resources, plant species at risk, ecological communities at risk, old forests, OGMAs, riparian ecosystems, wetlands, sparsely vegetated ecosystems and unlisted terrestrial ecosystems. The issues and candidate VCs helped to delineate Local Study Areas (LSAs) and develop field surveys for the 2015 field season.

5.4 Spatial Boundaries

The Project footprint comprises a transmission line with a maximum clearing area width of 120 m and a 20 m average clearing area for new roads. These clearing areas are referred to as transmission line ROW, new access road and reconstruction access road for the purpose of this assessment and should not be confused with the 42 m Statutory ROW as defined in **Section 2.4.1**. The Project footprint is part of the LSA.

The LSA includes the maximum geographic extent of potential Project effects on vegetation VCs. A potential effect is any direct or indirect interactions the Project's construction, operation, or dismantling may have on vegetation VCs. Potential effects may be adverse, neutral or positive. Direct environmental changes would occur within the Project footprint due to clearing and ground disturbance during the clearing/construction phase to vegetation management during the operation/maintenance phase and to erosion during all phases. Indirect changes during the operation/maintenance phase would primarily result from the creation and maintenance of anthropogenic edges along the Project footprint (i.e. edge effect).

Edges may indirectly affect vegetation VCs because they alter the natural light and dust levels, air and soil moisture and temperature, hydrology, wind speed and disturbance regimes and they increase the ease with which humans can access the LSA. These changes may ultimately lead to the alteration of plant community composition and structure. While there is no absolute rule of thumb regarding precisely how far an edge effect penetrates into an ecological community, edge effect on cool north-facing slopes adjacent to trees is less severe and penetrates a shorter distance than those edges with a hot south-facing slope adjacent to an open habitat (Chen and Franklin, 1995; Gehlhausen et al., 2000; Gignac and Dale, 2007). Chen and Franklin (1995) found that the maximum depth of an edge's influence was about five tree heights. The tallest tree in the Project is Sitka spruce (*Picea sitchensis*), which can grow to a maximum recorded height of 95 m (Farrar, 1999). This results in a theoretical maximum depth of an edge's influence at 475 m. The LSA is therefore conservatively defined as 500 m from the edge of the engineering boundary and proposed new and reconstruction roads (**Figure 4.4-1**).

5.5 Valued Component Selection

The choice of VCs is critical to the identification of species or attributes that can potentially be affected by development on the landscape. EAO (2013) defines a VC as any "part of the environment that is considered important by the proponent, public, scientists or government involved in the assessment process. Importance may be determined on the basis of cultural values or scientific concern.*"* In addition to the methodology described in section 3, a final list of VCs was selected considering the following factors:

- The degree to which culturally, economically, ecologically or scientifically important species or ecosystems are potentially affected by the Project's activities and infrastructure; and
- The regulatory setting and existing guidelines

All nine candidate VC were selected as VCs. Nine possible candidate VCs were selected and all nine were included; see **Table 5.5-1** for rationale.

Table 5.5-1: Valued Ecosystem Components and Rationale for Inclusion

Possible Valued Component	Final Valued Components	Rationale
First Nations botanical resources	Included	Are susceptible to the Project's potential effects and are of high cultural value
Plant species at risk	Included	Are part of the regulatory setting, may be susceptible to the Project's potential effects and are of high cultural value.
Ecological communities at risk (listed communities)	Included	Are part of the regulatory setting, are susceptible to the Project's potential effects and are of high cultural value.
Old forests	Included	Are culturally and ecologically important and are susceptible to the Project's potential effects.
OGMAs	Included	Are part of the regulatory setting, are culturally, ecologically and scientifically important and are susceptible to the Project's potential effects.
Riparian ecosystems	Included	Are sensitive to potential Project effects, are culturally and ecologically significant and are part of the regulatory setting.
Wetlands	Included	Are sensitive to potential Project effects, are culturally and ecologically significant and are part of the regulatory setting, and are of high cultural value.
Sparsely vegetated ecosystems	Included	Are sensitive to potential Project effects, are culturally and ecologically significant and are part of the regulatory setting.
Unlisted terrestrial ecosystems	Included	Are sensitive to potential Project effects and are culturally and ecologically significant.

Note: OGMAs = Old Growth Management Areas.

5.6 Vegetation Studies

5.6.1 Methods

5.6.1.1 Desktop Overview

The authors conducted a desktop review (AMEC, 2014) to gather information on plant species and ecological communities in the LSA. The results of the 2014 review were updated for this report where required. The objectives of the desktop review were as follows:

- Provide an overview of environmental conditions;
- Identify potential sensitive environmental features;
- Compare two route options and identify potential environmental constraints for consideration in project planning, design, and scheduling; and
- Highlight differences in known or likely environmental issues along two proposed routes.

Desktop reviews were conducted before (AMEC, 2014) and after fieldwork (Burton, 2015) to document general information regarding First Nations botanical resources. Burton's report analyzed existing literature and data to provide a brief history of the First Nations involved and to document general information regarding traditional and current plant use of these peoples.

5.6.1.2 Fieldwork Methods

Ecosystem and plant species at risk field crews independently conducted fieldwork in the LSA between June and August 2015. An additional plant species at risk survey was conducted in July 2016. The ecosystem field crew completed 12 days of field work from July 7 to July 19, 2015. The plant species at risk crew completed two six-day surveys in 2016, one in June (2 to 7) and the other in July (17 to 22), and a third survey July 19 and 20 of 2016. Field crews prepared sampling plans prior to fieldwork. The ecosystem, plant species at risk and fisheries field crews incidentally recorded First Nations botanical resources, particularly Pacific crabapple populations, as they were encountered.

The primary objective of the ecosystem crew's fieldwork was to gather data to ground-truth the existing Predictive Ecosystem Map (PEM) (Trowbridge and Trowbridge, 2004). Ground-truthing is a critical step in the production of an accurate ecosystem map (RISC, 1998e). The ecosystem field crew comprised an ecosystem classification specialist, a soils scientist, a wildlife biologist and environmental technicians from the Haisla, Kitselas and Kitsumkalum First Nations. The ecosystem field crew gathered data using an electronic version of three types of data collection: site-visit (SIVI), visual checks and georeferenced notes and/or photographs. Site visit plots involved a detailed survey that included a complete plant species list with percent cover for each species, site information such as slope and aspect and soil data such as soil class, texture, and drainage as per provincial standards (BC MFLNRO & BC MOE, 2010). Visual checks are less detailed than SIVI plots, at a minimum consisting of a UTM coordinate and an ecosystem classification call, and were completed either at specific sampling point or from a distance are short . Visual inspections were also used to record the location of invasive plant species. Georeferenced notes and photographs were collected with Avenza PDF maps (version 2.7.4). The level of detail is similar to a visual inspection, the difference being the data are recorded in PDF maps whereas visual inspections were recorded on plot forms.

The primary objective of the plant species at risk field crew was to document the location and extent of plant species at risk populations in the LSA. This field crew comprised an Amec Foster Wheeler vascular plant species at risk specialist and field assistant, and environmental technicians from the Haisla, Kitselas and Kitsumkalum First Nations. The crew conducted two field surveys using a modified timed-meander search procedure (Goff et al., 1982). This procedure targeted habitats for plant species at risk identified during the desktop review (AMEC, 2014) (**Table 5.6-1**). Once the plant species at risk field crew was in one of these habitats, they did the following:

- Started at a convenient location and moved from point to point so as to investigate the full range of micro-habitats at a site;
- Recorded a track of their route using a Global Positioning System (GPS);
- Recorded all vascular plant species as they were encountered;
- Recorded plant species at risk using an electronic version of the BC CDC plant observation form (http://www.env.gov.bc.ca/cdc/documents/animlobs.pdf);
- Recorded and collected unknown plant species; and
- Continued searching the site until no new species were found for 15 minutes.

One survey for the plant species at risk VC was conducted between June 2 and June 7, 2015, and a second between July 17 and July 22, 2015. A third was conducted on July 19 and 20 of 2016. These surveys targeted time periods when plant species at risk identified during the desktop review (**Table 5.6-1**) are most conspicuous. The plant species at risk field crew also incidentally recorded invasive plant species as they were encountered.

Table 5.6-1: Plant Species at Risk Habitats Surveyed by the Plant Species at Risk Crew

Group	Scientific Name	Common Name	Habitat
bryophyte	*Gollania turgens*	gollania moss	Wet to moist calcareous rocks
bryophyte	*Sphagnum aongstroemii*	Aongstroem's sphagnum	Wet rock faces and relatively minerotrophic wetlands
fern	*Botrychium montanum*	mountain moonwort	Riparian old growth cedar
fern	*Botrychium pedunculosum*	stalked moonwort	Meadows, roadsides, brushy secondary woodlands and open to closed forests
fern	*Botrychium simplex* var. *compositum*	least moonwort	Open seasonally dry meadows
fern	*Botrychium spathulatum*	spoon-shaped moonwort	Grassy flats
fern	*Polystichum kruckebergii*	Kruckeberg's hollyfern	Weakly ultramafic talus
fern	*Polystichum lemmonii*	Lemmon's hollyfern	Weakly ultramafic talus
fern	*Polystichum setigerum*	Alaska holly fern	Riparian thickets
flowering plant	*Arceuthobium tsugense* subsp. *Mertensianae*	mountain hemlock dwarf mistletoe	*Tsuga mertensiana*

Group	Scientific Name	Common Name	Habitat
flowering plant	*Malaxis monophyllos* var. *brachypoda*	white adder's-mouth orchid	Swamps, bogs, stream banks, and moist forests
flowering plant	*Malaxis paludosa*	bog adder's-mouth orchid	Open sphagnum bogs, and swampy woods
flowering plant	*Montia chamissoi*	Chamisso's montia	Bogs, marshes and stream banks
flowering plant	*Pinguicula villosa*	hairy butterwort	Bogs or fens with peat
flowering plant	*Sparganium fluctuans*	water bur-reed	Bogs
flowering plant	*Brotherella roellii*	Roell's brotherella	Secondary forests and forest edge
flowering plant	*Callitriche heterophylla* var. *heterophylla*	two-edged water-starwort	Shallow ponds and slow-moving streams
lichen	*Leptogium polycarpum*	peacock vinyl	Trunks and branches of deciduous trees
lichen	*Nephroma occultum*	cryptic paw	Upper and middle canopy of old forests
lichen	*Pseudocyphellaria rainierensis*	Old-growth specklebelly	Drip zones of large yellow-cedar and calcareous toe-slope of old growth forests
lichen	*Sclerophora peronella*	frosted glass-whiskers	On bark at base of large black cottonwood in rich, shady cottonwood stands

5.6.1.3 Post-Fieldwork Methods and VC Descriptions

Ecosystem mapping is one of the most important steps in developing an ESER. At short timescales, the distributions of all plant and animal species are inextricably linked to the health and distribution of ecosystems. Determining the identity and circumscribing the limits of ecological communities makes quantifying potential Project effects on all vegetation, most wildlife and some fisheries VCs possible.

An ecosystem map of the LSA was developed using the following data sources:

- Vegetation Resource Inventory (VRI) (BC MFLNRO, 2013);
- VRI for TFL 41;
- FWA Stream Network and Wetlands (DataBC, 2008);
- Predictive Ecosystem Mapping for Kalum Forest District (Trowbridge and Trowbridge, 2004);
- A Field Guide to Site Identification and Interpretation for the Prince Rupert Forest Region (Banner et al., 1993);
- Biogeoclimatic Ecosystem Classification (BEC) version 9 BC (Ministry of Forests and Range. 2015);
- TRIM (contours);

- Orthophotos;
- Terrain Map (Clague, 1984);
- OGMAs (legal and non-legal); and
- Field data collected by the ecosystem, and plant species at risk field crews.

Ecosystem mapping was conducted in a two-dimensional digital environment in ArcGIS v. 10.2 and followed the principles and standards (RISC, 1998e) of Terrestrial Ecosystem Mapping (TEM). Orthophotographs were used as a basemap and were overlain with data sources listed above. Ecological information was displayed on ecosystem maps using a standard label format (RISC, 1998e) (**Figure 5.6-1**). The label indicates the decile, site series, map code; site modifiers, structural stage, and stand composition.

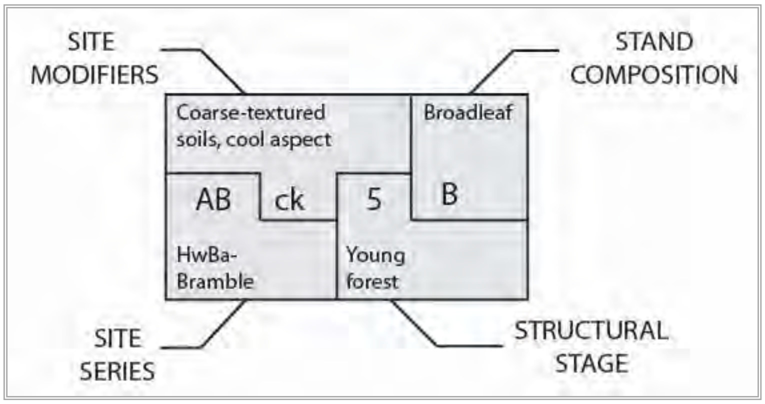


Figure 5.6-1: Typical Ecosystem Map Label

5.6.1.3.1 First Nations Botanical Resources

A post-fieldwork study was written (Burton, 2015) to document existing literature and data to provide a brief history of the First Nations involved and to document general information regarding traditional and current plant use of these peoples (**Appendix C.1**). A list of 68 species for Tsimshian First Nations and 95 Haisla First Nations traditional plants. In total 110 unique values. Of the 110 species, this list was reduced to 77 by dropping species or species categories that could not be run through the analysis. For example, broad species categories (e.g. currants, fungi, yellow hanging lichens etc), marine species or seaweed. The short-list was used to run the analysis. Amec FW field data and the provincial relevé data were used to calculate species diversity indexes for ecological communities in the Project. The objective of this analysis was to identify ecological communities that support a high number and high cover of First Nations botanical resources. The relevé data present a number of challenges and we wanted to ensure that our analysis was biologically meaningful. During the analysis, we found that unequal sample size between ecological communities and comparing data collected by different field crews often produced misleading result. We overcame these issues by analysing the same number of plots from each ecological community using data from the same field crews. For these reasons and with these data, it is not likely possible to compile a data matrix that comprises all species listed in the TLUS that would not produce erroneous results. However, these types of analysis are little affected by the addition or loss or plant species. We are confident that our original analysis is biologically meaningful and that we have identified ecological communities that support both the highest numbers and high covers of First Nations vegetation resources in the Project.

Several approaches were taken to identify ecological communities in the LSA that likely represent high quality habitat for First Nations botanical resources identified during the desktop review (AMEC, 2014; Burton, 2015; Downs, 2006) and may be influenced by potential Project effects. AMEC conducted three separate statistical analyses on a data matrix comprising the vegetation field crew's plot data and the province's biogeoclimatic relevé database (Ministry of Forests and Range, 2015). The Shannon-Wiener diversity index determined how likely it is, based on field data and relevé data, that a plant drawn at random from an ecological community is a First Nations botanical resource. Those communities with both a high species diversity of First Nations botanical resources and whose species share those communities equally (i.e. have equal cover values) have high Shannon-Wiener diversity index values (McCune & Grace, 2002). Initially, all plots in the relevé database were used to calculate the Shannon-Wiener diversity index, but uneven sample size (e.g. 298 plots for CWHvm1/01 and 2 plots for CWHvm1/wb13) led to grossly erroneous results. It was necessary to eliminate plots from ecological communities with too many plots and eliminate ecological communities with too few plots. After iteratively re-running the analyses with different numbers of plots, 15 plots per ecological community struck the best balance of maximum statistical power and including the greatest number of ecological communities. The 90th percentile for mean Shannon-Wiener diversity indices is the value at which 90% of the ecological communities have smaller mean values and 10% have larger values. Ecological communities in the top 10th percentile have mean Shannon-Wiener diversity indices that are greater than 90% of the other ecological communities. Conversely, 90% of ecological communities have lower mean Shannon-Wiener diversity indices. Using ArcGIS v. 10.2, the total area was calculated for ecological communities with mean Shannon-Wiener diversity indices in the top 10th percentile that occur in the transmission line ROW or new roads (**Table 5.6-6**).

One group of species and three individual species of First Nations botanical resources were identified in AMEC (2014), Burton (2015), and Downs (2006) as warranting special attention. These include berry-producing species, Pacific crabapple, devil's club and western redcedar (*Thuja plicata*). Berry-producing species include all blueberries, huckleberries and cranberries (*Vaccinium* sp.), raspberries (*Rubus* sp.) and currents (*Ribes* sp.) Table X below. The quality of ecological communities for berry-producing species was assessed using the Shannon-Wiener diversity index in the same manner as described above. Since the Shannon-Wiener diversity index is not appropriate for the analysis of single species, devil's club and western redcedar were assessed by determining their mean cover for all relevant ecosystems using the relevé database and plot data.

The total area of those ecological communities in the top 70th percentile for mean cover of devil's club and western redcedar in the transmission line ROW and new access roads was then calculated. However, only those polygons with structural stage six or older were included in the analysis for western redcedar (**Table 5.6-6**). Because Pacific crabapple is not as common as devil's club or western redcedar, all plots from the relevé and our dataset were used to identify all relevant ecological communities in which this species is known to occur. The area occupied by these ecological communities in the transmission line ROW, new access roads was then calculated. The same ecological community was only counted once during area calculations.

5.6.1.3.2 Plant Species at Risk

The plant species at risk VC is defined as any vascular or non-vascular (bryophyte or lichen) plant species, subspecies or varieties that meet one of more of the follow criteria:

- Is listed under Schedule 1 of *SARA*;
- Has been given a rank by COSEWIC other than not at risk;
- Has a BC list status of extinct, Red or Blue;
- Has a BC Rank of special concern (S3), imperiled (S2), critically imperiled (S1), historical (SH), or presumed extirpated (SX); and
- Is listed as an Identified Wildlife by the *FRPA*.

Habitat requirements for plant species at risk documented by the plant species at risk field crew in the LSA were determined by conducting a review of the primary and secondary literature.

5.6.1.3.3 Ecological Communities at Risk

An ecological community at risk is any plant association that meets one or more of the following criteria:

- Has a BC list status of Red or Blue; and
- Is listed as a category of species at risk by the *FRPA*.

In BC, the “plant association” is the basic unit of the ecological community at risk. It is a common ecological unit of the vegetation classification component of the BEC system. A “plant association” comprises a diagnostic suite of plant species at a particular successional stage. A “site series” is a location on the landscape that has the potential to produce a particular plant association at a given successional (seral) stage because of a shared suite of abiotic properties (e.g. slope, aspect and soil nutrient and moisture regimes). Site series support a range of plant associations during different seral stages. In many cases, but not all, only mid- to late-seral plant associations may be Red- or Blue-listed at a particular site series (Green, 2005). For example, mid-seral plant associations in some geographically restricted ecological communities at risk may be recommended for protection to achieve adequate recruitment rates of late-seral stages to ensure their persistence over the landscape (BC CDC, 2015a). The ecological communities at risk VC is defined as those communities that are greater than 140 years old and occur on site series likely to support ecological communities at risk.

The BC CDC database was searched to find potentially occurring Red- and Blue-listed ecological communities within the ecosections and BGC variants associated with the Kalum Forest District (BC CDC, 2015a). The BC CDC database was also searched for any mapped element occurrence records that may occur in the LSA (BC CDC, 2015b). The ecosystem map was queried to extract site series that potentially support Blue- or Red-listed ecological communities at risk in the LSA. However, site series with early seral stage communities are not likely to comprise listed plant association (i.e. listed ecological communities at risk). Only those site series older than 140 years are likely to harbour Red- or Blue-listed plant associations. Site series younger than 140 years were excluded from the analysis.

5.6.1.3.4 Old Forests

Old forests have a complexity that younger forests do not have. Old growth forests are characterized by stands with relatively tall, large trees, and structural diversity comprising multilayers, wildlife trees and coarse woody debris. Gaps in the forest canopy support non-shade-tolerant plants, while patches of dense canopy cover support shade-tolerant plants. The forest floor is typically composed of decaying wood, which supports a rich lichen and moss community. Retaining old growth forests has been identified as important for biodiversity and wildlife habitat. The Kalum SRMP recommends maintaining old seral stage forest reflective of the full range of ecosystems, some with interior forest conditions. Old forests are important for wildlife habitat but also for maintaining biodiversity. Retaining old forests is identified as a management objective in the Kalum LRMP and SRMP.

The age of old forests varies from one BGC unit to another. Forests that occur in areas where stand-initiating events are frequent have shorter intervals since their last disturbance, and old forests in these areas are generally older than 140 years. The time since last disturbance in stands with infrequent stand-initiating events is greater, and old growth forests in these areas are generally older than 250 years old. Old forests were identified using the ecosystem map attribute structural stage 7, which represents forests greater than 250 years old. The old forest VC is defined as structural stage 7 forests outside of Old Growth Management Areas. The latter are a distinct VC in this ESER.

5.6.1.3.5 Old Growth Management Areas

OGMAs are permanent old growth retention areas—removed from the operable forestland base—and are protected from harvesting and activities that cause blowdown within their boundary. The Kalum LRMP identifies OGMAs as an important component of biodiversity and recommends maintaining old growth forest attributes through designation of OGMAs across the landscape (Kalum LRMP Biodiversity Objective 2). Furthermore, the Kalum SRMP recommends maintaining old seral stage forest reflective of a full range of ecosystems, some with interior forest conditions (Objective 2, Kalum SRMP [2006]). Creating OGMAs involves considerable effort by regulators, stakeholders and First Nations; therefore, large-scale changes are often met with resistance. Some inclusions are permitted and the allowable disturbance is 10 ha or 10% of the OGMA area, whichever is less, to be disturbed for road development, boundary shifts, harvesting, or forest health issues provided that an alternative area within the same BGC variant and landscape unit of equal or greater extent will be retained.

5.6.1.3.6 Riparian Ecosystems

The riparian ecosystems VC is specific to the vegetation section and is separate from riparian vegetation discussed in the fisheries and aquatics section (**Section 4**). The riparian ecosystems VC should also not be confused with BC Hydro's Riparian Vegetation Management Areas (RVMAs) (BC Hydro, 2003a; 2003b). For the purposes of this ESER, the riparian ecosystems VC is meant to represent a generic buffer around wetlands, lakes and streams that is wide enough to support their long-term ecological functions.

Riparian ecosystems in the Kalum LRMP (Government of BC, 2002) and SRMP (Government of BC, 2006) are corridors that occupy areas adjacent to streams, lakes and wetlands that develop a typically rich and diverse array of plant species. The Kalum LRMP defines riparian as “the land adjacent to the normal high water line in a stream, river or lake and extending to the portion of land that is influenced by the presence of the adjacent ponded or channelled water” (Government of BC, 2002). Riparian ecosystems may be coniferous forest, deciduous forest, mixed or shrub-dominated. In addition to contributing to biodiversity, riparian ecosystems provide bank stability and connective corridors within a landscape and are an important source of coarse woody debris (CWD) and nutrient input for aquatic ecosystems (Banner and MacKenzie, 1998). While not all riparian ecosystems are characterized by distinctive vegetation, these ecosystems are nevertheless important because of their proximity to water (Banner and MacKenzie, 1998). Riparian ecosystems rely on adjacent upland habitat to support important ecological functions. These functions are generally found within one tree height of a stream (Stevens et al., 1995; Young, 2001) or one-and-a-half site-specific tree heights beyond the stream (Coast Information Team, 2004). BC MOE BMPs state that riparian ecosystems can extend 30 m or more from a water feature (BC MOE, 2014c). In this assessment, the riparian ecosystems VC incorporates a 36 m buffer from the edges of wetlands, lakes, and streams. This distance is based on the average tree height for trees greater than 250 years old (VRI age class 9). Average tree height in age class 9 forests was calculated using VRI data. The edges of wetlands and lakes were identified during the ecosystem mapping process. The centre line for each stream was identified using the Freshwater Atlas (BC MFLNRO, 2015b) in ArcGIS v. 10.2. Stream width for each stream order (**Table 5.6-2**) was determined using data gathered by the fisheries field crew (**Section 4**).

Table 5.6-2: Stream Orders and Average Channel Width

Stream Order	Average Channel Width (m)
1	3
2	5
3	10
4	22
5	41
6	40

The Lakelse River accounts for why stream order 5 is wider than stream order 6 in the LSA. Lakelse River is considered stream order 5, while the Wedeene River is stream order 6 even though the Lakelse River seems to be wider. Stream order denotes both the size of the stream and the amount of area that it drains. Wedeene River drains more area than the Lakelse River; therefore, it gets a higher stream order number even though it is not as wide.

Active floodplain ecosystems occupy areas adjacent to streams and rivers and are subject to periodic flooding, erosion and deposition events. The BEC system divides active floodplain ecosystems into high, middle, and low benches based on flooding frequency, vegetation composition and other factors (Banner et al., 1993; MacKenzie and Moran, 2004). Each has distinctive hydrological properties and plant communities with successional development progressing from low bench ecosystem to high bench ecosystems, depending on sediment accumulation and changes in channel morphology (deGroot, 2005; MacKenzie and Moran, 2004). Active floodplain ecosystems in the LSA that are also components of the riparian ecosystems VC include:

- Sitka spruce – Salmonberry (CWHvm1/09; CWHws1/07) – high fluvial bench;
- Black cottonwood – Red-osier dogwood (CWHvm1/10; CWHws1/08) – middle fluvial bench; and
- Black cottonwood – Willow (CWHvm1/11; CWHws1/09) – low fluvial bench.

5.6.1.3.7 Wetlands

The federal policy on wetland conservation (Government of Canada, 1991) defines wetlands as land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation and various types of biological activity that typically only occur in a wet environment. The wetlands is defined as any fens, marshes, swamps and shallow waters (usually 2 m deep or less) as defined by the National Wetlands Working Group (1997).

Wetlands are sensitive ecosystems and are vulnerable to disturbance, and as such, most wetland ecological communities are considered at risk (BC CDC, 2015a). Wetlands have a high biodiversity, and provide food, shelter, breeding habitat and cover for many species of amphibians, reptiles, mammals, birds and insects, as well as store, filter and maintain good water quality (Iverson et al., 2008).

Wetlands were identified and circumscribed in the LSA ecosystem map. Wetland extent was defined by the total size and distribution of wetland types within the LSA. Wetlands have been classified into five main categories (Pojar et al., 1991; Warner and Rubec, 1997): bog, fen, marsh, swamp and shallow open water. **Table 5.6-3** shows the typical water quality, hydrological source, soil characteristics, vegetation cover and habitat structure for these five wetland classes.

Wetlands serve many important functions, including hydrological, biogeochemical, habitat, ecological, social, cultural, commercial, aesthetic, recreational, and educational (Canadian Wildlife Service, 2008; Lynch-Stewart, 1996; Government of Canada, 1991; Hanson, 2008). Each function contributes to wetland value such as water quality, flood control, habitat for wildlife and habitat for plant species at risk. Provincial regulators consider a "no net loss of wetland function" to be a best management practice (BMP).

Table 5.6-3: Summary Characteristics of Wetland Classes in British Columbia

Wetland Class	Environmental Feature	Cover Type	Species Group
Bogs	Ombrotrophic; pH <5.5; >40 cm fibric/mesic peat	Conifer treed or low shrub	Sphagnum mosses, ericaceous shrubs, conifers
Fens	Groundwater-fed; pH >5; >40 cm fibric/mesic peat	Graminoid or low shrub	Deciduous shrubs, sedges, brown mosses
Marshes	Mineral soils or well-humified peat; protracted shallow flooding (0.5 m to 2.0 m)	Graminoid or forb	Large emergent sedge, grass, forb, horsetail species

Wetland Class	Environmental Feature	Cover Type	Species Group
Swamps	Mineral soils or well-humified peat; temporally shallow flooding (0.1 m to 1.0 m); significant water flow	Tall shrub or forested	Conifers, willows, alders, forbs, grasses, leafy mosses
Shallow waters	Permanent deep flooding (0.5 m to 2.0 m)	Aquatic	Aquatic species, emergent vegetation, <10% cover

Source: Adapted from MacKenzie and Moran, 2004

5.6.1.3.8 Sparsely Vegetated Ecosystems

Sparsely vegetated ecosystems VC comprises areas where rock or talus limits vegetation establishment. Vegetation cover is discontinuous and interspersed with bedrock or rock outcrops (Iverson et al., 2008), which include talus, cliff and rock outcrops. Ecosystem mapping data were queried to obtain output of sparsely vegetated areas such as rock outcrops, talus and cliffs. Sparsely vegetated ecosystems were included because they are sensitive to disturbance, have a high potential to contain plant species at risk, provide habitat for a variety of wildlife species (e.g. snakes, bats, mountain goat, and grizzly bear) and contribute to stand- and landscape-level biodiversity.

5.6.1.3.9 Unlisted Terrestrial Ecosystems

Unlisted terrestrial ecosystems defined as those terrestrial ecosystem that are not listed by the BC CDC and are not considered sensitive. This VC comprises unlisted terrestrial ecosystems that have not otherwise been assigned to a vegetation VC. In part, these ecosystems connect listed ecological communities and sensitive ecosystems across the landscape.

5.6.2 Existing Condition

This section synthesizes information from desktop overviews (AMEC, 2014; Burton, 2015) and field surveys to determine the existing condition of vegetation VCs in the LSA. The ecosystem field crew completed 260 ecosystem inspections, 65 of which were SIVI plots, 26 were visual checks and 169 were georeferenced notes and/or photographs. This field data was well-distributed across the study area from north to south. The field program aimed to capture as many different types of ecosystems, age classes, slope positions, aspects and BGC variants as possible. The ecosystem map of the LSA is provided as a mapbook in **Appendix C.2**. The section below describes the ecoregions and BGC variants of the LSA followed by a detailed account of existing conditions for each VC.

Ecoregions

The Project area encompasses one ecoprovince, two ecoregions, and two ecosections. The majority (72%) is the COG ecoregion and the Kitimat Ranges (KIR) ecosection (**Table 5.6-4**). The NRA ecoregion and the NAM ecosection comprise 28%.

Table 5.6-4: Ecoprovince, Ecoregion, and Ecosection in the Vegetation Local Study Area

Ecoprovince	LSA		Ecoregion	LSA		Ecosection	LSA	
	(ha)	(%)		(ha)	(%)		(ha)	(%)
Coast and Mountains	10,609	100	COG	2,930	72	KIR	2,930	72
			NRA	7,679	28	NAM	7,679	28
Total	**10,609**	**100**		**10,609**	**100**		**10,609**	**100**

Notes: LSA = Local Study Area; NRA = Nass Ranges; COG = Coastal Gap; NAM = Nass Mountain; KIR = Kitimat Ranges; ha = hectare; % = percent

Biogeoclimatic Units

There are five BGC variants in the LSA. The lower elevation variants are the most abundant. The CWHws1 variant has the greatest area (7,610 ha, 72% of LSA) and the CWHvm1 variant has the second greatest area (2,403 ha, 23% of LSA) (**Table 5.6-5**). The higher elevation variants, CWHws2, CWHvm2, and MHmm1, comprise 461 ha, 77 ha and 57 ha, respectively.

Table 5.6-5: Biogeoclimatic Units in the Vegetation Local Study Area

BGC Variant Unit	BGC Variant Name	LSA	
		(ha)	(%)
CWHws1	Coastal Western Hemlock Wet Submaritime Submontane	7,610	72
CWHws2	Coastal Western Hemlock Wet Submaritime Montane	77	1
CWHvm1	Coastal Western Hemlock Very Wet Maritime Submontane	2403	23
CWHvm2	Coastal Western Hemlock Montane Very Wet Maritime Montane	461	4
MHmm1	Mountain Hemlock Moist Maritime Windward	58	1
Total		**10,609**	**100**

Notes: BGC = biogeoclimatic; ha = hectare; LSA = Local Study Area; % = percent

5.6.2.1 First Nations Botanical Resources

The First Nations botanical resource VC comprises 97 plant species for the Haisla and 69 for the Tsimshian peoples (**Appendix C.2**; AMEC, 2014; Burton, 2015). Fungi, lichens and bryophytes were generally referred to by genera only, because either no particular use was recalled and/or identity of the precise species is in question. Collaborative work with First Nations to document traditional plant use occurred generally long after first contact, so much information is only partially remembered, or has been lost altogether (Burton, 2015). Since the completion of this assessment traditional use information has been made available by several First Nations. An addendum has been prepared to consider this additional information.

There are plant species of particular traditional and contemporary importance to the Haisla and Tsimshian peoples that can be found in the LSA. One currently important medicinal plant is devil's club. Devil's club was traditionally important to all northwest cultures, which is evident in the recordings of a "devil's club story" told by Harriet Hudson in 1947 to William Beynon. Devil's club remains important to both Haisla and Tsimshian communities and to all northwest coastal people (Turner, 1982; Compton, 1993). People still talk about devil's club with reverence and respect and commonly recall the name for it in their respective languages. Today, it is used for medicinal and spiritual purposes (Carla Burton, pers. comm., 2015). Devil's club is found frequently on moist-rich sites in the CWH zones (especially the CWHws variants), though it is less abundant on analogous sites in the CWHvm subzone and the MH zone. Similarly, Indian hellebore, a medicinal and spiritual plant is still considered important by some First Nations (Campbell, 2005; Vickers, 2008), is estimated to be frequent in the CWHvm2 and MHmm1 variants but is less frequent to rare in the other CWH variants.

Food plants, such as Alaskan blueberry and other vaccinium species and red huckleberry, are still collected and stored by many people. These species are frequently found throughout the LSA. Black huckleberry, another highly valued berry, is frequently found in the MHmm1 variant but is rarer in the CWH variants. Pacific crabapple, a historically important cultivated crop regaining popularity today, is estimated to be infrequent in the CWHws1, CWHvm1 and CWHvm2 variants and not found in the CWHwm2 and MHm1 variants. The proposed southern terminus of the transmission line is close to an old village site. At this site, there is evidence of old crabapple orchards as well as the presence of other traditionally important plants (Tirrul-Jones, 1985).

All parts of western redcedar are utilized by First Nations and is of particular importance because it was traditionally used for ceremonial head bands and neck rings, and is still used in making ceremonial regalia (Compton, 1993). Cedar-leading forests greater than 250 years old are also important predictors of culturally modified trees (Archaeology Branch, 2001).

Seventeen ecosystems meet our criteria for representing high-quality habitat for the First Nations botanical resources VC. These ecosystems occupy 2,626.5 ha (25%) of the LSA (**Table 5.6-6**).

Table 5.6-6: Ecosystems Supporting High Quality Habitat for First Nations Botanical Resources in the Local Study Area

BGC Unit	Ecosystem Name	Site Series	Map Code	Area of FN Botanical Resources in LSA (ha)	Percentage of Area of LSA	Reason for Including In Analysis				
						Top 10th Percentile for Diversity (✓)	Top 10th Percentile for Berries (✓)	Top 10th Percentile for Devil's Club (✓)	Important Pacific Crabapple Habitat (✓)	Top 30th Percentile for western redcedar (✓)
CWHws1	Amabilis fir - Western redcedar - Oak fern	04	AO**	474.9	4.5			✓		
CWHws1	Western hemlock - Amabilis fir - Queen's cup	05	HQ	164.1	1.6				✓	
CWHws1	Amabilis fir - Western redcedar - Devil's club	06	AD**	474.8	4.5		✓	✓		
CWHws1	Sitka spruce – Salmonberry	07	SS*	197.3	1.9	✓		✓		
CWHws1	Black cottonwood - Red-osier dogwood	08	CD**	116.5	1.1				✓	
CWHws1	Pink spirea - Sitka sedge	00	Ws50	34.1	0.3				✓	
CWHws1	Western redcedar - Sitka spruce - Skunk cabbage	11	Ws54**	154.5	1.5					✓
Total CWHws1				**1,616.1**	**15.4**					
CWHws2	Amabilis fir - Western redcedar - Oak fern	04	AO**	0.7	<0.1			✓		
CWHws2	Amabilis fir - Western redcedar - Devil's club	06	AD**	5.2	<0.1			✓		
Total CWHws2				**5.9**	0.1					
CWHvm1	Western hemlock - Western redcedar - Salal	03	HS**	228.1	2.2				✓	✓
CWHvm1	Western hemlock - Amabilis fir - Deer fern	06	HD**	60.5	0.6		✓			
CWHvm1	Amablis fir - Sitka spruce - Devil's club	08	AD**	405.2	3.9			✓		
CWHvm1	Sitka spruce - Salmonberry	09	SS*	52.0	0.5			✓		
CWHvm1	Black cottonwood - Red-osier dogwood	10	CD**	28.5	0.3	✓		✓		
CWHvm1	Western redcedar - Sitka spruce - Skunk cabbage	14	Ws54**	177.1	1.7	✓	✓		✓	
Total CWHvm1				**951.4**	**9.0**					
CWHvm2	Amabilis fir - Western redcedar - Foamflower	05	AF	27.5	0.3		✓			
CWHvm2	Amablis fir - Sitka spruce - Devil's club	08	AD**	25.6	0.2		✓			
Total CWHvm2				**53.0**	**0.5**					
Total First Nations Botanical Resource Ecosystems				**2,626.5**	**25.0**					
Total LSA				**10,520.2**						

Notes: BGC = biogeoclimatic; ha = hectare; * = Red-listed; ** = Blue-listed; % = percent
CWHws1 = Coastal Western Hemlock Wet Submaritime Montane variant; CWHws2 = Coastal Western Hemlock Very Wet Maritime Submontane variant; CWHvm1 = Coastal Western Hemlock Montane Very Wet Maritime Submontane variant; CWHvm2 = Coastal Western Hemlock Montane Very Wet Maritime Montane variant.
[1]Ecological communities with mean Shannon-Wiener diversity indices in the top 10th percentile for First Nations botanical resources. Ecological communities in the top 90th percentile have a higher mean Shannon-Wiener diversity index than 90% of other ecological communities. [2]Ecological communities with mean Shannon-Wiener diversity indices in the top 10th percentile for berry-producing First Nations botanical resources. [3]Ecological communities with mean cover values in the top 30th percentile for devil's club. [4]Ecological communities with known records for Pacific crabapple. [5]Ecological communities with mean cover values in the top 30th percentile for western redcedar and older than age class 6

5.6.2.2 Plant Species at Risk

The plant species at risk VC comprises two Blue-listed plant species: white adder's-mouth orchid (**Figure 5.6-2**; *Malaxis monophyllos* var. *brachypoda* [A. Gray] F. Morris & E.A. Eames) and bog adder's-mouth orchid (**Figure 5.6-2**; *Malaxis paludosa* [L.] Sw.). Both species were observed in open, sloped bogs near rivers in the LSA. The micro-topographical heterogeneity in these peatlands results in a rich mosaic of plant species dominated by shore sedge (*Carex limosa*), white beak-rush (*Rhynchospora alba*), and buckbean (*Menyanthes trifoliata*). Dominant mosses include yellow-green peat moss (*Sphagnum angustifolium*), Magellanic peat-moss (*Sphagnum magellanicum*), and Warnstorf's peat-moss (*Sphagnum warnstorfii*). During the 2015 growing season, white adder's-mouth orchid flowered in June in the LSA. It was recorded at a single site near the Little Wedeene River. Bog adder's-mouth orchid flowered in July during the 2015 growing season in the LSA. It was recorded in every sloped bog with micro-topographical heterogeneity visited by the plant species at risk field crew during the July site visit. These two species of adder's-mouth orchid are easily overlooked if they are not specifically being searched. **Table 5.6-7** gives the locality information for all known adder's-mouth orchid populations in the Kitimat Valley. **Appendix C.3** shows the distribution of plant species at risk VC in the LSA.

Although these two adder's-mouth orchid species may be found in a wide variety of habitats across their ranges, they specialize in the exploitation of moist, moss-dominated ecosystems devoid of much competition from other flowering plants. In the LSA, open, slightly sloped, buck bean-shore, sedge-peat moss bogs (Wb13) with micro-topographical heterogeneity seem to meet the pH, moss and competition requirements for these orchid species. In other parts of their ranges, these species are found in open forested swamps with a robust bryophyte layer but little else (Reddoch & Reddoch, 1997). Forested swamps in the LSA are not likely to harbour large populations of these orchids because of too much competition from other flowering plants in the herb layer.

The Blue-listed Alaska holly fern (*Polystichum setigerum*) is difficult to identify because it co-occurs with similar looking Anderson's hollyfern (*P. andersonii*) and Braun's hollyfern (*Polystichum braunii*) (Cody and Britton, 1989; Wagner, 1979). The plant species at risk field crew spent as much time as possible investigating populations of *P. braunii* and *P. andersoni* but failed to detect *P. setigerum*.

The plant species at risk field crew targeted suitable habitat (**Table 5.6-7**) for the following *SARA*-listed lichens: peacock vinyl (*Leptogium polycarpum*), cryptic paw (*Nephroma occultum*), *oldgrowth specklebelly* (*Pseudocyphellaria rainierensis*), and frosted glass-whiskers (*Sclerophora peronella*). The plant species at risk specialist familiarized himself with these *SARA*-listed lichens by visiting the collection at the University of British Columbia herbarium and conducting desktop research.

Notes: Left; *Malaxis monophyllos* var. *brachypoda*
Right; *Malaxis paludosa*

Figure 5.6-2: Adder's-mouth Orchids of the Kitimat Valley

Table 5.6-7: Location of Adder's-mouth Orchid Populations in the Kitimat Valley

Species	Location	Habitat	Collector and Number	Date
Malaxis monophyllos var. *brachypoda*	Lakelse Lake	Unknown	*G. Mendel s.n.*	10 August 1975
Malaxis monophyllos var. *brachypoda*	Near Kitimat City Centre	Bog	*G. Mendel s.n.*	15 June 1975
Malaxis monophyllos var. *brachypoda*	North side of Little Wedeene River	Buck bean-shore sedge- peat moss bog	*Sears & Prentice TKTP002*	2 June 2015
Malaxis paludosa	Kitimat	Unknown	*G. Mendel s.n.*	12 August 1972
Malaxis paludosa	South side of Little Wedeene River	Buck bean-shore sedge- peat moss bog	*Sears, Moore & Wilson TKTP013*	17 July 2015
Malaxis paludosa	North side of Little Wedeene River	Buck bean-shore sedge- peat moss bog	*Sears, Moore & Wilson TKTP014*	17 July 2015
Malaxis paludosa	Between Wedeene and Little Wedeene Rivers	Buck bean-shore sedge- peat moss bog	*Sears, Moore & Wright TKTP015*	18 July 2015
Malaxis paludosa	Between Wedeene and Little Wedeene Rivers	Buck bean-shore sedge- peat moss bog	*Sears, Moore & Bolton TKTP020*	20 July 2015
Malaxis paludosa	North side of Wedeene River	Buck bean-shore sedge- peat moss bog	*Sears, Moore & Bolton TKTP017*	19 July 2015

Notes: s.n. = without collection numbers

5.6.2.3 Ecological Communities at Risk

Based on the BC CDC (2015a) database, 16 ecological communities at risk potentially occur in the LSA. Depending on BGC unit, they may have different rankings. Twelve out of the 16 ecological communities at risk were field verified and mapped, (**Appendix C.4**). However, only forested ecological communities greater than 140 years old are likely to be ecological communities at risk (i.e. the plant association at risk). Conversely, ecological communities younger than 140 years are not likely to be ecological communities at risk because the plant association that forms the basis of an ecological community at risk has not developed due to the early seral stage at that particular site. All non-forested wetland communities were included in this analysis. The ecological community at risk VC comprise one Red-listed and nine Blue-listed ecological communities.

The total area of ecological communities at risk in the LSA is 1,044.6 ha (9.9% of the total LSA area), (**Table 5.6-8**, **Appendix C.3**). All percentages presented from this point forward are based on the total area of ecological communities at risk in the LSA, not the total are of the LSAs. Some ecological communities at risk occur in more than one variant.

Red-listed ecological community at risk cover 183 ha of the LSA, and Blue-listed ecological communities at risk cover 861 ha of the LSA. Upland ecological communities at risk account for 715.7 ha (68.5%), riparian floodplain forest for 211.6 ha (20.3%) and wetlands for the final 117.2 ha (11.2%) of the total area occupied by ecological communities at risk. Two variants of the Sitka spruce – Salmonberry ecological community at risk,—CWHws1 07/SS and CWHvm1 09/SS comprise the only Red-listed ecological community at risk. The Sitka spruce – Salmonberry community is a high-bench, active floodplain site prone to infrequent flood events and occupies 146.8 ha (14.1%) in the CWHws1 variant and 36.4 ha (1.7%) in the CWHvm1 variant. The most widespread ecological community at risk is the Blue-listed Amabilis fir – Western redcedar – Devil's club (AD) ecological community at risk, comprising 320.8 ha (30.7% of the LSA): 224.7 ha in the CWHws1, 72.1 ha in the CWHvm1 and 24.0 ha in the CWHvm2. As a result of a continual influx of nutrients via subsurface seepage, this community is one of the most productive in the LSA with old forests supporting large amablis fir, western hemlock, and Sitka spruce, and a dense to very dense understory of devil's club along with various ferns. The second most widespread ecological community at risk is the lbue-listed Western hemlock – Western redcedar – Salal (03/HS) comprising 208.9 ha. A total area of 90.2 ha occurs in the CWHvm1 and 118.7 occurs in the CWHvm2. The 03/HS unit occurs on shallow, steep, upper slopes with rapid drainage, which results in very dry soil conditions in the southern portion of the LSA.

Table 5.6-8: Ecological Communities at Risk Mapped in the Local Study Area

BGC Unit	Ecosystem Name	Site Series	Map Code	Area of Ecological Communities at Risk in LSA (ha)	Percentage of Total Ecological Communities at Risk (%)	Percentage of LSA (%)
CWHws1	Lodgepole pine – Kinnikinnick	02	LK*	<0.1	<0.1	<0.1
CWHws1	Western hemlock – Lodgepole pine – Feathermoss	03	HM**	79.0	7.6	0.8
CWHws1	Amabilis fir – Western redcedar – Oak fern	04	AO**	44.8	4.3	0.4
CWHws1	Amabilis fir – Western redcedar – Devil's club	06	AD**	224.7	21.5	2.1
Total CWHws1 Upland				**348.5**	**33.4**	**3.3**
CWHws1	Sitka spruce – Salmonberry	07	SS*	146.8	14.1	1.4
CWHws1	Black cottonwood – Red-osier dogwood	08	CD**	20.2	1.9	0.2
Total CWHws1 Riparian Floodplain Forest				**167.0**	**16.0**	**1.6**
CWHws1	Shore sedge – Buckbean – Peatmoss	00	Wb13**	9.1	0.9	0.1
CWHws1	Slender sedge – Buckbean	00	Wf06**	0.5	<0.1	<0.1
CWHws1	Western redcedar – Sitka spruce – Skunk cabbage	11	Ws54**	55.8	5.3	0.5
Total CWHws1 Wetlands				**65.3**	**6.3**	**0.6**
Total CWHws1				**580.9**	**55.6**	**5.5**
CWHws2	Amabilis fir – Western redcedar – Oak fern	04	AO**	0.7	0.1	<0.1
Total CWHws2 Upland				0.7	0.1	<0.1
Total CWHws2				**0.7**	**0.1**	**0.0**
CWHvm1	Western hemlock – Western redcedar – Salal	03	HS**	90.2	8.6	0.9
CWHvm1	Western hemlock – Amabilis fir – Deer fern	06	HD**	14.2	1.4	0.1
CWHvm1	Amablis fir – Sitka spruce – Devil's club	08	AD**	72.1	6.9	0.7
Total CWHvm1 Upland				**176.5**	**16.9**	**1.7**
CWHvm1	Sitka spruce – Salmonberry	09	SS*	36.4	3.5	0.3
CWHvm1	Black cottonwood – Red-osier dogwood	10	CD**	8.2	0.8	0.1
Total CWHvm1 Riparian Floodplain Forest				**44.6**	**4.3**	**0.4**
CWHvm1	Shore sedge – Buckbean – Peatmoss	00	Wb13**	8.5	0.8	0.1
CWHvm1	Western redcedar – Sitka spruce – Skunk cabbage	14	Ws54**	43.4	4.2	0.4

BGC Unit	Ecosystem Name	Site Series	Map Code	Area of Ecological Communities at Risk in LSA (ha)	Percentage of Total Ecological Communities at Risk (%)	Percentage of LSA (%)
Total CWHvm1 Wetlands				**51.9**	**5.0**	**0.5**
Total CWHvm1				**273.0**	**26.1**	**2.6**
CWHvm2	Western hemlock – Western redcedar – Salal	03	HS**	118.7	11.4	1.1
CWHvm2	Western hemlock – Amabilis fir – Deer fern	06	HD**	47.3	4.5	0.4
CWHvm2	Amablis fir – Sitka spruce – Devil's club	08	AD**	24.0	2.3	0.2
Total CWHvm2 Upland				**190.1**	**18.2**	**1.8**
Total CWHvm2				**190.1**	**18.2**	**1.8**
Total Upland Communities at Risk				**715.7**	**68.5**	**6.8**
Total Riparian Floodplain Forest at Risk				**211.6**	**20.3**	**2.0**
Total Wetlands at Risk				**117.2**	**11.2**	**1.1**
Total Ecological Communities At Risk				**1,044.6**	**100.0**	**9.9**
Total LSA	**10,520.2**					

Notes: BGC = biogeoclimatic; ha = hectare**;** * = Red-listed; ** = Blue-listed; % = percent
CWHws1 = Coastal Western Hemlock Wet Submaritime Montane variant; CWHws2 = Coastal Western Hemlock Very Wet Maritime Submontane variant; CWHvm1 = Coastal Western Hemlock Montane Very Wet Maritime Submontane variant; CWHvm2 = Coastal Western Hemlock Montane Very Wet Maritime Montane variant; MHmm1 = Mountain Hemlock Moist Maritime Windward variant; LSA = Local Study Area

5.6.2.4 Old Forest

Many areas throughout the LSA have experienced extensive logging and other disturbance, leading to fragmented patches of old forests and a greater prominence of early seral stages. Roughly, 81% of forested ecosystems in the LSA are in early seral stage (shrub, pole sapling, young) due largely to harvesting. The few old forest that remain are heavily fragmented and contain a network of active, retired, and deactivated forestry roads.

A total of 1,764 ha of old forest VC occurs in the LSA. Upland old forest comprises 1,659.7 ha (94.1% of the LSA), riparian floodplain old forest comprises 64.3 ha (3.6% of the LSA), and wetland old-forest comprises 39.7 ha (2.3% of the LSA) (**Table 5.6-9**, **Appendix C.3**).

The most widespread upland old forest occurring throughout the LSA in all BGC variants is the mesic Western hemlock – Amabilis fir – Bramble (01/AB) ecosystem comprising 963.9 ha (54.7% of the LSA). The second most widespread upland old forest is the wet forest ecosystem—CWHws1 and CWHws2 06/AD and CWHvm1 and CWHvm2 08/AD—comprising 298.1 ha (16.9% of the LSA). The third most widespread upland old forest are the dry forest ecosystems—CWHws1 03/HM and CWHvm1 and CWHvm2 03/HS—comprising 203.6 ha (11.5%). The most widespread riparian floodplain ecosystem is the Sitka spruce – Salmonberry (SS) ecosystem comprising 58.9 ha (3.3%) and occurs in the CWHws1 and CWHvm1. The most widespread wetland with old forest is the Western redcedar – Sitka spruce – Skunk cabbage swamp forest comprising 22.4 ha (1.3% of the LSA).

Table 5.6-9: Old Forest in the Local Study Area

BGC Unit	Ecosystem Name	Site Series	Map Code	Area of Old Forest (ha)	Percentage of Old Forest (%)	Percentage of LSA (%)
CWHws1	Western hemlock – Amabilis fir - Bramble	01	AB	526.7	29.9	5.0
CWHws1	Western hemlock – Lodgepole pine – Feathermoss	03	HM**	22.4	1.3	0.2
CWHws1	Amabilis fir – Western redcedar – Oak fern	04	AO**	41.3	2.3	0.4
CWHws1	Amabilis fir – Western redcedar – Devil's club	06	AD**	209.4	11.9	2.0
Total CWHws1 Upland				**799.8**	**45.3**	**7.6**
CWHws1	Sitka spruce - Salmonberry	07	SS*	51.7	2.9	0.5
CWHws1	Black cottonwood – Red-osier dogwood	08	CD**	5.5	0.3	0.1
Total CWHws1 Riparian Floodplain Ecosystem				**57.1**	**3.2**	**0.5**
CWHws1	Western redcedar – Sitka spruce – Skunk cabbage	11	Ws54**	22.4	1.3	0.2
Total CWHws1 Wetlands				**22.4**	**1.3**	**0.2**
Total CWHws1				**879.2**	**49.9**	**8.4**
CWHws2	Western hemlock – Amabilis fir – Bramble	01	AB	65.9	3.7	0.6
CWHws2	Amabilis fir – Western redcedar – Oak fern	04	AO**	0.7	<0.1	<0.1
CWHws2	Amabilis fir – Western redcedar – Devil's club	06	AD	5.1	0.3	<0.1
Total CWHws2 Upland				**71.7**	**4.1**	**0.7**
Total CWHws2				**71.7**	**4.1**	**0.7**
CWHvm1	Western hemlock – Amabilis fir – Blueberry	01	AB	237.8	13.5	2.3
CWHvm1	Western hemlock – Western redcedar – Salal	03	HS**	73.4	4.2	0.7
CWHvm1	Amabilis fir – Western redcedar – Foamflower	05	AF	18.3	1.0	0.2
CWHvm1	Western hemlock – Amabilis fir – Deer fern	06	HD**	14.2	0.8	0.1
CWHvm1	Amablis fir – Sitka spruce – Devil's club	08	AD**	59.9	3.4	0.6
Total CWHvm1 Upland				**403.6**	**22.9**	**3.8**
CWHvm1	Sitka spruce – Salmonberry	09	SS*	7.2	0.4	0.1
Total CWHvm1 Riparian Floodplain Ecosystem				**7.2**	**0.4**	**0.1**
Total CWHvm1				**410.7**	**23.3**	**3.9**
CWHvm2	Western hemlock – Amabilis fir – Blueberry	01	AB	133.5	7.6	1.3

BGC Unit	Ecosystem Name	Site Series	Map Code	Area of Old Forest (ha)	Percentage of Old Forest (%)	Percentage of LSA (%)
CWHvm2	Western hemlock – Western redcedar – Salal	03	HS**	107.8	6.1	1.0
CWHvm2	Amabilis fir – Western redcedar – Foamflower	05	AF	25.4	1.4	0.2
CWHvm2	Western hemlock – Amabilis fir – Deer fern	06	HD**	36.7	2.1	0.3
CWHvm2	Amablis fir – Sitka spruce – Devil's club	08	AD**	23.8	1.3	0.2
Total CWHvm2 Upland				**327.1**	**18.5**	**3.1**
CWHvm2	Western redcedar – Yellowcedar – Goldthread	12	YG	17.3	1.0	0.2
Total CWHvm2 Wetlands				**17.3**	**1.0**	**0.2**
Total CWHvm2				344.4	19.5	3.3
MHmm1	Mountain hemlock – Amabilis fir – Blueberry	01	MB	18.5	1.0	0.2
MHmm1	Mountain hemlock – Amabilis fir – Mountain heather	02	MM	39.1	2.2	0.4
Total MHmm1 Upland				**57.6**	**3.3**	**0.5**
Total MHmm1				**57.6**	**3.3**	**0.5**
Total Upland				**1,659.7**	**94.1**	**15.8**
Total Riparian Floodplain Ecosystem				**64.3**	**3.6**	**0.6**
Total Wetlands				**39.7**	**2.3**	**0.4**
Total OGF in LSA				**1,763.7**	**100.0**	**16.8**
Total LSA	**10,520.2**					

Notes: BGC = biogeoclimatic; LSA = Local Study Area; ha = hectare; OGF = old growth forest; % = percent; CWHws1 = Coastal Western Hemlock Wet Submaritime Montane variant; CWHws2 = Coastal Western Hemlock Very Wet Maritime Submontane variant; CWHvm1 = Coastal Western Hemlock Montane Very Wet Maritime Submontane variant; CWHvm2 = Coastal Western Hemlock Montane Very Wet Maritime Montane variant; MHmm1 = Mountain Hemlock Moist Maritime Windward variant; LSA = Local Study Area

5.6.2.5 Old Growth Management Area

There are 22 spatially defined legal OGMAs within the LSA (**Table 5.6-10**, **Appendix C.3**) with a combined total of 343.3 ha, representing 3.3% of the LSA. Legal OGMA boundaries do not end at the LSA boundary but extend beyond; the total original extent of all legal OGMAs that intersect with the LSA is 905 ha.

Table 5.6-10: Old Growth Management Area in the Local Study Area

Legal OGMA	Legal OGMA Internal ID	Size of OGMA (ha)	Area of OGMA in LSA (ha)	Percentage of OGMA in LSA (%)	Percentage of LSA (%)
SKE_KLM_402	9177	65	12.9	3.8	0.1
SKE_KLM_410	9185	12	2.5	0.7	<0.1
SKE_KLM_428	9203	12	<0.1	0.0	<0.1
SKE_KLM_446	9220	0.9	0.9	0.3	<0.1
SKE_KLM_447	9221	5.4	2.1	0.6	<0.1
SKE_KLM_467	9239	96	87.7	25.5	0.8
SKE_KLM_473	9245	31	10.3	3.0	0.1
SKE_KLM_477	9249	36.72	22.6	6.6	0.2
SKE_KLM_488	9260	0.12	0.1	<0.1	<0.1
SKE_KLM_498	9270	0.1	0.1	<0.1	<0.1
SKE_KLM_499	9271	0.3	0.3	0.1	<0.1
SKE_KLM_500	9272	0.1	0.1	<0.1	<0.1
SKE_KLM_501	9273	5.81	5.8	1.7	0.1
SKE_KLM_502	9274	1.2	1.3	0.4	<0.1
SKE_KLM_509	9281	4.3	4.3	1.3	<0.1
SKE_KLM_512	9284	0.4	0.4	0.1	<0.1
SKE_KLM_604	9376	184	21.9	6.4	0.2
SKE_KLM_609	9381	73.25	58.8	17.1	0.6
SKE_KLM_611	9383	24	23.8	6.9	0.2
SKE_KLM_617	9389	27.98	28.0	8.2	0.3
SKE_KLM_629	9401	55.3	55.3	16.1	0.5
SKE_KLM_646	9418	269	4.1	1.2	<0.1
Total OGMA		**905**	**343.3**	**100.0**	**3.3**
Total LSA	**10,520.20**				

Notes: OGMA = Old Growth Management Area; ID = identification; ha = hectare; % = percent;
Total LSA = 10,609 ha; OGMA = Old Growth Management Area; LSA = Local Study Area

5.6.2.6 Riparian Ecosystems

The LSA has several large creeks and rivers with extensive riparian floodplain complexes associated with high-value riparian ecosystems (e.g. Lakelse River, Coldwater Creek, Cecil Creek, Lone Wolf Creek, Wedeene River, Little Wedeene River and Anderson Creek). The Kitimat River lies east and is outside of the LSA. Hai Lake, End Lake and West Lake occur within the LSA.

Riparian ecosystems comprise 1,677.1 ha (15.9%) of the LSA (**Table 5.6-11**, **Appendix C.3**). The majority (96.4%) of riparian ecosystems are found in the valley bottom and lower elevations (i.e. CWHws1 and CWHvm1). The greatest extent of riparian ecosystems in the LSA occurs in the CWHws1 (1,142.4 ha) and the CWHvm1 (474.4 ha).

A total of 414.1 ha (3.9% of the LSA) of all riparian ecosystems are active floodplains. The greatest extent is represented by the high-bench Sitka spruce – Salmonberry (CWHws1 07/SS) ecosystems comprising 197.3 ha (47.6% of the LSA). This ecosystem accounts for 52 ha (12.6%) in the CWHvm1 (09/SS). The middle-bench Black cottonwood – Red-osier dogwood (CWHws1 08/CD) ecosystem comprises 116.5 ha (28.1% of the LSA), while the same unit in the CWHvm1 variant comprises 28.5 ha (6.9% of the LSA). Low-bench ecosystems occupy areas closest to the river and experience frequent flood events annually. The CWHws1 Black cottonwood – Willow (09/CW) comprises a total of 14.6 ha (3.5% of the LSA) and in the CWHvm1 (11/CW) unit comprises 5.2 ha (1.3% of the LSA).

Table 5.6-11: Riparian Ecosystems in the Local Study Area

BGC Unit	Ecosystem Name	Site Series	Map Code	Area of Riparian Ecosystem (ha)	Percentage of Total Riparian Ecosystem in LSA (%)	Percentage of the LSA (%)
CWHws1	Non-floodplain Riparian Ecosystems	-	-	814.0	48.5	7.7
CWHws1	[1]Sitka Spruce – Salmonberry	07	SS*	197.3	11.8	1.9
CWHws1	[1]Black cottonwood – Red-osier dogwood	08	CD**	116.5	6.9	1.1
CWHws1	[1]Black cottonwood – Willow	09	CW	14.6	0.9	0.1
Total CWHws1 Riparian Ecosystems				**1,142.4**	**68.1**	**10.9**
CWH ws2	Non-floodplain Riparian Ecosystems	-	-	3.7	0.2	<0.1
Total CWHws2 Riparian Ecosystems				**3.7**	**0.2**	**0.0**
CWHvm1	Non-floodplain Riparian Ecosystems	-	-	388.7	23.2	3.7
CWHvm1	[1]Sitka Spruce – Salmonberry	09	SS*	52.0	3.1	0.5
CWHvm1	[1]Black cottonwood – Red-osier dogwood	10	CD**	28.5	1.7	0.3
CWHvm1	[1]Black cottonwood – Willow	11	CW	5.2	0.3	<0.1
Total CWHvm1 Riparian Ecosystems				**474.4**	**28.3**	**4.5**
CWHvm2	Non-floodplain Riparian Ecosystems	-	-	47.5	2.8	0.5
Total CWHvm2 Riparian Ecosystems				**47.5**	**2.8**	**0.5**
MHmm1	Non-floodplain Riparian Ecosystems	-	-	9.1	0.5	0.1
Total MHmm1 Riparian Ecosystems				**9.1**	**0.5**	**0.1**
Total Riparian Floodplain Ecosystems				**1,677.1**	**100.0**	**15.9**
Total LSA	**10,520.2**					

Notes: [1] = floodplain riparian ecosystem. * = Red-listed; ** = Blue-listed; BGC = biogeoclimatic; ha = hectare; LSA = Local Study Area; % = percent; CWHws1 = Coastal Western Hemlock Wet Submaritime Montane variant; CWHvm1 = Coastal Western Hemlock Montane Very Wet Maritime Submontane variant; LSA = Local Study Area.

5.6.2.7 Wetlands

Wetlands are presented by total wetland area and wetland types (**Table 5.6-12**) and their distribution is shown in **Appendix C.3**.

The total wetland extent in the LSA is 591.3 ha (5.6% of the total LSA). Wetlands are classified to wetland type based on the Wetlands of BC (Mackenzie and Moran, 2004) where possible. However, during the mapping process not all wetlands are attributable down to a detailed site level without ground verification. Where site-level classification was not possible, wetlands were classified to broad categories consisting of bog, fen, marsh and swamp.

Swamp wetlands account for the greatest area of all wetland types in the LSA and comprise 447.3 ha (75.6% of all wetlands in the LSA). Bog forests have the second greatest area, 91.2 ha (15.4% in the LSA), followed by fens at 25.3 ha (4.3% in the LSA), shallow open water at 14.3 ha (2.4% in the LSA) and marshes at 13.3 ha (2.3% in the LSA).

The western redcedar – Sitka spruce – skunk cabbage (CWHws1 11/Ws54 and CWHvm1 14/Ws54) accounts for 331.6 ha (56.1% of all wetlands in the LSA) of the predominant wetland types. These western redcedar – Sitka spruce –skunk cabbage wetlands form extensive wetlands throughout the LSA. They are found on level sites or in depressions with either deep or shallow organic soils. These treed wetlands are characterized by a diversity of tree species, although cold, saturated soils limit tree productivity and most stands are stunted. The understory is rich and diverse with an array of shrubs and herbs. Common tree and shrub species include western redcedar, western hemlock, Sitka spruce, amabilis fir, mountain hemlock, red alder, mountain alder, Pacific crabapple, red-osier dogwood, false azalea, blueberries, highbush cranberry, devil's club, gooseberries and red raspberry.

Table 5.6-12: Wetlands in the Local Study Area

BGC Unit	Ecosystem Name	Site Series	Map Code	Area of Wetlands (ha)	Percentage of All Wetlands in LSA (%)	Percentage of LSA (%)
CWHws1	Lodgepole pine – Sphagnum	10	LS	29.0	4.9	0.3
CWHws1	Wetland bog	00	Wb	5.7	1.0	0.1
CWHws1	Shore sedge – Buckbean – Peatmoss	00	Wb13**	9.1	1.5	0.1
CWHws1	Labrador tea – Bog laurel – Peatmoss	00	Wb50	3.3	0.6	<0.1
CWHws1	Wetland fen	00	Wf	20.2	3.4	0.2
CWHws1	Slender sedge – Buckbean	00	Wf06**	0.5	0.1	<0.1
CWHws1	Wetland marsh	00	Wm	5.8	1.0	0.1
CWHws1	Swamp horsetail – Beaked sedge	00	Wm02	1.0	0.2	0.0
CWHws1	Wetland swamp	00	Ws	2.4	0.4	0.0
CWHws1	Pink spirea – Sitka sedge	00	Ws50	34.1	5.8	0.3
CWHws1	Red alder – Skunk cabbage	00	Ws52	18.2	3.1	0.2
CWHws1	Western redcedar – Sitka spruce – Skunk cabbage	11	Ws54**	154.5	26.1	1.5
CWHws1	Shallow Open Water	00	OW	8.7	1.5	0.1
Total CWHws1 Wetlands				**292.4**	**49.5**	**2.8**
CWHvm1	Lodgepole pine – Sphagnum	13	LS	5.5	0.9	0.1
CWHvm1	Wetland bog	00	Wb	0.2	<0.1	<0.1
CWHvm1	Shore sedge – Buckbean - Peatmoss	00	Wb13**	8.5	1.4	0.1
CWHvm1	Wetland fen	00	Wf	4.6	0.8	0.0
CWHvm1	Sitka sedge – Hemlock-parsley	00	Wm50	6.5	1.1	0.1
CWHvm1	Pink spirea – Sitka sedge	00	Ws50	19.6	3.3	0.2
CWHvm1	Red alder – Skunk cabbage	00	Ws52	41.3	7.0	0.4
CWHvm1	Western redcedar – Sitka spruce – Skunk cabbage	14	Ws54**	177.1	30.0	1.7
CWHvm1	Shallow Open Water	00	OW	5.5	0.9	0.1

BGC Unit	Ecosystem Name	Site Series	Map Code	Area of Wetlands (ha)	Percentage of All Wetlands in LSA (%)	Percentage of LSA (%)
Total CWHvm1 Wetlands				**268.8**	**45.5**	**2.6**
CWHvm2	Western redcedar – Yellowcedar – Goldthread	12	YG	29.9	5.1	0.3
CWHvm2	Shallow Open Water	00	OW	0.2	<0.1	<0.1
Total CWHvm2 Wetlands				**30.1**	**5.1**	**0.3**
Total Wetlands in LSA				**591.3**	**100.0**	**5.6**
Total LSA	**10,520.2**					

Notes: BGC = biogeoclimatic; LSA = Local Study Area; ha = hectare; % = percent; Total LSA = 10,609 ha; CWHws1 = Coastal Western Hemlock Wet Submaritime Montane variant; CWHvm1 = Coastal Western Hemlock Montane Very Wet Maritime Submontane variant; CWHvm2 = Coastal Western Hemlock Montane Very Wet Maritime Montane variant; LSA = Local Study Area.

5.6.2.8 Sparsely Vegetated Ecosystems

Sparsely vegetated ecosystems consist solely of talus slopes in the LSA. A total of 7.5 ha (0.1% of the LSA) (**Table 5.6-13**, **Appendix C.3**) occur within the LSA. The majority (6.9 ha) of the talus slopes occurs along the steep, east-facing side slopes south of the Little Wedeene River and above Sandhill properties in the CWHvm1 and CWHvm2 variants. A small talus slope (0.6 ha) occurs on the east side of Iron Mountain in the CWHws1 and is associated with a small stream gully.

Table 5.6-13: Sparsely Vegetated Areas in the Local Study Area

BGC Unit	Ecosystem Name	Site Series	Map Code	Sparsely Vegetated Areas (ha)	Percentage of Total Sparsely Vegetated Areas in LSA (%)	Percentage of LSA (%)
CWHws2	Talus	00	TA	0.6	8.6	<0.1
CWHvm1	Talus	00	TA	2.1	28.0	<0.1
CWHvm2	Talus	00	TA	4.8	63.4	<0.1
Total Talus in LSA				**7.5**	**100.0**	**0.1**
Total LSA	**10,520.2**					

Notes: BGC = biogeoclimatic; ha = hectare; LSA = Local Study Area; % = percent; CWHws2 = Coastal Western Hemlock Very Wet Maritime Submontane variant; CWHvm1 = Coastal Western Hemlock Montane Very Wet Maritime Submontane variant; CWHvm2 = Coastal Western Hemlock Montane Very Wet Maritime Montane variant; LSA = Local Study Area.

5.6.2.9 Unlisted Terrestrial Ecosystems

This section describes and quantifies the existing condition of unlisted terrestrial ecosystems not discussed or assessed as part of other vegetation VCs. Detailed ecosystem maps showing the distribution of all ecosystems within the LSA can be found in **Appendix C.1**.

The total unlisted terrestrial ecosystems in the LSA is 6,985.8 ha (**Table 5.6-14**). The most abundant unlisted terrestrial ecosystem is the mesic CWHws1 Western hemlock – Amabilis fir – Bramble (01/AB) ecosystem with 5,161.9 ha (73.9% of LSA). This ecosystem is widespread in the northern two-thirds of the Project area from Skeena substation to south of Lakelse River and downstream to the Little Wedeene River. It occurs on all slope positions and on a variety of parent materials (e.g. glaciomarine, glaciofluvial, morainal till, colluvium). The shrub layer is dominated by berry-producing shrubs such as Alaskan blueberry; however, some sites in younger forests have virtually no understory development due to a dense closed canopy.

The second most abundant unlisted terrestrial ecosystem in the LSA is the CWHvm1 Western hemlock – Amabilis fir – Blueberry (01/AB) ecosystem with a total of 1,186.9 ha (17% of LSA). This mesic ecosystem is common throughout the southern third of the LSA, from the little Wedeene River south towards Minette and Kitimat substations. It occurs primarily on mid-slope positions on colluvial, morainal or fluvial deposits. Older forests have a well-developed understory, which includes abundant blueberries (*Vaccinium* spp), while younger forests have virtually no understory development.

Table 5.6-14: Unlisted Terrestrial Ecosystems in the Local Study Area

Biogeoclimatic Unit	Ecosystem Name	Site Series	Map Code	Unlisted Terrestrial Ecosystems (ha)	Percent of Total Unlisted Terrestrial Ecosystem (%)	Percent of LSA (%)
CWHws1	Western hemlock – Amabilis fir – Bramble	01	AB	5,161.9	73.9	0.7
CWHws1	Western hemlock – Amabilis fir – Queen's cup	05	HQ	164.1	2.3	<0.1
Total CWHws1 Unlisted Terrestrial Ecosystems				**5,326.0**	**76.2**	**0.7**
CWHws2	Western hemlock – Amabilis fir – Bramble	01	AB	70.9	1.0	<0.1
CWHws2	Amabilis fir – Western redcedar – Devil's club	06	AD	5.2	0.1	<0.1
Total CWHws2 Unlisted Terrestrial Ecosystems				**76.1**	**1.1**	**0.0**
CWHvm1	Western hemlock – Amabilis fir – Blueberry	01	AB	1,186.9	17.0	0.2
CWHvm1	Western hemlock – Lodgepole pine – Cladina	02	LC	2.0	0.0	<0.1
CWHvm1	Amabilis fir – Western redcedar – Foamflower	05	AF	105.4	1.5	<0.1
CWHvm1	Slide/Avalanche Track	00	SA	0.7	<0.1	<0.1
Total CWHvm1 Unlisted Terrestrial Ecosystems				**1,295.0**	**18.5**	**0.2**
CWHvm2	Western hemlock – Amabilis fir – Blueberry	01	AB	173.9	2.5	<0.1
CWHvm2	Amabilis fir – Western redcedar – Foamflower	05	AF	27.5	0.4	<0.1
CWHvm2	Slide/Avalanche Track	00	SA	29.7	0.4	<0.1
Total CWHvm2 Unlisted Terrestrial Ecosystems				**231.1**	**3.3**	<0.1
MHmm1	Mountain hemlock – Amabilis fir – Blueberry	01	MB	18.5	0.3	<0.1
MHmm1	Mountain hemlock – Amabilis fir – Mountain heather	02	MM	39.1	0.6	<0.1
Total MHmm1 Unlisted Terrestrial Ecosystems				**57.6**	**0.8**	<0.1
Total Unlisted Terrestrial Ecosystems				**6,985.8**	**100.0**	**1.0**
Total LSA	**10,520.2**					

Notes: BGC = biogeoclimatic; ha = hectare**;** * = Red-listed; ** = Blue-listed; % = percent
CWHws1 = Coastal Western Hemlock Wet Submaritime Montane variant; CWHws2 = Coastal Western Hemlock Very Wet Maritime Submontane variant; CWHvm1 = Coastal Western Hemlock Montane Very Wet Maritime Submontane variant; CWHvm2 = Coastal Western Hemlock Montane Very Wet Maritime Montane variant; MHmm1 = Mountain Hemlock Moist Maritime Windward variant; LSA = Local Study Area

5.7 Vegetation Effects Assessment

5.7.1 Potential Effects and Proposed Mitigation

This section quantifies potential Project effects on vegetation VCs by superimposing clearing standards and Project components onto the LSA ecosystem map in ArcGIS v.10.2. The following Project components were considered in this section:

- Transmission line ROW (120 m maximum clearing widths to allow for one time tree clearing and ancillary facilities outside of the 42 m Statutory ROW);
- New access roads (up to average clearing widths of 20 m); and
- Structure locations.

Potential Project effects on vegetation VCs can be divided into direct (e.g. removal of vegetation) and indirect effects (e.g. introduction of invasive plants, edge effect). Potential Project effects on vegetation VCs are summarized by Project phase in **Table 5.7-1**.

Vegetation VCs that directly overlap Project components will be directly affected by the Project. Direct ecosystem alteration and loss will occur because existing vegetation will be removed during the clearing/construction phase as per the clearing standards. Changes to the humus and soil horizons will occur during the construction of new roads and structures. These changes will affect all vegetation VCs during the clearing/construction phase due to direct surface disturbance, the development of accelerated erosion, soil compaction and rutting of the land surface. Clearing vegetation during the clearing/construction phase will indirectly affect all vegetation VCs within cleared areas because this activity will result in the establishment and spread of invasive plant species. Vegetation VCs will be indirectly affected by potential Project effects outside of cleared areas because of edge effect, fugitive dust and ecosystem fragmentation. Edge effect refers to changes in ecological community structure and composition at the boundary of a habitat artificially produced by the Project (e.g. ROW) and an adjacent habitat (e.g. second growth forest). Edge effect can be a natural phenomenon or can be driven by human (anthropogenic) habitat alteration. Fugitive dust deposited on plants adversely affects photosynthesis, transpiration and gas exchange rates, adversely affecting their physiology and vigor. Ecosystem fragmentation is known to reduce the resilience of ecosystems and plant species to adverse Project effects over various temporal and geographic scales.

Vegetation VCs will be directly affected during the operation/maintenance phase as per BC Hydro's integrated vegetation management plan (BC Hydro, 2016) and approved work practices for managing riparian vegetation (BC Hydro, 2003a; 2003b). All vegetation VCs will be directly affected in managed areas by mechanical and chemical vegetation management during this phase. Vegetation VCs will be indirectly affected outside of managed areas due to edge effect and fugitive dust.

Dismantling and removal of structures and line removal will disturb surface soil during the closure phase. This may lead to the establishment and spread of invasive plant species because disturbed soil is suitable habitat for these plants. All vegetation VCs will likely respond positively during the closure and post-closure phases because they will partially return to existing conditions naturally. During the initial post-closure phase, early-seral plant communities will be susceptible to colonization by invasive plant species. Populations of invasive plants, if they occur will have an adverse effect on all vegetation VCs. However, populations of invasive plant species will likely become extinct as early-seral plant communities develop into mid- to late-seral plant communities. Invasive plant species will not likely persist in mid- to late-seral plant communities.

Table 5.7-1: Potential Project Effects on Vegetation by Phase

Project Phase	Project Activity	Potential Effects On Vegetation Valued Components
Clearing/Construction	Vegetation clearing, road construction, construction of structures and construction of laydown areas	Direct ecosystem alteration and loss
		Introduction, establishment and spread of invasive plants
		Edge effect
		Fugitive dust deposited on vegetation
		Changes to the humus and soil horizons
		Soil erosion
		Compaction and rutting of land surface
		Ecosystem fragmentation
Operation/Maintenance	Integrated vegetation management	Direct ecosystem alteration and loss
		Introduction, establishment and spread of invasive plants
		Anthropogenic edge effect
		Fugitive dust deposited on vegetation
		Changes to the humus and soil horizons
		Soil erosion
		Compaction and rutting of land surface
		Ecosystem fragmentation
Closure	Dismantling and removal of structures and lines	Changes to the humus and soil horizons
		Introduction, establishment and spread of invasive plants
		Fugitive dust deposited on vegetation
		Soil erosion
		Compaction and rutting of land surface
Post-Closure	Cessation of integrated vegetation management	Initial introduction, establishment and spread of invasive plants in early seral plant communities. Early seral plant communities will be present during the early parts of this phase.

The effect pathway of potential Project effects and the results of those effects are VC-, site- and phase-specific. The majority of potential Project effects will occur during the clearing/construction and operation/maintenance phases. Relatively minor effects will occur during the closure and post-closure phases (**Table 5.7-2**).

Table 5.7-2: Summary of Potential Project Effects by Phase on Vegetation Valued Component

Potential Project Effect	First Nations Botanical Resources	Plant Species at Risk	Ecological Communities at Risk	Old Forests	Old Growth Management Areas	Riparian Ecosystems	Wetlands	Sparsely Vegetated	Non-listed Terrestrial Ecosystems
Clearing/ Construction Phase	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Operation/ Maintenance Phase	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Closure	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Post-Closure	No	No	Yes	Yes	Yes	No	No	No	No

Proposed Mitigation

If potential effects are anticipated, mitigation measures are provided. Some mitigation measures are general as they apply to all vegetation VCs during all Project phases, while others are VC- and phase-specific. Mitigation measures include avoidance and minimization, and correspond to the mitigation hierarchy of the BC Environmental Mitigation Policy (BC MOE, 2014c) and BC Hydro's vegetation management programs (BC Hydro, 2003a, 2003b, 2016.). If adverse potential Project effects are anticipated for a given vegetation VC after implementation of mitigation measures (i.e. anticipated effectiveness of mitigation is not high), this VC will be carried forward as a residual effect and characterized. If Project effects during any phase are positive or neutral (e.g. habitat restoration activities), they will not be carried forward to residual effects assessment.

Iterative changes to Project design have been made to minimize effects on vegetation VCs, where practicable. For example, structures 21 and 22 have been moved and their height increased so that minimal (7 old growth trees) clearing will take place in old forests in the Lakelse SRMZ. These design changes were made to meet objectives in the Kalum LRMP and SRMP. Clearing standards used during the clearing/construction phase are determined by qualified forestry personnel. These requirements strive to strike a practicable balance between meeting construction, safety and post-construction vegetation management requirements while minimizing environmental effects. Clearing requirements have been optimized to minimize potential Project effects on vegetation VCs during the clearing/construction phase of the Project.

During the operation/maintenance phase, BC Hydro must control vegetation under, above and near its transmission lines in order to maintain the safe and reliable transmission of electricity to its customers. Vegetation management must also conform to the North American Electric Reliability Council standard FAC-003-4, *Vegetation Management* (North American Electric Reliability Corporation, 2009), and section 20 of the *BC Hydro Power and Authority Act*. In part, BMPs outlined in BC Hydro's Integrated Vegetation Management Plan (BC Hydro, 2016) and Approved Work Practices for Managing Riparian Vegetation (BC Hydro 2003a, 2003b) allow BC Hydro to meet these obligations. All mitigation measures given below must also incorporate the following requirements:

- Minimize public and worker safety hazards;
- Reduce the number of outages due to vegetation growing into transmission lines or falling onto transmission lines;

- Reduce the risk of fires caused by trees contacting the lines;
- Allow access and lines of sight for maintenance and security; and
- Be practicable.

Mitigation VM1: establish compatible use First Nations botanical resources in the provisional route ROW during the clearing/construction and operation/maintenance phases.

During the clearing/construction phase, First Nations botanical resources that represent a compatible use will be salvaged and used to revegetate the transmission line ROW as per the CEMP. Compatible use plants are defined as those that will not conflict with the transmission line and will control or prevent the growth of tall trees. This dovetails with BC Hydro's compatible use vegetation management strategy, which is outlined in the integrated vegetation management plan (BC Hydro, 2016).

The CEMP or associated plans will include procedures around First Nations botanical resources management, which will be developed in consultation with First Nations to identify compatible use plants to be cultivated during the operation/maintenance phase of the Project. For example, if Pacific crabapple orchards represent a compatible use, then orchards could be established on the margins of specific wetlands near the northern and southern ends of the provisional route. Any such areas would be included in BC Hydro's mapping system, and designated as treatment-free zones (BC Hydro, 2016) because they would likely not be used if treated with herbicides or pesticides.

Mitigation VM2: develop site-specific prescriptions, as appropriate, for seven identified riparian/wetland areas during the operation/maintenance phase.

Seven wetlands or streams have been identified as high value as they harbour multiple vegetation, fisheries and wildlife VCs. Clearing standards will be optimized at these sites to minimize disturbance to the humus and soil layers during the clearing/construction phase. If practicable, site-specific prescriptions will be implemented at these sites during the operation/maintenance phase of the Project. Site-specific prescriptions may reduce potential Project effects on these VCs at these sites during the operation/maintenance phase and facilitate a return to existing conditions during the post-closure phase. Qualified professionals will prepare site-specific prescriptions as appropriate during the operations/maintenance phase (BC Hydro, 2003a; 2003b). These prescriptions use site-specific details to identify multi-year management objectives. The seven wetlands and streams for which site-specific prescriptions may be implemented and accompanying maps are given in **Appendix C.5**.

Mitigation VM3: minimize clearing of old forests in the Lakelse River SRMZ during all phases.

The Kalum LRMP identified Lakelse River as an important resource to a variety of interests and values and has demarcated a special resource management zone to either side of that river. There are two subzones: Subzone 1 is the 200 m buffer to either side of the river; Subzone 2 is the rest of the area within the Lakelse River special resource management zone. One of the main objectives for Subzone 1 is no harvesting and for Subzone 2 is to manage for characteristics that maintain the integrity of old forest conditions within Subzone 1 (Government of BC, 2002). The current provisional route only removes seven old growth trees in the Lakelse River special resource management zone Subzone 1 and minimal tree clearing for two structures in order to span the Lakelse River. Where practicable, clearing techniques will minimize potential Project effects on vegetation VCs during the clearing/construction phase in the Lakelse River special resource management zone Subzone 2.

Mitigation VM4: Development of construction environmental management plan for the clearing/construction phase.

A CEMP will be finalized considering direction from regulators and including consultation with First Nations, prior to the clearing/construction phase. Contractors will be chosen, in part, based on their ability to fulfill the objectives of the CEMP. At a minimum, the CEMP will include the following sections that may help mitigate potential Project effects on vegetation VCs:

- Responsibilities of the contractor(s) and BC Hydro;
- The requirement for an environmental monitor and a summary of their roles, work practices and reporting and communication responsibilities;
- An ethnobotanical section written in consultation with First Nations to identify First Nations botanical resources that may be used for planting material;
- A site restoration section that describes scenarios where revegetation is required during clearing/construction and operations/maintenance. This section will also provide detailed revegetation plans for each scenario;
- Erosion and sediment control plan;
- Fugitive dust control program; and
- Invasive plant and noxious weed control plan.

Mitigation VM5: topsoil preservation at temporary construction sites during the clearing/construction phase.

This mitigation measure applies to the clearing/construction phase and applies to temporary construction sites such as construction pads, laydown yards and one-time-use construction sites, and includes, to the extent practicable:

- Subsoil will be stripped and stored separate from topsoil in a manner to prevent mixing;
- Temporary stockpiles will be protected from erosion; and
- The subsoil and topsoil will be replaced in the same order in which they were removed.

Mitigation VM6: spatial vegetation VC data to be used whenever practicable by BC Hydro and their contractor(s) in finalizing Project design and developing procedures for the clearing/construction and operation/maintenance phases.

Relevant spatial vegetation VC data will be given to consultants and contractor(s) assisting BC Hydro with Project design. These data may be used to guide development of clearing standards and access plans before and during the clearing/construction phase. These data may be used to inform decisions regarding integrated vegetation management of the ROW.

Mitigation VM7: Development of an RCP for the closure phase.

A Restoration and Closure Plan (RCP) will be finalized prior to the closure phase of the Project. Contractors will be chosen, in part, based on their ability to fulfill the objectives of the RCP. Contractors will in turn use the RCP to provide them with guidance and inform their strategies to meet the objectives of the RCP. The objectives of the RCP may include, but not be limited to:

- Establish self-sustaining, locally appropriate ecological communities that support identified land uses or vegetation VCs where required and practicable; and
- Identify First Nations botanical resources that may be used for planting material.

The plans to meet these objectives may include:

- Consulting with First Nations;
- Describing the responsibilities of the contractor(s) and BC Hydro;
- Describing the requirement for an environmental monitor and a summary of their roles, work practices and reporting and communication responsibilities;
- Describing scenarios where revegetation may take place (e.g. stream crossings and riparian ecosystems). This section may also provide detailed revegetation plans for each scenario;
- Describing other scenarios as appropriate, such as where silvicultural practices may be used to accelerate forest succession; and
- Describing anticipated timeframes for completion of revegetation stages, including quantifiable targets and how these targets will be monitored.

Detailed objectives and contents for the RCP cannot be prescribed at this time. This is because contemporary prescriptions may not reflect or meet the legislative and societal environment of the distant future. However, for the purposes of determining residual effects on vegetation VCs in this ESER, it is assumed that the objectives and contents of the RCP will be similar to those given above.

5.7.1.1 First Nations Botanical Resources

A total of 173 ha (6.6% of First Nations botanical resources in LSA) (**Table 5.7-3**) of ecosystems that likely represent high quality habitat for First Nations botanical resources in the LSA overlap with new roads or the transmission line ROW and will be directly adversely affected during the clearing/construction phase. During all phases of the Project, those First Nations botanical resources that typically occur in riparian ecosystems (map code SS), wetlands (map codes Ws50 and Ws54) and ecological communities at risk (map codes AO, AD, CD, HS and HD) (157.5 ha; 6% of First Nations botanical resources in LSA) are likely to be less resilient and more sensitive to potential Project effects than those in upland unlisted ecological communities. This VC will likely respond positively during the closure and post-closure phases because will partially return to existing conditions naturally. The likelihood of First Nations botanical resources incurring adverse residual effects in upland unlisted terrestrial ecosystems is low given that mitigation measures VM1 to VM7 are likely to be practicable and effective for this VC. However, some adverse residual effects are anticipated for those First Nations botanical resources that occur in riparian ecosystems, wetlands and ecological communities at risk, so this vegetation VC is carried forward to the residual effects section.

Table 5.7-3: Potential Direct Effects on First Nations Botanical Resources Valued Component in the Local Study Area

BGC Unit	Ecosystem Name	Site Series	Map Code	Existing Condition in LSA (ha)	Area Overlapping New Access Roads		Area Overlapping Transmission Line ROW		Combined Area Overlapping New Access Roads or ROW	
					Hectares	Percent of VC in LSA (%)	Hectares	Percent of VC in LSA (%)	Hectares	Percent of VC in LSA (%)
CWHws1	Amabilis fir – Western redcedar – Oak fern	04	AO**	474.9	5.1	0.2	33.1	1.3	38.2	1.5
CWHws1	Western hemlock –Amabilis fir – Queen's cup	05	HQ	164.1	2.5	0.1	13.4	0.5	15.9	0.6
CWHws1	Amabilis fir – Western redcedar – Devil's club	06	AD**	474.8	3.8	0.1	28.5	1.1	32.3	1.2
CWHws1	Sitka Spruce – Salmonberry	07	SS*	197.3	0.7	<0.1	5.4	0.2	6.0	0.2
CWHws1	Black cottonwood – Red-osier dogwood	08	CD**	116.5	0.1	<0.1	4.1	0.2	4.2	0.2
CWHws1	Pink spirea – Sitka sedge	00	Ws50	34.1	0.1	<0.1	1.7	0.1	1.8	0.1
CWHws1	Western redcedar – Sitka spruce – Skunk cabbage	11	Ws54**	154.5	0.5	<0.1	10.3	0.4	10.8	0.4
Total CWHws1				**1,616.1**	**12.8**	**0.5**	**96.5**	**3.7**	**109.2**	**4.2**
CWHvm1	Western hemlock – Western redcedar – Salal	03	HS**	228.1	0.9	<0.1	19.4	0.7	20.4	0.8
CWHvm1	Western hemlock – Amabilis fir – Deer fern	06	HD**	60.5	0.0	0.0	1.8	0.1	1.8	0.1
CWHvm1	Amablis fir – Sitka spruce – Devil's club	08	AD**	405.2	5.0	0.2	32.5	1.2	37.5	1.4
CWHvm1	Sitka Spruce – Salmonberry	09	SS*	52.0	0.0	0.0	2.8	0.1	2.8	0.1
CWHvm1	Black cottonwood – Red-osier dogwood	10	CD**	28.5	0.0	0.0	0.2	<0.1	0.2	<0.1
CWHvm1	Western redcedar – Sitka spruce – Skunk cabbage	14	Ws54**	177.1	0.1	<0.1	1.4	0.1	1.5	0.1
Total CWHvm1				**951.4**	**6.1**	**0.2**	**58.1**	**2.2**	**64.2**	**2.4**
Total First Nations Botanical Resources Ecosystems in New Access Roads or Transmission Line ROW					**18.8**	**0.7**	**154.6**	**5.9**	**173.4**	**6.6**
Total First Nations Botanical Resource Ecosystems in LSA				**2,626.5**						

Notes: BGC = biogeoclimatic; VC = Valued Component; LSA = Local Study Area; * = Red-listed; ** = Blue-listed; ROW = right-of-way; % = percent
CWHws1 = Coastal Western Hemlock Wet Submaritime Montane variant; CWHws2 = Coastal Western Hemlock Very Wet Maritime Submontane variant; CWHvm1 = Coastal Western Hemlock Montane Very Wet Maritime Submontane variant; CWHvm2 = Coastal Western Hemlock Montane Very Wet Maritime Montane variant; MHmm1 = Mountain Hemlock Moist Maritime Windward variant.

5.7.1.2 Plant Species at Risk

Two Wb13 wetlands are known to harbour *Malaxis* populations in the provisional route (**Appendix C.6**). These wetlands represent 5.4 ha (30.7%) of the 17.6 ha of Wb13 wetlands in the LSA. A total of 0.9 ha (5.1%) overlaps directly with Project components. However, indirect effects may occur over the entire extent of the wetland. The more southern wetland (Polygon ID 1589) occurs in a complex riparian system just north of the Little Wedeene River near structure 128. The provisional route intersects the centre of this wetland while it skirts the edge of the more northern Wb13 wetland (Polygon ID 899) near structure 122. As a result, *Malaxis* populations in the southern wetland are likely to be more adversely affected than those in the northern wetland during the clearing/construction and operation/maintenance phases. As long as conditions are favourable for seed germination, maturation to flowering, the mycorrhizal associate and the pollinator, *Malaxis* populations should be self-sustaining in suitable habitat in the provisional route (Burgeff, 1954) throughout the operation/maintenance phase. Relevant mitigations measures for this VC include VM2, VM4, VM6, VM7 and BC Hydro's BMPs (BC Hydro, 2003a; 2003b; 2011; and 2016). However, the likelihood of *Malaxis* populations experiencing adverse residual effects during the clearing/construction and operation/maintenance phases is moderate because mitigation measures VM4 and VM2 may not be practicable or effective for this VC, especially for the more southern population. *Malaxis* populations would likely respond positively during the closure and post-closure phases, especially if specifically addressed in mitigation VM7. However, it is not known if or how long it would take these populations to return to existing conditions. Adverse residual effects are anticipated, especially for *Malaxis* populations in the southern wetland, so this VC is carried forward to the residual effects section.

5.7.1.3 Ecological Communities at Risk

Of the total 1,044.6 ha of ecological communities at risk in the LSA, 32.9 ha (3.1%) overlap with Project components, including five ecological communities at risk in the CWHws1 and five in the CWHws1 (**Table 5.7-4**, **Appendix C.6**). Of those potentially directly affected by the Project, 7.2 ha (0.7% of all ecological communities at risk in the LSA) are Red-listed communities, and 25.7 ha (2.5%) are Blue-listed communities. At 18.9 ha (1.8% of all ecological communities at risk in the LSA), the Blue-listed Amabilis fir – Western redcedar – Devil's club (CWHws1 06/AD and CWHvm1 08/AD) ecological community comprises the greatest area of all ecological communities at risk potentially directly affected by the Project.

Ecological communities at risk will be directly removed during the clearing/construction phase. Alteration to the soil profile and soil compaction will occur around structures and new roads, and to a lesser extent, throughout the transmission line ROW during this phase. Vegetation management during the operation/maintenance phase will prevent this VC from returning to existing conditions during this phase. Adverse effects during the closure phase will be confined to activities associated with disassembling structures, line removal and road deactivation. This VC will respond positively during the post-closure phase, but is unknown to what extent it will return to existing conditions naturally.

Table 5.7-4: Potential Direct Effects on Ecological Communities at Risk Valued Component in the Local Study Area

BGC Unit	Ecosystem Name	Site Series	Map Code	Existing Condition in LSA (ha)	Area Overlapping New Access Roads		Area Overlapping Transmission Line ROW		Area Overlapping New Roads or ROW	
					Hectares	Percent of VC in LSA (%)	Hectares	Percent of VC in LSA (%)	Hectares	Percent of VC in LSA (%)
CWHws1	Amabilis fir – Western redcedar – Devil's club	06	AD**	224.7	0.8	0.1	10.9	1.0	11.7	1.1
CWHws1	Sitka Spruce – Salmonberry	07	SS*	146.8	0.7	0.1	4.7	0.4	5.3	0.5
CWHws1	Black cottonwood – Red-osier dogwood	08	CD**	20.2	0.0	0.0	1.0	0.1	1.0	0.1
CWHws1	Shore sedge - Buckbean – Peatmoss	00	Wb13**	9.1	0.0	0.0	0.3	<0.1	0.3	0.0
CWHws1	Western redcedar – Sitka spruce – Skunk cabbage	11	Ws54**	55.8	0.3	<0.1	2.2	0.2	2.5	0.2
Total CWHws1				**456.6**	1.8	0.2	19.0	1.8	20.8	2.0
CWHvm1	Western hemlock – Western redcedar – Salal	03	HS**	90.2	0.2	<0.1	1.9	0.2	2.1	0.2
CWHvm1	Western hemlock – Amabilis fir – Deer fern	06	HD**	14.2	0.0	0.0	0.4	<0.1	0.4	<0.1
CWHvm1	Amabilis fir – Sitka spruce – Devil's club	08	AD**	72.1	1.1	0.1	6.1	0.6	7.2	0.7
CWHvm1	Sitka Spruce – Salmonberry	09	SS*	36.4	0.0	0.0	1.8	0.2	1.8	0.2
CWHvm1	Shore sedge – Buckbean – Peatmoss	00	Wb13**	8.5	0.0	0.0	0.6	0.1	0.6	0.1
Total CWHvm1				**221.4**	1.3	0.1	10.8	1.0	12.1	1.2
Total Ecological Communities in New Access Roads or Transmission Line ROW					3.0	0.3	29.8	2.9	32.9	3.1
Total Ecological Communities At Risk in LSA				**1,044.6**						

Notes: BGC = biogeoclimatic; VC = valued component; ha = hectare; LSA = Local Study Area; * = Red-listed; ** = Blue-listed; ROW = right-of-way; % = percent
CWHws1 = Coastal Western Hemlock Wet Submaritime Montane variant; CWHws2 = Coastal Western Hemlock Very Wet Maritime Submontane variant; CWHvm1 = Coastal Western Hemlock Montane Very Wet Maritime Submontane variant; CWHvm2 = Coastal Western Hemlock Montane Very Wet Maritime Montane variant; MHmm1 = Mountain Hemlock Moist Maritime Windward variant

Clearing standards and structure locations will be optimized to mitigate for ecological communities at risk, where practicable. Mitigation measures VM2 to VM7, and BC Hydro's BMPs (BC Hydro, 20003a; 2003b; 2011; 2016) will do much to reduce potential Project effects during relevant Project phases. However, it is unknown if these mitigation measures will be effective for this VC. As a result, the ecological communities at risk VC is carried forward to the characterization of residual effects section.

5.7.1.4 Old Forest

Retaining old forests is identified as a component of maintaining biodiversity in both the Kalum LRMP and SRMP. Biodiversity objective 1 in the Kalum LRMP is to "maintain a range of seral stages across the landscape to meet the needs of a wide variety of species." The Project landscape is dominated by early seral forests as a result of extensive harvesting that occurred in Kitimat Valley in the late 1960s and early 1970s. The Project will reduce the amount of old forest in the LSA by 62.1 ha (3.5% of all old forest in the LSA; **Table 5.7-5**). Of the 62.1 ha, upland old forest comprise 55.0 ha (3.1% of all old forest in the LSA), riparian floodplain ecosystems comprise 5.2 ha (0.3% of all old forest in the LSA) and wetlands comprise 1.5 ha (0.1% of all old forest in the LSA) within ROWs. **Appendix C.4** shows the extent of potential Project effects on old forests.

The clearing/construction phase will remove old forests by cutting trees. Grubbing will remove stumps, change the soil profile and may compact the soil. The removal of trees will result in edge effects on the remaining old forest, increasing the potential for blowdown, changing light conditions and possibly altering soil moisture.

Old forest will not be allowed to regenerate within the Statutory ROW during the operation/ maintenance phase, and danger trees may be removed from outside of the Statutory ROW. Edge effects will persist during this phase.

The closure phase will involve decommissioning of the line and result in some additional alteration of vegetation in order to move equipment in and out, dismantle structures, remove the line and deactivate roads. It is anticipated that the total area affected at closure will be less than during the clearing/construction phase.

Mitigation VM2 to VM7 will reduce but not eliminate Project effects. Restoration during the post-closure phase (VM7) is expected to result in the regeneration of old forests. However, given the long-time interval (250 years post-closure) required for old forests to re-establish, this VC is carried forward to the residual effects section.

Table 5.7-5: Potential Direct Effects on Old Forest Valued Component in the Local Study Area

BGC Unit	Ecosystem Name	Site Series	Map Code	Existing Condition in LSA (ha)	Area Overlapping New Access Roads		Area Overlapping Transmission Line ROW		Area Overlapping New Roads or ROW	
					Hectares	Percent of VC in LSA (%)	Hectares	Percent of VC in LSA (%)	Hectares	Percent of VC in LSA (%)
CWHws1	Western hemlock – Amabilis fir – Bramble	01	AB	526.7	3.5	0.2	19.0	1.1	22.5	1.3
CWHws1	Amabilis fir – Western redcedar – Devil's club	06	AD**	209.4	0.8	0.0	10.9	0.6	11.7	0.7
Total CWHws1 Old Forest - Upland				**736.1**	**4.3**	**0.2**	**29.9**	**1.7**	**34.2**	**1.9**
CWHws1	Sitka Spruce – Salmonberry	07	SS*	51.7	0.4	<0.1	2.8	0.2	3.1	0.2
CWHws1	Black cottonwood – Red-osier dogwood	08	CD**	5.5	0.0	<0.1	0.2	<0.1	0.2	<0.1
Total CWHws1 Old Forest - Riparian Floodplain Ecosystems				**57.2**	**0.4**	<0.1	**2.9**	**0.2**	**3.3**	**0.2**
CWHws1	Western redcedar – Sitka spruce – Skunk cabbage	11	Ws54**	22.4	0.2	<0.1	1.3	0.1	1.5	0.1
Total CWHws1 Old Forest- Wetland				**22.4**	**0.2**	<0.1	**1.3**	**0.1**	**1.5**	**0.1**
Total CWHws1				**815.7**	**4.9**	**0.3**	**34.1**	**1.9**	**39.0**	**2.2**
CWHvm1	Western hemlock – Amabilis fir – Blueberry	01	AB	237.8	2.1	0.1	7.4	0.4	9.5	0.5
CWHvm1	Western hemlock – Western redcedar – Salal	03	HS**	73.4	0.2	<0.1	1.8	0.1	2.0	0.1
CWHvm1	Amabilis fir – Western redcedar – Foamflower	05	AF	18.3	0.4	<0.1	1.6	0.1	2.0	0.1
CWHvm1	Western hemlock – Amabilis fir – Deer fern	06	HD**	14.2	<0.1	<0.1	0.4	0.0	0.4	<0.1
CWHvm1	Amablis fir – Sitka spruce – Devil's club	08	AD**	59.9	1.1	0.1	5.8	0.3	6.9	0.4
Total CWHvm1 Old Forest - Upland				**403.6**	**3.8**	**0.2**	**17.0**	**1.0**	**20.8**	**1.2**
CWHvm1	Sitka Spruce – Salmonberry	09	SS*	7.2	<0.1	<0.1	1.8	0.1	1.8	0.1
Total CWHvm1 Old Forest Riparian Floodplain Ecosystems				**7.2**	<0.1	<0.1	**1.8**	**0.1**	**1.8**	**0.1**
Total CWHvm1				**410.8**	**3.8**	**0.2**	**18.9**	**1.1**	**22.7**	**1.3**
Total Old Forest Upland				**1,139.7**	**8.1**	**0.5**	**46.9**	**2.7**	**55.0**	**3.1**
Total Old Forest Riparian Floodplain Ecosystems				**64.4**	**0.4**	<0.1	**4.8**	**0.3**	**5.2**	**0.3**
Total Old Forest Wetlands				**86.8**	**0.6**	<0.1	**1.3**	**0.1**	**1.9**	**0.1**
Total Old Forest in New Access Roads or Transmission Line ROW				**1,290.9**	**9.0**	**0.5**	**53.0**	**3.0**	**62.1**	**3.5**
Total Old Forest in LSA				**1,763.7**						

Notes: BGC = biogeoclimatic; VC = valued component; ha = hectare; * = Red-listed; ** = Blue-listed; OF = Old Forest; % = percent
CWHws1 = Coastal Western Hemlock Wet Submaritime Montane variant; CWHvm1 = Coastal Western Hemlock Montane Very Wet Maritime Submontane variant

5.7.1.5 Old Growth Management Areas

A total of 9.6 ha in three spatially defined legal OGMAs are intersected by Project components (i.e. transmission line ROW and / or new access roads) (**Table 5.7-6**). These OGMAs are SKE_KLM_467, SKE_KLM_617, and SKE_KLM_629 (**Appendix C.3**).

Like old forests, OGMAs have been identified for conservation by the Kalum LRMP and SRMP. These plans discourage clearing, harvesting and any activity that may lead to blowdowns within the boundaries of OGMAs. OGMAs were established to retain a variety of ecosystems and stand characteristics across a range of topography and BGC units. The target amounts of OGMAs are agreed upon during plan negotiations, such as those that were carried out for the Kalum LRMP and SRMP. Establishing OGMAs involves considerable effort and is important for wildlife habitat and biodiversity. As a result, losses to OGMAs are typically met with concern from First Nations, stakeholders and the general public. Amendments to OGMAs are allowed in order to provide operational flexibility, provided they are replaced so that both biodiversity and timber supply are maintained. Minor amendments are granted for OGMAs between 1 ha and 200 ha when the area of amendment is ≤10% or ≤10 ha (whichever is less) and when no other significant resources have been identified in that OGMA. Significant resources include First Nations values, wildlife habitat for species at risk and ecological communities at risk. However, the percent of area values given above only apply where applicable legal orders do not specify size criteria (Skeena Region Forest Licensees and BC Timber Sales Skeena and Babine, 2010). If the size criteria are exceeded or if significant resources have been identified in an OGMA, a significant amendment may be required.

OGMA SKE_KLM_467 may require an amendment because it contains significant resources: documented Blue- and *SARA*-listed species, documented Red-listed ecological community at risk and wildlife habitat for Red- or Blue-listed species. A total of 3.8 ha (4%) of OGMA SKE_KLM_467 will be affected by the Project. It was surveyed by the archaeology, fisheries, vegetation and wildlife field crews. The archaeology field crew did not detect culturally modified trees (CMTs) or cultural heritage resources. Blue-listed coastal cutthroat trout have been historically reported upstream of two stream crossings in this OGMA and in Coldwater Creek, which is downstream of these crossings. No plant species at risk were detected, but the presence of cottonwood makes it suitable habitat for frosted glass-whiskers lichen (*Sclerophora peronella*; Red-listed). The OGMA harbours the Red-listed Sitka spruce – Salmonberry high fluvial bench (CWHws1/07; SS) ecological community at risk. The wildlife field crew detected coastal tailed frogs (*Ascaphus truei*; Blue-listed; *SARA*-listed) and western toads (*Anaxyrus boreas*; Blue-listed; *SARA*-listed) in this OGMA. It represents suitable habitat for Keen's myotis (*Myotis keenii*; Blue-listed), olive-sided flycatcher (*Contopus cooperi*; Blue-listed; *SARA*-listed), rusty blackbird (*Euphagus carolinus*; Blue-listed; *SARA*-listed), northern goshawk (*Accipiter gentilis laingi*; Red-listed; *SARA*-listed), marbled murrelet (*Brachyramphus marmoratus*; Blue-listed; *SARA*-listed) and grizzly bear (Blue-listed).

Table 5.7-6: Potential Direct Effects on OGMA Valued Component in the Local Study Area

OGMA Name	OGMA Internal ID	Existing Condition in LSA (ha)	Area Overlapping New Roads		Area Overlapping Transmission Line ROW		Area Overlapping New Roads or ROW	
			Hectares	Percent of VC in LSA (%)	Hectares	Percent of VC in LSA (%)	Hectares	Percent of VC in LSA (%)
SKE_KLM_467	9239	87.7	0.3	0.1	3.5	1.0	3.8	1.1
SKE_KLM_617	9389	28.0	0.9	0.3	4.8	1.4	5.7	1.7
SKE_KLM_629	9401	55.3	0.0	0.0	0.1	<0.1	0.1	<0.1
Total OGMA in New Roads or Transmission Line ROW		**170.9**	**1.2**	**0.3**	**8.4**	**2.4**	**9.6**	**2.8**
Total OGMA in LSA		**343.3**						

Notes: VC = valued component; ha = hectare; KLM = Kalum; LSA = Local Study Area; OGMA = Old Growth Management Area; ROW = right-of-way; SKE = Skeena; % = percent

OGMA SKE_KLM_617 may require an amendment because >10% of its area will be affected by the Project and it contains suitable wildlife habitat for Red- or Blue-listed species. A total of 5.7 ha (20.4%) of OGMA SKE_KLM_617 will be affected by the Project. Two targeted surveys for cryptic paw were conducted in this OGMA by the plant species at risk field crews. Cryptic paw was not detected during the survey, but this OGMA represents suitable habitat for this species. The nearest stream crossing is 60 m from the edge of this OGMA. This stream is unlikely to support Red- or Blue-listed fish species at or upstream of the crossing site. This OGMA represents suitable habitat for coastal tailed frog, Keen's myotis, olive-sided flycatcher, rusty blackbird, northern goshawk, marbled murrelet and grizzly bear.

OGMA SKE_KLM_629 may require an amendment because it contains suitable wildlife habitat for Red- or Blue-listed species. A total of 0.1 ha (0.2%) of OGMA SKE_KLM_629 will be affected by the Project. OGMA_SKE_KLM_629 does not overlap with any mapped streams. This OGMA represents suitable habitat for cryptic paw, Keen's myotis, olive-sided flycatcher, northern goshawk, marbled murrelet and grizzly bear.

Appendix C.4 shows the extent of potential Project effects on OGMAs.

Those portions of the OGMA VC that directly overlap new roads or the transmission line ROW will be directly removed during the clearing/construction phase. Vegetation management throughout the operation/maintenance phase will prevent this VC from returning to existing conditions during this phase. Minor potential effects are anticipated during the closure and post-closure phases. Mitigation measures VM2 to VM7 will reduce but not eliminate project effects. Given this, and the long-time interval (250 years post-closure) required for old forests to re-establish, this VC is carried forward to the residual effects section.

5.7.1.6 Riparian Ecosystems

As stated above in the vegetation post-fieldwork methods section, the riparian ecosystems VC is meant to represent a generic buffer around wetlands, lakes and streams that is wide enough to support their long-term ecological functions in the absence of information regarding top-of-bank. The riparian ecosystems VCs should not be confused with riparian vegetation discussed in the fisheries and aquatics resources section, nor with BC Hydro's RVMAs. There are 1,677.1 ha of riparian ecosystems in the LSA, 95.3 ha (5.7% of all riparian ecosystems in the LSA) of which will be intersected by the Project components (**Table 5.7-7**; **Appendix C.6**). A total of 86.2 ha (5.1%) of riparian ecosystems in the LSA will be intersected by the transmission line ROW, and 9.1 ha (0.5% of all riparian ecosystems in the LSA) by new roads. Riparian ecosystems along major rivers are of particular concern because they not only represent suitable habitat for Blue- and Red-listed species at risk, but are also active floodplain communities at risk. A total of 12.7 ha (0.8 % of all riparian ecosystems in the LSA) of floodplain ecosystems will intersect the transmission line ROW and 0.8 ha (<0.1% of all riparian ecosystems in the LSA) with new access roads (**Table 5.7-7**). Major rivers with potentially affected riparian ecosystems include Coldwater Creek (structures 49–50), Lone Wolf Creek (structures 83–85), Wedeene River (structures 116–117), Little Wedeene River (structures 128–129), and Anderson Creek (near Kitimat substation).

Vegetation clearing during the clearing/construction phase will directly adversely affect components of this VC (e.g. trees). Road construction during this phase will compact soil and alter soil profile and hydrological features. Vegetation maintenance in the ROW during the operation/maintenance phase will directly affect this VC by preventing it from returning to existing conditions. Edge effect will indirectly affect this VC outside of the ROW during the operation/maintenance phase. Minimal adverse Project effects are anticipated during the closure and post/closure phases. This VC will likely respond positively during the closure and post-closure phases because it will partially return to existing conditions over time.

It is assumed that no temporary construction sites will occur in this VC, so mitigation VM5 is not relevant. Mitigations VM2, VM3, VM4, VM6, VM7 and BC Hydro's BMPs (BC Hydro, 20003a; 2003b; 2016) will help to minimize but not eliminate potential Project effects. This VC is therefore carried forward to the residual effects section.

Table 5.7-7: Potential Direct Effects on Riparian Ecosystems Valued Component in the Local Study Area

BGC Unit	Ecosystem Name	Site Series	Map Code	Existing Condition in LSA (ha)	New Access Road		Transmission Line ROW		Combine Area in New Roads and ROW	
					Hectares	Percent of VC in LSA (%)	Hectares	Percent of VC in LSA (%)	Hectares	Percent of VC in LSA (%)
CWHws1	Non-floodplain Riparian Ecosystems	-	-	814.0	4.9	20.0	47.8	636.1	52.7	3.1
CWHws1	[1]Sitka Spruce – Salmonberry	07	SS*	197.3	0.7	<0.1	5.4	0.3	6.0	0.4
CWHws1	[1]Black cottonwood – Red-osier dogwood	08	CD**	116.5	0.1	<0.1	4.1	0.2	4.2	0.3
CWHws1	[1]Black cottonwood – Willow	09	CW	14.6	0.0	0.0	<0.1	<0.1	<0.1	<0.1
Total CWHws1 Riparian Ecosystems				1,142.4	5.7	20.0	57.3	636.7	63.0	3.8
CWHvm1	Non-floodplain Riparian Ecosystems	-	-	388.7	3.4	0.2	25.7	320.9	29.1	1.7
CWHvm1	[1]Sitka Spruce – Salmonberry	09	SS*	52.0	0.0	0.0	2.8	0.2	2.8	0.2
CWHvm1	[1]Black cottonwood – Red-osier dogwood	10	CD**	28.5	0.0	0.0	0.2	<0.1	0.2	<0.1
CWHvm1	[1]Black cottonwood – Willow	11	CW	5.2	0.0	0.0	0.2	<0.1	0.2	<0.1
Total CWHvm1 Riparian Ecosystems				474.4	3.4	0.2	28.9	321.1	32.3	1.9
Total Riparian Ecosystems in New Roads or Transmission Line ROW					**9.1**	**0.5**	**86.2**	**5.1**	**95.3**	**5.7**
Total Riparian Ecosystems in LSA				**1,677.1**						

Notes: [1] = floodplain riparian ecosystem. BGC = biogeoclimatic; VC = valued component; ha = hectare; LSA = Local Study Area; ROW = right-of way; % = percent
CWHws1 = Coastal Western Hemlock Wet Submaritime Montane variant; CWHvm1 = Coastal Western Hemlock Montane Very Wet Maritime Submontane variant; Riparian Ecosystems = 36 m buffer around streams, wetlands and waterbodies.

5.7.1.7 Wetlands

A total of 16.5 ha (2.8% of wetlands in the LSA) will be intersected by Project components (**Table 5.7-8**, **Appendix C.6**). New access roads will intersect 0.7 ha (0.1% of all wetlands in the LSA) and the transmission line ROW will intersect 15.8 ha (2.7% of all wetlands within the LSA). Blue-listed wetlands (**Table 5.7-8**) and wetland ecosystems along major rivers are of particular concern. These major rivers include Coldwater Creek (structures 49–50), Lone Wolf Creek (structures 83–85), Wedeene River (structures 116–117), Little Wedeene River (structures 128–129), and Anderson Creek (near Kitimat substation). The following proposed structures will be in wetlands or their riparian buffers: 3, 4 and 33. The following structures will be near wetlands or their riparian buffers and will result in the transmission line spanning wetlands: 24, 25, 37, 38, 39, 58, 59, 61, 74, 76, 77, 78, 80, 81, 99, 100, 121, 122, 128, 129, 132 and 133.

Wetlands dominated by vegetation <2 m tall will likely be less affected by Project activities during all phases compared to wetlands dominated by vegetation ≥2 m tall. Unless intersected by a road, wetlands dominated by vegetation <2 m tall (e.g. fens, marshes and some bogs) will likely require less clearing during the clearing/construction phase and less vegetation maintenance during the operation/maintenance phase compared to wetlands dominated by vegetation ≥2 m tall. Conversely, wetlands dominated by trees or shrubs ≥2 m tall (e.g. LS, and all swamps) will be cleared during the clearing/construction phase and be prevented from returning to existing conditions during the operation/maintenance phase. Approximately 14.8 ha of wetlands dominated by trees or shrubs ≥2 m tall will be intersected by the transmission line ROW and new access roads. Road construction during the clearing/construction phase will compact soil and alter soil profile and hydrological features. Vegetation maintenance in the transmission line ROW during the operation/maintenance phase will directly affect this VC by preventing it from returning to existing conditions and by altering the composition and structure of this VC. Edge effect will indirectly affect this VC outside of the transmission line ROW during the operation/maintenance phase. Minimal adverse Project effects are anticipated during the closure and post/closure phases. The wetlands VC will likely respond positively during the closure and post-closure phases because it will partially return to existing conditions naturally.

It is assumed that no temporary construction sites will occur in this VC, so mitigation VM5 is not relevant. Mitigations VM2, VM3, VM4, VM6, VM7m and BC Hydro's BMPs (BC Hydro, 20003a; 2003b; 2016) will reduce but not eliminate Project effects during relevant phases. This VC is therefore carried forward to the residual effects section.

Table 5.7-8: Potential Direct Effects on Wetlands Valued Component in the Local Study Area

Vegetation Structure	Vegetation Height (m)	BGC Unit	Ecosystem Name	Site Series	Map Code	Existing Condition in LSA (ha)	Area Overlapping New Access Roads		Area Overlapping Transmission Line ROW*		Area Overlapping New Access Roads or ROW	
							Hectares	Percent of VC in LSA (%)	Hectares	Percent of VC in LSA (%)	Hectares	Percent of VC in LSA (%)
herbaceous or graminoid	<2	CWHws1	Wetland fen	00	Wf	20.2	<0.1	<0.1	0.5	0.1	0.5	0.1
herbaceous or graminoid	<2	CWHws1	Swamp horsetail - Beaked sedge	00	Wm02	1.0	0.1	<0.1	0.3	0.1	0.4	0.1
dwarf shrub or low shrub	<2	CWHws1	Shore sedge - Buckbean – Peatmoss	00	Wb13**	9.1	0.0	0.0	0.3	<0.1	0.3	<0.1
dwarf shrub or low shrub	<2	CWHvm1	Shore sedge – Buckbean – Peatmoss	00	Wb13	8.5	0.0	0.0	0.6	0.1	0.6	0.1
Wetlands with vegetation <2 m tall						38.8	0.1	<0.1	1.7	0.3	1.8	0.3
tall shrub	2 to 10	CWHws1	Pink spirea – Sitka sedge	00	Ws50	34.1	0.1	<0.1	1.7	0.3	1.8	0.3
tall shrub	2 to 10	CWHvm1	Pink spirea – Sitka sedge	00	Ws50	19.6	0.0	0.0	0.1	<0.1	0.1	<0.1
treed	>10	CWHws1	Lodgepole pine – Sphagnum	10	LS	29.0	0.0	0.0	0.2	<0.1	0.2	<0.1
treed	>10	CWHws1	Red alder – Skunk cabbage	00	Ws52	18.2	<0.1	<0.1	0.4	0.1	0.4	0.1
treed	>10	CWHws1	Western redcedar – Sitka spruce – Skunk cabbage	11	Ws54**	154.5	0.5	0.1	10.3	1.7	10.8	1.8
treed	>10	CWHvm1	Western redcedar – Sitka spruce – Skunk cabbage	14	Ws54**	177.1	0.1	<0.1	1.4	0.2	1.5	0.2
Wetlands with vegetation ≥2 m tall						432.5	0.6	0.1	14.2	2.4	14.8	2.5
Total Wetlands in New Access Roads or Transmission Line ROW							**0.7**	**0.1**	**15.8**	**2.7**	**16.5**	**2.8**
Total Wetlands in LSA						**591.30**						

Notes: [1]based on maximum clearing width of 120 m; VC = valued component; ** = Blue-listed; LSA = Local Study Area; ROW = right-of-way; ha = hectare; % = percent
CWHws1 = Coastal Western Hemlock Wet Submaritime Montane variant; CWHvm1 = Coastal Western Hemlock Montane Very Wet Maritime Submontane variant

5.7.1.8 Sparsely Vegetated Ecosystems

A single talus slope is the only sparsely vegetated ecosystem in the LSA. It comprises colluvial blocks and boulders and is dominated by low-growing vegetation such as lichens, moss and shrubs. This VC is known to provide suitable habitat for plant species at risk and wildlife such as bats, snakes and small mammals. Of the 7.5 ha in the LSA, 0.3 ha (3.7%) will be directly affected by the transmission line and new access ROW. The talus slope occurs within 42 m of proposed structure 134 and is currently intersected by an existing road (1078R); therefore, previous disturbance has already taken place.

Clearing and construction will result in ground disturbance, which will alter the existing vegetation such as low growing shrubs, lichens and mosses. Unstable portions (e.g. loose talus boulders) may require stabilization resulting in further ground disturbance. One-time project effects will likely occur due to ground disturbance during the clearing/construction phase. Minimal to no disturbance is anticipated during the operation/maintenance, closure and post-closure phases. This VC will likely respond positively during the closure and post-closure phases because it may return to existing conditions naturally.

This VC is not carried forward to the residual effects section because mitigation measures VM6 and VM7 are expected to be effective, even though all effects may not be completely eliminated, the area potentially affected is very small resulting in negligible potential Project effects.

5.7.1.9 Unlisted Terrestrial Ecosystems

This VC comprises the four unlisted terrestrial ecosystems that have not otherwise been assigned to a vegetation VC. All other ecosystem types have been identified as components of other vegetation VCs and are independently assessed above.

Of the 6,985.8 ha of the unlisted terrestrial ecosystems VC in the LSA, 450 ha (6.4% of all unlisted terrestrial ecosystems in the LSA) will be directly affected by the Project (**Table 5.7-9**, **Appendix C.1**). The most affected unlisted terrestrial ecosystem is the mesic Western hemlock – Amabilis fir – Bramble (CWHws1 01/AB) ecosystem. A total of 46.0 ha (0.7% of all unlisted terrestrial ecosystems in the LSA) of this ecosystem will be affected by new roads, and another 279.4 ha (4.0% of all unlisted terrestrial ecosystems in the LSA) by the transmission ROW.

The removal of vegetation during the clearing/construction phase will result in a one-time disturbance to this VC. The construction of a new transmission line ROW requires grubbing to remove stumps, soil compaction/alteration for crane pads and structure foundations.

Integrated vegetation management (BC Hydro, 2016) during the operation/maintenance phase will affect this VC during the operation/maintenance phase by mechanically and chemically maintaining it in a shrubby/herbaceous early seral plant community that is compatible with the requirements of a transmission line ROW.

This VC will likely respond positively during the closure and post-closure phases. Outside of new roads, mitigation VM7 will likely contribute to a timely return to existing condition during the post-closure phase. However, potential project effects due to construction of new access roads are likely to be a residual effect, so this VC is carried forward to the residual effects section because mitigation measures will reduce but not eliminate Project effects.

Table 5.7-9: Potential Direct Effects on Unlisted Terrestrial Ecosystems in the Local Study Area

BGC Unit	Ecosystem Name	Site Series	Map Code	Existing Condition in LSA (ha)	Area Overlapping New Access Roads		Area Overlapping Transmission Line ROW		Area Overlapping New Access Roads or ROW	
					Hectares	Percent of VC in LSA (%)	Hectares	Percent of VC in LSA (%)	Hectares	Percent of VC in LSA (%)
CWHws1	Western hemlock – Amabilis fir – Bramble	01	AB	5,161.9	46.0	0.7	279.4	4.0	325.4	4.7
CWHws1	Western hemlock – Amabilis fir – Queen's cup	05	HQ	164.1	2.5	<0.1	13.4	0.2	15.9	0.2
Total CWHws1 Unlisted Terrestrial Ecosystems				**5,326.0**	**48.4**	**0.7**	**292.9**	**4.2**	**341.3**	**4.9**
CWHvm1	Western hemlock – Amabilis fir – Blueberry	01	AB	1,186.9	15.0	0.2	70.9	1.0	85.9	1.2
CWHvm1	Amabilis fir – Western redcedar – Foamflower	05	AF	105.4	3.3	<0.1	19.4	0.3	22.7	0.3
Total CWHvm1 Unlisted Terrestrial Ecosystems				**1,292.3**	**18.4**	**0.3**	**90.3**	**1.3**	**108.7**	**1.6**
Total Unlisted Terrestrial Ecosystems in New Access Roads or Transmission Line ROW					**66.8**	**1.0**	**383.2**	**5.5**	**450.0**	**6.4**
Total of all Unlisted Terrestrial Ecosystems total in LSA				**6,985.8**						

Notes: BGC = biogeoclimatic; ha = hectare; VC = valued component; LSA = Local Study Area; ROW = right-of-way; % = percent
CWHws1 = Coastal Western Hemlock Wet Submaritime Montane variant; CWHvm1 = Coastal Western Hemlock Montane Very Wet Maritime Submontane variant

5.7.2 Residual Effects

If potential Project effects on vegetation VCs cannot be avoided through design, the optimization of clearing standards or mitigation during the clearing/construction, operation/maintenance or closure phases as described in the previous section, residual effects may be expected. **Table 5.7-17** provides a summary of potential residual Project effects by vegetation VC and the rationale for their determination. Vegetation VCs that are anticipated to incur adverse residual effects are carried forward to the characterization of residual effects section.

5.7.2.1 First Nations Botanical Resources

Compatible use management is practicable and an effective means of mitigating for some residual effects, but is unlikely to mitigate for those First Nations botanical resources that typically occur in riparian ecosystems (map code SS), wetlands (map codes Ws50 and Ws54), ecological communities at risk (map codes AO, AD, CD, HS, and HD), or new roads. A total of 126.9 ha (4.8% of this VC in the LSA) of First Nations Botanical Resource ecosystems are in riparian ecosystems, wetlands, ecological communities at risk, or new roads, and are unlikely to return to existing conditions (**Table 5.7-10**), so this VC is carried forward to the characterization of residual effects section.

Table 5.7-10: Residual Effects on First Nations Botanical Resources Valued Component in the Local Study Area

BGC Unit	Ecosystem Name	Site Series	Map Code	Existing Condition in LSA (ha)	Closure and Post-Closure Phases	
					Area Not Likely to Return to Existing Condition (ha)	Percentage of Total Area of VC in LSA Not Likely to Return to Existing Condition
CWHws1	Amabilis fir – Western redcedar – Oak fern	04	AO**	474.9	5.1	0.2
CWHws1	Western hemlock – Amabilis fir – Queen's cup	05	HQ	164.1	2.5	0.1
CWHws1	Amabilis fir – Western redcedar – Devil's club	06	AD**	474.8	32.3	1.2
CWHws1	Sitka Spruce – Salmonberry	07	SS*	197.3	6.0	0.2
CWHws1	Black cottonwood – Red-osier dogwood	08	CD**	116.5	4.2	0.2
CWHws1	Pink spirea – Sitka sedge	00	Ws50	34.1	1.8	0.1
CWHws1	Western redcedar – Sitka spruce – Skunk cabbage	11	Ws54**	154.5	10.8	0.4
Total CWHws1				**1,616.1**	**62.7**	**2.4**
CWHvm1	Western hemlock – Western redcedar – Salal	03	HS**	228.1	20.4	0.8
CWHvm1	Western hemlock – Amabilis fir – Deer fern	06	HD**	60.5	1.8	0.1
CWHvm1	Amablis fir – Sitka spruce – Devil's club	08	AD**	405.2	37.5	1.4
CWHvm1	Sitka Spruce – Salmonberry	09	SS*	52.0	2.8	0.1
CWHvm1	Black cottonwood – Red-osier dogwood	10	CD**	28.5	0.2	<0.1
CWHvm1	Western redcedar – Sitka spruce – Skunk cabbage	14	Ws54**	177.1	1.5	0.1
Total CWHvm1				**951.4**	**64.2**	**2.4**
Total Area of First Nations Botanical Resources Ecosystems Not Likely to Return to Existing Condition					**126.9**	**4.8**
Total First Nations Botanical Resource Ecosystems in the LSA				**2,626.5**		

Notes: BGC = biogeoclimatic; VC = valued component; ha = hectare; LSA = Local Study Area; * = Red-listed; ** = Blue-listed; ROW = right-of-way; % = percent
CWHws1 = Coastal Western Hemlock Wet Submaritime Montane variant; CWHws2 = Coastal Western Hemlock Very Wet Maritime Submontane variant; CWHvm1 = Coastal Western Hemlock Montane Very Wet Maritime Submontane variant; CWHvm2 = Coastal Western Hemlock Montane Very Wet Maritime Montane variant; MHmm1 = Mountain Hemlock Moist Maritime Windward variant

5.7.2.2 Plant Species At Risk

Edge effect and vegetation management during the operation/maintenance phase would will likely result in increased competition from herbaceous plants throughout any Wb13 wetland intersected by the transmission line ROW. This VC is only known from Wb13 wetlands in the LSA. Increased competition will likely lead to a long-term declining trend in population growth rates for this VC from the clearing/construction to the post-closure phase. A negative population growth rate is anticipated to occur in 5.4 ha (30.7%) of the 17.6 ha, this VC occupies in the LSA. Given that a negative population growth rate is anticipated, it is not known if this VC will persist in Wb13 wetlands intersected by the ROW until the post-closure phase. This VC is therefore carried forward to the characterization of residual effects section.

5.7.2.3 Ecological Communities At Risk

Ecological communities at risk have arisen due to complex ecological requirements, unique disturbance history and physiographic settings. It is uncertain whether these variables can be reproduced during the closure and post-closure phase of the Project. This, and the long time period required for ecological communities at risk to re-establish (≥140 years), is why clearing during the clearing/construction phase is likely to result permanent adverse effect on the ecological communities at risk VC. The ecological communities at risk VC is carried forward to the characterization of residual effects section because 32.9 ha (3.1% of this VC in the LSA) (**Table 5.6-12**) are unlikely to return to existing conditions.

Table 5.7-11: Residual Effects on Ecological Communities At Risk Valued Component in the Local Study Area

BGC Unit	Ecosystem Name	Site Series	Map Code	Existing Condition LSA (ha)	Closure and Post-Closure Phases: Area Not Likely to Return to Existing Condition (ha)	Closure and Post-Closure Phases: Percentage of Total Area of VC in LSA Not Likely to Return to Existing Condition
CWHws1	Amabilis fir – Western redcedar – Devil's club	06	AD**	224.7	11.7	1.1
CWHws1	Sitka Spruce – Salmonberry	07	SS*	146.8	5.3	0.5
CWHws1	Black cottonwood – Red-osier dogwood	08	CD**	20.2	1.0	0.1
CWHws1	Shore sedge – Buckbean – Peatmoss	00	Wb13**	9.1	0.3	<0.1
CWHws1	Western redcedar – Sitka spruce – Skunk cabbage	11	Ws54**	55.8	2.5	0.2
Total CWHws1				**456.6**	**20.8**	**2.0**
CWHvm1	Western hemlock – Western redcedar – Salal	03	HS**	90.2	2.1	0.2
CWHvm1	Western hemlock – Amabilis fir – Deer fern	06	HD**	14.2	0.4	0.0
CWHvm1	Amabilis fir – Sitka spruce – Devil's club	08	AD**	72.1	7.2	0.7
CWHvm1	Sitka Spruce – Salmonberry	09	SS*	36.4	1.8	0.2
CWHvm1	Shore sedge – Buckbean – Peatmoss	00	Wb13**	8.5	0.6	0.1
Total CWHvm1				**221.4**	**12.1**	**1.2**
Total Area of Ecological Communities not Likely to Return to Existing Condition					**32.9**	**3.1**
Total Ecological Communities At Risk in LSA				**1,044.6**		

Notes: BGC = biogeoclimatic; ha = hectare; VC = valued component; LSA = Local Study Area; * = Red-listed; ** = Blue-listed; ROW = right-of-way; % = percent
CWHws1 = Coastal Western Hemlock Wet Submaritime Montane variant; CWHws2 = Coastal Western Hemlock Very Wet Maritime Submontane variant; CWHvm1 = Coastal Western Hemlock Montane Very Wet Maritime Submontane variant; CWHvm2 = Coastal Western Hemlock Montane Very Wet Maritime Montane variant; MHmm1 = Mountain Hemlock Moist Maritime Windward variant

5.7.2.4 Old Forest

The implementation of a RCP (VM7) will likely reverse residual effects in the far future (≥250 years). However, given the long-time interval needed for old forest to re-establish, residual effects are considered permanent. This VC is carried forward to the characterization of residual effects section because 62.1 ha (3.5% of this VC in the LSA) (**Table 5.7-12**) of old forest are not likely to return to existing conditions.

Table 5.7-12: Residual Effects on Old Forest in the Local Study Area

BGC Unit	Ecosystem Name	Site Series	Map Code	Existing Condition in LSA (ha)	Closure and Post-Closure: Area Unlikely to Return to Existing Condition (ha)	Closure and Post-Closure: Percentage of Total Area of VC in LSA Not Likely to Return to Existing Condition
CWHws1	Western hemlock – Amabilis fir – Bramble	01	AB	526.7	22.5	1.3
CWHws1	Amabilis fir – Western redcedar – Devil's club	06	AD**	209.4	11.7	0.7
Total CWHws1 Old Forest – Upland				**736.1**	**34.2**	**1.9**
CWHws1	Sitka Spruce – Salmonberry	07	SS*	51.7	3.1	0.2
CWHws1	Black cottonwood – Red-osier dogwood	08	CD**	5.5	0.2	<0.1
Total CWHws1 Old Forest – Riparian Floodplain Ecosystems				**57.2**	**3.3**	**0.2**
CWHws1	Western redcedar – Sitka spruce – Skunk cabbage	11	Ws54**	22.4	1.5	0.1
Total CWHws1 Old Forest – Wetland				**22.4**	**1.5**	**0.1**
Total CWHws1				**815.7**	**39.0**	**2.2**
CWHvm1	Western hemlock – Amabilis fir – Blueberry	01	AB	237.8	9.5	0.5
CWHvm1	Western hemlock – Western redcedar – Salal	03	HS**	73.4	2.0	0.1
CWHvm1	Amabilis fir – Western redcedar – Foamflower	05	AF	18.3	2.0	0.1
CWHvm1	Western hemlock - Amabilis fir – Deer fern	06	HD**	14.2	0.4	<0.1
CWHvm1	Amablis fir – Sitka spruce – Devil's club	08	AD**	59.9	6.9	0.4
Total CWHvm1 Old Forest – Upland				**403.6**	**20.8**	**1.2**
CWHvm1	Sitka Spruce – Salmonberry	09	SS*	7.2	1.8	0.1
Total CWHvm1 Old Forest Riparian Floodplain Ecosystems				7.2	1.8	0.1
Total CWHvm1				**410.8**	**22.7**	**1.3**
Total Old Forest Upland				**1,139.7**	**55.0**	**3.1**
Total Old Forest Riparian Floodplain Ecosystems				**64.4**	**5.2**	**0.3**
Total Old Forest Wetlands				**86.8**	**1.9**	**0.1**
Total Old Forest area not Likely to Return to Existing Condition					**62.1**	**3.5**
Total Old Forest in LSA				**1,763.7**		

Notes: BGC = biogeoclimatic; ha = hectare; VC = valued component; LSA = Local Study Area; * = Red-listed; ** = Blue-listed; ROW = right-of-way; % = percent
CWHws1 = Coastal Western Hemlock Wet Submaritime Montane variant; CWHws2 = Coastal Western Hemlock Very Wet Maritime Submontane variant; CWHvm1 = Coastal Western Hemlock Montane Very Wet Maritime Submontane variant; CWHvm2 = Coastal Western Hemlock Montane Very Wet Maritime Montane variant; MHmm1 = Mountain Hemlock Moist Maritime Windward variant

5.7.2.5 OGMAs

The one-time loss of OGMAs directly affected by the Project is considered to represent a residual effect for two reasons. Firstly, one-time clearing during clearing/construction will result in a loss of old-growth forest. Given the long-time interval needed for old-growth forest to re-establish (≥250 years), this loss is considered to be a permanent residual effect. Secondly, amendments to OGMAs may not be sought and implemented. This VC is carried forward to the characterization of residual effects because 9.6 ha are not likely to return to existing conditions and one OGMA will lose 20.4% of its extent (**Table 5.7-13**).

Table 5.7-13: Residual Effects on OGMA Valued Component in the Local Study Area

OGMA Name	Legal OGMA Internal ID	Existing Condition of OGMA (ha)	Closure and Post-Closure Phases	
			Area Unlikely to Return to Existing Condition (ha)	**Percentage of each OGMA's Total Area Not Likely to Return to Existing Condition**
SKE_KLM_467	9239	96.0	3.8	4.0
SKE_KLM_617	9389	28.0	5.7	20.4
SKE_KLM_629	9401	55.3	0.1	0.2
Total Area of OGMA not Likely to Return to Existing Condition		**-**	**9.6**	**-**
Total OGMA in LSA		**343.3**		**-**

Notes: ha = hectare; KLM = Kalum; LSA = Local Study Area; OGMA = Old Growth Management Area; ROW = right-of-way; SKE = Skeena; % = percent

5.7.2.6 Riparian Ecosystems

Clearing of riparian ecosystems VC and road construction during the clearing/construction phase and vegetation maintenance during the operation/maintenance phase will result in a permanent residual effect. This VC is carried forward to the residual effects section because 108.8 ha of riparian ecosystems overlap proposed new roads or the transmission line ROW and will incur a residual effect (**Table 5.7-14**).

Table 5.7-14: Residual Effects on Riparian Ecosystems Valued Component in the Local Study Area

BGC Unit	Ecosystem Name	Site Series	Map Code	Existing Condition in LSA (ha)	Closure and Post-Closure Phases	
					Area Not Likely to Return to Existing Condition (ha)	Percentage of Total Area of VC in LSA Not Likely to Return to Existing Condition
CWHws1	Non-floodplain Riparian Ecosystems	-	-	814.0	63.0	3.8
CWHws1	[1]Sitka Spruce - Salmonberry	07	SS*	197.3	6.0	0.4
CWHws1	[1]Black cottonwood - Red-osier dogwood	08	CD**	116.5	4.2	0.3
CWHws1	[1]Black cottonwood - Willow	09	CW	14.6	<0.1	<0.1
Total CWHws1 Riparian Ecosystems				**1,142.4**	**73.3**	**4.4**
CWHvm1	Non-floodplain Riparian Ecosystems	-	-	388.7	32.3	1.9
CWHvm1	[1]Sitka Spruce - Salmonberry	09	SS*	52.0	2.8	0.2
CWHvm1	[1]Black cottonwood - Red-osier dogwood	10	CD**	28.5	0.2	<0.1
CWHvm1	[1]Black cottonwood - Willow	11	CW	5.2	0.2	<0.1
Total CWHvm1 Riparian Ecosystems				**474.4**	**35.5**	**2.1**
Total Area of Riparian Ecosystems Not Likely to Return to Existing Condition					**108.8**	**6.5**
Total Riparian Floodplain Ecosystems in LSA				**1,667.1**		

Notes: [1] = Floodplain riparian ecosystem; BGC = biogeoclimatic; VC = valued component; ha = hectare; LSA = Local Study Area; ROW = right-of way; % = percent; CWHws1 = Coastal Western Hemlock Wet Submaritime Montane variant; CWHvm1 = Coastal Western Hemlock Montane Very Wet Maritime Submontane variant; Riparian Ecosystems = 36 m buffer around streams, wetlands and waterbodies

5.7.2.7 Wetlands

Residual effects on wetlands are anticipated because one-time clearing for line construction during the clearing/construction phase and vegetation management during the operation/maintenance phase may result in a permanent change to this VC's plant community composition. As mentioned in **Section 5.7.1.7**, not all wetlands will be affected equally because those with tall shrubs or trees (>2 m tall) will be cleared and maintained to a greater extent than wetlands with low growing vegetation (<2 m tall). Those portions of wetlands that overlap with proposed new roads will likely represent a permanent residual effect. A total of 14.9 ha (**Table 5.7-15**) of wetlands are not likely to return to existing conditions during the post-closure phase because they are wetlands dominated by vegetation <2 m tall and overlap proposed roads or they are wetlands dominated by vegetation >2 m tall and overlap a proposed road or the transmission line ROW. Therefore, this VC is carried forward to the characterization of residual effects section.

Table 5.7-15: Residual Effects on Wetlands Valued Component in the Local Study Area

Vegetation Structure	Height (m)	BGC Unit	Ecosystem Name	Site Series	Map Code	Existing Condition in LSA (ha)	Closure and Post-Closure Phases: Area Not Likely to Return to Existing Conditions (ha)	Closure and Post-Closure Phases: Percentage of Total Area of VC in LSA Not Likely to Return to Existing Condition
herbaceous or graminoid	<2	CWHws1	Wetland fen	00	Wf	20.20	0.0	<0.1
herbaceous or graminoid	<2	CWHws1	Swamp horsetail – Beaked sedge	00	Wm02	1.00	0.1	<0.1
Wetlands vegetation <2 m tall overlapping new roads						21.2	0.1	<0.1
tall shrub	2 to 10	CWHws1	Pink spirea – Sitka sedge	00	Ws50	34.10	1.8	0.3
tall shrub	2 to 10	CWHvm1	Pink spirea – Sitka sedge	00	Ws50	19.60	0.1	<0.1
treed	>10	CWHws1	Lodgepole pine – Sphagnum	10	LS	29.00	0.2	<0.1
treed	>10	CWHws1	Red alder – Skunk cabbage	00	Ws52	18.20	0.4	0.1
treed	>10	CWHws1	Western redcedar – Sitka spruce – Sunk cabbage	11	Ws54**	154.50	10.8	1.8
treed	>10	CWHvm1	Western redcedar – Sitka spruce – Skunk cabbage	14	Ws54**	177.10	1.5	0.2
Wetlands with shrub or trees >2 m tall overlapping new roads or transmission line ROW						432.50	14.8	2.5
Total Wetlands Not Likely to Return to Existing Conditions							**14.9**	**2.5**
Total Wetlands in LSA						**591.30**		

Notes: [1]based on maximum clearing width of 120 m; BGC = biogeoclimatic; **=Blue-listed; LSA = Local Study Area; ROW = right-of-way; ha = hectare; VC = valued component; % = percent; CWHws1 = Coastal Western Hemlock Wet Submaritime Montane variant; CWHvm1 = Coastal Western Hemlock Montane Very Wet Maritime Submontane variant

5.7.2.8 Unlisted Terrestrial Ecosystems

With mitigation, project effects in the transmission line ROW will be reduced, but may not be eliminated. Those portions of unlisted terrestrial ecosystems that overlap new roads (66.8 ha) (**Table 5.7-16**) are not likely to return to existing conditions during the post-closure phase because of the changes that will occur to the soil profile and soil compaction. As a result, this VC is carried forward to the characterization of residual effects section.

Table 5.7-16: Residual Effects on Unlisted Terrestrial Ecosystems

BGC Unit	Ecosystem Name	Site Series	Map Code	Existing Condition in LSA (ha)	Closure and Post-Closure Phases	
					Area Not Likely to Return to Existing Conditions (ha)	Percentage of Total Area of VC in LSA Not Likely to Return to Existing Condition
CWHws1	Western hemlock – Amabilis fir – Bramble	01	AB	5,161.9	46.0	0.7
CWHws1	Western hemlock – Amabilis fir – Queen's cup	05	HQ	164.1	2.5	<0.1
Total CWHws1 Unlisted Terrestrial Ecosystems				**5,326.0**	**48.4**	**0.7**
CWHvm1	Western hemlock – Amabilis fir – Blueberry	01	AB	1,186.9	15.0	0.2
CWHvm1	Amabilis fir – Western redcedar – Foamflower	05	AF	105.4	3.3	<0.1
Total CWHvm1 Unlisted Terrestrial Ecosystems				**1,292.3**	**18.4**	**0.3**
Total Unlisted Terrestrial Ecosystems Not Likely to Return to Existing Condition					**66.8**	**1.0**
Total of All Unlisted Terrestrial Ecosystems Total in LSA				**6,985.8**		

Notes: BGC = biogeoclimatic; VC = valued component; ha = hectare; LSA = Local Study Area; ROW = right-of-way; % = percent; CWHws1 = Coastal Western Hemlock Wet Submaritime Montane variant; CWHvm1 = Coastal Western Hemlock Montane Very Wet Maritime Submontane variant

Table 5.7-17: Potential Residual Effects on Vegetation Valued Components

Project Effect	Valued Component	Adverse Residual Effect (yes/no)	Rationale
Direct ecosystem alteration and loss	First Nations Botanical Resources	Yes	Habitat loss and alteration incurred during the clearing/construction, and operation/maintenance phases of the Project. Compatible use management is a practicable and effective means of mitigating for some, but not all of these losses.
Direct ecosystem loss and edge effect	Plant Species At Risk	Yes	Edge effect and vegetation management during the operation/maintenance phase would likely increase competition from herbaceous plants. Increased competition would likely lead to a long-term declining trend in population growth rates from the clearing/construction to the post-closure phase.
Direct ecosystem alteration and loss	Ecological Communities At Risk	Yes	Ecological communities at risk are not likely to fully recover in the post-closure phase because they had arisen as a result of unique disturbance histories and physiographic settings, which are not likely to be artificially reproduced. This applies to all Project components where clearing or construction are required. Mitigation measures for most riparian and wetland ecological communities at risk will minimize potential Project effects and will be practicable. However, mitigation measures for upland ecological communities at risk will likely not be effective. Any upland ecological community at risk overlapping with a Project component likely represents a permanent loss, especially those in the ROW of new roads.
Direct ecosystem alteration and loss and Ecosystem Fragmentation	Old Forest	Yes	The implementation of a RCP (VM7) will reverse residual effects in the far future (250 years). However, given the long-time interval needed for old forest to re-establish, this effect is considered to be residual.
Direct ecosystem alteration and loss and Ecosystem Fragmentation	OGMAs	Yes	The one-time loss of OGMAs directly affected by the Project is considered to be residual effect for two reasons. Firstly, one-time clearing during clearing/construction will result in a loss of old forest. Given the long-time interval needed for old forest to re-establish, this loss is considered to be residual effect.
Direct ecosystem alteration and loss	Riparian Ecosystems	Yes	Clearing of riparian ecosystems VC for new access roads, will result in a residual effect. Clearing of non-listed riparian ecosystems for the transmission line will result in a temporary alteration and mitigation measures may not completely eliminate potential effects.
Direct ecosystem alteration and loss	Wetlands	Yes	One-time clearing for line construction, as well as intermittent clearing during the operation/maintenance phase will adversely affect the community composition of this VC. Post-closure, these changes will likely result in the establishment of novel ecosystems so residual effects may persist.
Direct ecosystem alteration and loss	Sparsely Vegetated Ecosystems	No	The amount of clearing of this VC is very small; therefore, the potential effect is negligible. There will be a one-time effect during clearing/construction phase after which vegetation will regenerate. The low stature of the existing vegetation (e.g. lichens and mosses) will not interfere with maintenance/operation activities.
Direct ecosystem alteration and loss	Unlisted Terrestrial Ecosystems	Yes	With mitigation, project effects in the transmission line ROW will be reduced, but may not be eliminated. The potential for these ecosystems to be restored to their existing condition is not likely given the changes that will occur to the soil profile and ground compaction.

Notes: OGMA = Old Growth Management Area; ROW = right-of-way; *SARA = Species at Risk Act*.

5.7.3 Characterization of Residual Effects

Residual effects were characterized according to methodology described in the methods section (**Section 3.3.9**). **Table 5.7-18** provides a summary residual effects characterization by vegetation VC. The direction of all residual effects for vegetation VCs are considered to be adverse due to potential loss and alteration of habitat.

5.7.3.1 First Nations Botanical Resources

The context for the First Nations botanical resources VC is medium for two reasons. Firstly, those existing components of this VC that occur in upland areas of the LSA are likely resilient to landscape-scale habitat alterations, given the extent to which this area was harvested in the mid- to late-20th Century. Secondly, those First Nations botanical resources that tend to occur in riparian ecosystems and wetlands are generally sensitive to residual effects and have a low resilience to them. Devil's club and Pacific crabapple are of particular traditional and contemporary importance to local First Nations and primarily occur in riparian ecosystems and wetlands.

The magnitude is expected to be low because 6.8% of the area occupied by First Nations botanical resources ecosystems in the LSA will be affected by the Project. Residual effects on this VC in uplands areas will likely be within the expected range of variation, given the extent to which these areas were harvested in the mid- to late-20th Century. The extent rating for the First Nations botanical resources VC is local because high quality upland habitat for this VC will be affected throughout the LSA.

The duration of residual effects will be long-term because it will likely span from the clearing/construction phase to the operation/maintenance phase. Residual effects will likely be reversible in upland areas. However, the duration of the residual affect in riparian areas not previously harvested will likely extend well into the post-closure phase and may be fully to partially reversible. Physical clearing will occur once during the clearing/construction phase and intermittently during the operation/maintenance phase.

The full characterization of residual effects for the First Nations botanical resources VC is described in **Table 5.7-18**. These residual effects are characterized as low magnitude, local extent and of intermittent occurrence and will be managed as a component of the application of BC Hydro's IVMP (BC Hydro, 2016) and AWPRV (BC Hydro, 2003a). These effects are not anticipated to require further planning.

Table 5.7-18: Characterization of Potential Residual Effects on Vegetation Valued Components

Valued Component	Direction	Context	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
First Nations Botanical Resources	Adverse	Medium	Low	Local	Long-term	Intermittent	Fully to partially reversible
Plant Species At Risk	Adverse	High	High	Local	Long-term	Intermittent	Fully to partially reversible
Ecological Communities At Risk	Adverse	High	Low	Local	Long-term to permanent	Intermittent	Irreversible
Old Forest	Adverse	High	Low	Local	Long-term to permanent	Intermittent	Irreversible
OGMAs	Adverse	High	Low	Local	Long-term to permanent	Intermittent	Irreversible
Riparian Ecosystems	Adverse	High	Low	Local	Long-term to permanent	Intermittent	Partially reversible to irreversible
Wetlands	Adverse	High	Low	Local	Long-term to permanent	Intermittent	Partially reversible to irreversible
Unlisted Terrestrial Ecosystems	Adverse	Low	Low to medium	Local	Long-term	Intermittent	Fully to irreversible

Notes: See **Table 3.3.2, Table 3.3.4** and **Table 3.3.5** for criteria definitions.
LSA = Local Study Area; VC = valued component; OGMAs = Old Growth Management Areas

5.7.3.2 Plant Species at Risk

The context of the plant species at risk VC is high because it is likely highly sensitive to residual effects and may not be resilient to them. Changes to the moss layer and increased competition from other herbaceous plants would likely result in a negative population growth rate for the plant species at risk VC (*Malaxis* spp.). Clearing and vegetation management in any part of this VC's habitat (Wb13) would likely lead to increased competition from other herbaceous plants and may also affect the moss layer (i.e. edge effect). The magnitude of the residual effect is high because 30.7% of the area occupied by this VC in the LSA will be directly or indirectly affected by the Project. The geographic extent of residual effects is local given the narrow ecological requirements for this VC in the LSA and the direct and indirect adverse effect clearing and vegetation management is likely to have throughout this VC's habitat. The duration is long-term because potential residual effects will occur from clearing/construction to post-closure. Residual effects are likely fully to partially reversible during the post-closure phase. Physical clearing will occur once during the clearing/construction phase and intermittently during the operation/maintenance phase.

The full characterization of residual effects for the Plant Species at Risk VC is described in **Table 5.7-18**. These residual effects are characterized as high magnitude, local extent and of intermittent occurrence and will be managed as a component of the application of BC Hydro's IVMP (BC Hydro, 2016) and AWPRV (BC Hydro, 2003a). These effects are not anticipated to require further planning.

5.7.3.3 Ecological Communities at Risk

The context for the ecological communities at risk VC is high because it is highly sensitive to direct residual effects and not resilient to them. This VC (i.e. plant associations) will be directly removed during the clearing/construction phase and prevented from re-establishing during the operation/maintenance phase. The magnitude is low because 3.1% of the area occupied by ecological communities at risk in the LSA will be directly affected by the Project. The geographic extent is local as direct residual effects occur in the ROWs and indirect residual effects (e.g. edge effect) will extend beyond the ROWs but not into the regional area. The duration is long-term to permanent because the likelihood of restoring an ecological community at risk to existing condition is low. Residual effects are considered irreversible because of the long time period required for ecological communities at risk to re-establish (>140 years post closure), and the uncertainty regarding the ability of ecological communities at risk to return to existing conditions. Physical clearing will occur once during the clearing/construction phase and intermittently during the operation/maintenance phase

The full characterization of residual effects for the Ecological Communities at Risk VC is described in **Table 5.7-18**. These residual effects are characterized as low magnitude, local extent and irreversible and will be managed as a component of the application of BC Hydro's IVMP (BC Hydro, 2016) and AWPRV (BC Hydro, 2003a). These effects are not anticipated to require further planning.

5.7.3.4 Old Forests

The context for the old forests VC is high for two reasons. Firstly, old forests will be directly removed during the clearing/construction phase and prevented from re-establishing during the operation/maintenance phase. Secondly, old forest ecosystems include riparian floodplain ecosystems, wetlands and ecological communities at risk that are highly sensitive to residual effects and not resilient to them. The magnitude is low because 3.5% of the area occupied by the old forest VC in the LSA will be directly affected by the Project. The geographic extent is local due to edge effects occurring beyond the ROW. The duration of residual effects is long-term to permanent because of the long time period required for old forests to return to existing conditions (≥250 years post-closure),. Residual effects are considered to be irreversible for the same reason. Old forest will experience one-time removal during the clearing/construction phase and intermittent residual effects due to vegetation maintenance during the operation/ maintenance phase

The full characterization of residual effects for the Old Forest VC is described in **Table 5.7-18**. These residual effects are characterized as low magnitude, local extent and irreversible and will be managed as a component of the application of BC Hydro's IVMP (BC Hydro, 2016) and AWPRV (BC Hydro, 2003a). These effects are not anticipated to require further planning.

5.7.3.5 Old Growth Management Areas

The OGMA VC has a high context for two reasons. Firstly, some of those attributes of OGMAs that were the impetus for their establishment (e.g. old-growth forests) will be directly removed during the clearing/construction phase and be prevented from re-establishing until the post-closure phase. Secondly, amendments to OGMAs may not be sought and implemented. The magnitude is low because 2.8% of the area occupied by OGMAs in the LSA will be directly affected. The geographic extent is local due to edge effects occurring beyond the ROWs. The duration is long-term to permanent because of the long time period required for important OGMA attributes (e.g. old-growth forests) to re-establish post-closure (≥250 years post-closure), which extends well into the post-closure phase. Residual effects are considered to be irreversible for the same reason. The OGMA VC will experience one-time clearing during the clearing/construction phase and intermittent residual effects during the operation/maintenance phase.

The full characterization of residual effects for the OGMAs VC is described in **Table 5.7-18**. These residual effects are characterized as low magnitude, local extent and irreversible and will be managed as a component of the application of BC Hydro's IVMP (BC Hydro, 2016) and AWPRV (BC Hydro, 2003a). These effects are not anticipated to require further planning.

5.7.3.6 Riparian Ecosystems

The context for the riparian ecosystems VC is high for two reasons. Firstly, riparian ecosystems will be directly removed during the clearing/construction phase and existing conditions will be supressed during the operation/maintenance phase. Secondly, this VC has a low resilience to residual effects, especially those components that are Red- or Blue-listed ecological communities at risk. Overall, the magnitude is low because less than 5.4% of the area occupied by the riparian ecosystems VC in the LSA will be directly affected by the Project. The geographic extent is local because indirect residual effects such as edge effects will extend beyond the transmission line ROW. For the most part, the duration of the residual effects is long-term and partially reversible, but residual effects on Red-listed active floodplain riparian ecosystems are considered to be irreversible as the likelihood of restoring these communities to existing condition is low. Physical clearing will occur once during the clearing/construction phase and intermittently during the operation/maintenance phase.

The full characterization of residual effects for the Riparian Ecosystem VC is described in **Table 5.7-18**. These residual effects are characterized as low magnitude, local extent and of intermittent occurrence and will be managed as a component of the application of BC Hydro's IVMP (BC Hydro, 2016) and AWPRV (BC Hydro, 2003a). These effects are not anticipated to require further planning.

5.7.3.7 Wetlands

The context for the wetlands VC is high for two reasons. Firstly, the tree and shrub layers (if any) will be directly removed during the clearing/construction phase, and the herb, shrub and tree layers will be modified during the operation/maintenance phase. Existing conditions will be suppressed until the post-closure phase. Secondly, this VC has a low resilience to residual effects, especially those components that are listed ecological communities at risk. The magnitude is low because 2.8% of the area occupied by this VC in the LSA will be directly affected. The geographic extent is local because indirect residual effects such as edge effects will extend beyond the ROWs. For the most part, the duration of the residual effects is long-term and partially reversible. However, residual effects are considered to be permanent and irreversible for those components of this VC that comprise ecological communities at risk, as the likelihood of restoring to existing condition is low. Physical clearing will occur once during the clearing/construction phase and intermittently during the operation/maintenance phase.

The full characterization of residual effects for the Wetlands VC is described in **Table 5.7-18**. These residual effects are characterized as low magnitude, local extent, and of intermittent occurrence, and will be managed as a component of the application of BC Hydro's IVMP (BC Hydro, 2016) and AWPRV (BC Hydro, 2003a). These effects are not anticipated to require further planning.

5.7.3.8 Unlisted Terrestrial Ecosystems

The context for the unlisted terrestrial ecosystems VC is low because it is likely resilient to landscape-scale habitat alterations, given the extent to which these areas were harvested in the mid- to late-20th Century. The magnitude is low to medium depending on the extent of indirect effects. Less than 7% (6.4%) of the total area occupied by this VC in the LSA will be directly affected by the Project. However, edge effect will potentially affect greater than 10% of the area occupied by this VC in the LSA. The geographic extent is local because indirect residual effects extend beyond the ROWs. The duration is long-term because residual effects will occur from the clearing/construction phase to the post-closure phase. The effects are fully reversible given the high likelihood of this VC returning to existing conditions during the post-closure phase to partially reversible for the 67 ha that overlap with proposed new roads. Physical clearing will occur once during the clearing/construction phase and intermittently during the operation/maintenance phase.

The full characterization of residual effects for the Unlisted Terrestrial Ecosystems VC is described in **Table 5.7-18**. These residual effects are characterized as low magnitude, local extent and of intermittent occurrence and will be managed as a component of the application of BC Hydro's IVMP (BC Hydro, 2016) and AWPRV (BC Hydro, 2003a). These effects are not anticipated to require further planning.

6 WILDLIFE

6.1 Introduction

The Project's clearing/construction, operation/maintenance, closure and post-closure activities are anticipated to affect wildlife and/or wildlife habitat, primarily through the clearing of vegetation, construction of structures and infrastructure components, vegetation management for ROW and access road maintenance, Project-related road traffic, and increased human access. Together, these works and activities can cause habitat loss and fragmentation, temporary or permanent displacement of wildlife and general disturbance. Some species at risk, species of conservation concern and/or species of interest or value to First Nations or stakeholders may be affected by the Project. Mitigation measures, BMPs and design criteria will be implemented to avoid or minimize adverse effects and are discussed as appropriate in the following sections.

The objectives for this wildlife and wildlife habitat effects assessment are to:

- Describe existing conditions within the LSA prior to Project-related activities;
- Select VCs that may be affected by the Project;
- Identify the Project's potential effects on selected VCs; and
- Identify BMPs and mitigation measures to avoid, minimize or offset adverse effects on wildlife and wildlife habitat VCs.

6.2 Regulatory Setting

BC Hydro operates under the provincial *Hydro and Power Authority Act* (Government of BC, 1996d), which specifies the application of other acts and provisions to the authority under section 32 (7). Where legislation does not apply, BC Hydro considers relevant intent and guidance contained in the acts/regulations/guidelines into its evaluation and BMPs, as appropriate.

Wildlife and wildlife habitat are managed and conserved under various federal and provincial acts, including the *Migratory Birds Convention Act* (*MBCA*; 1994), *SARA* (2002), the *Fisheries Act* (1985 with 2013 revisions), the *Wildlife Act* (, 2004), the *Forest and Range Practices Act* (2004) and the *Water Sustainability Act* (2014). These Acts, along with associated guidelines and standards, and BMPs help projects to be designed, developed and operated such that adverse effects on wildlife and wildlife habitat are avoided or minimized.

One initiative under the *Forest and Range Practices Act* is the Identified Wildlife Management Strategy (IWMS), which defined two categories of Identified Wildlife: *Species at Risk* and *Regionally Important Wildlife*. The IWMS provides direction, policy, procedures and guidelines for managing Identified Wildlife such that adverse effects of forest and range practices on identified species and their habitats are minimized. Identified Wildlife is managed through the establishment of wildlife habitat areas (WHAs), through the implementation of general wildlife measures and wildlife habitat area objectives or through other practices specified in strategic or landscape level plans.

6.3 Issues Scoping and Candidate Valued Components

Project-specific wildlife issues and candidate VCs were identified to determine local and regional species and habitats considered valuable by First Nations, regulators, the public and other stakeholders in the general area within which the Project is located. Issues scoping also included identifying species of federal and provincial conservation concern. Identification of issues was based on the following process and information sources:

- Desktop literature review and information gathering were conducted using published information and publicly available databases (AMEC, 2014);
- Wildlife and wildlife habitat concerns expressed by First Nations, the public and stakeholder groups were obtained directly from BC Hydro's consultation and engagement process;
- Additional focused literature reviews were conducted on potential wildlife and habitat issues;
- Reports provided by the Skeena-Stikine Regional District regarding background studies for a previous environmental assessment that was prepared in 1990 for the exact same project; and
- Meetings and additional communications with the Kalum LRMP committee.

The wildlife issues first identified in AMEC (2014), through BC Hydro's early consultation with First Nations, and by various interest groups were used to compile a list of candidate VCs and subcomponent species (**Table 6.3-1**). The issues and candidate VCs were then used to delineate LSAs and develop a program of wildlife field surveys, which was conducted in 2015. The categories and headings of the following sections reflect the set of candidate VCs and subcomponent species selected for this wildlife assessment. The wildlife issues were grouped into eight candidate VCs: Landbirds, Waterbirds, Raptors, Bears, Ungulates, Furbearers, Bats and Amphibians (**Table 6.3-1**). Wildlife issues or species considered too peripheral or not occurring in the Project area (e.g. mountain goat[1], hoary marmot), to have no or negligible anticipated interactions with the Project (e.g. Barn Swallow), to be better addressed through implementation of the Project's CEMP (e.g. avoidance of potential effects on gartersnake hibernacula) or to be impractical for assessment within the scope of this Project (e.g. predator-prey relationships involving grey wolf, coyote, and ungulates; common raven predation on western toad; or North American porcupine road mortality) were not further considered as candidate VCs. Selection of final VCs is described in the Effects Assessment **Section 6.6.1**.

[1] Scientific names of all wildlife species mentioned are provided in **Appendix D.1**.

Table 6.3-1: Wildlife Issues and Candidate Valued Components Terrace to Kitimat Transmission Project

Issue Type	Candidate VC Subcomponent Species (Candidate VC)	Issue Source / Interest Group
Legally designated wildlife	• Band-tailed Pigeon (Landbirds) • Common Nighthawk (Landbirds) • Great Blue Heron (Landbirds) • Marbled Murrelet (Waterbirds) • Northern Goshawk (Raptors) • Olive-sided Flycatcher (Landbirds) • Rusty Blackbird (Landbirds) • Western Screech-owl (Raptors) • Western toad (Amphibians) • Coastal tailed frog (Amphibians)	*SARA* Schedule 1 (Government of Canada, 2015); AMEC, 2014
Species of conservation concern	• Barn Swallow (Landbirds) • Fisher (Furbearers) • Grizzly bear (Bears) • Keen's myotis (Bats) • Little brown myotis (Bats) • Sooty Grouse[1] (Landbirds) • Wolverine (Furbearers)	COSEWIC (COSEWIC, 2015); CDC, 2015; AMEC, 2014
LRMP priority management species	• Trumpeter Swan (Waterbirds) • Mountain goat (Ungulates) • Moose (Ungulates) • Grizzly bear (Bears) • Kermode bear (Bears) • Hoary marmot (Furbearers) • Fisher (Furbearers)	Kalum LRMP (Government of BC, 2002b)
Species of concern to First Nations	• Kermode bear[2] (Bears) • Marbled Murrelet (Waterbirds) • Moose (Ungulates) • Grey wolf (Furbearers) • Coyote (Furbearers) • Bears • North American porcupine – road mortality • Mountain goat (Ungulates) • Goldeneye ducks (Waterbirds)	BC Hydro First Nations Consultation
Species, habitats and predator-prey relationships of concern to LRMP Implementation Committee	• Coastal tailed frog (Amphibians) • Long-toed salamander (Amphibians) • Northwestern salamander (Amphibians) • Roughskin newt (Amphibians) • Boreal chorus frog (Amphibians) • Wood frog (Amphibians) • Columbia spotted frog • Western toad (Amphibians) • Common gartersnake – hibernation sites • Terrestrial gartersnake – hibernation sites • Trumpeter Swan – Lakelse River flyway • Canada Goose – Lakelse River flyway • Ducks – Lakelse River flyway • Common Raven – predator-prey relationship with western toad • Grey wolf – predator-prey relationships with moose • Moose – predator-prey relationships with wolves • Grizzly bear (Bears)	LRMP Implementation Committee Meetings

Notes: [1]Note that after issues scoping and field survey planning was completed, the provincial conservation status rank of Sooty Grouse was changed in 2014/15 from Blue (Special Concern) to Yellow (apparently secure and not at risk). [2]Note that the issue of concern is the Kermode bear, a subspecies of the American black bear. The report therefore refers primarily to Kermode bear; any reference to American black bear includes the subspecies Kermode.

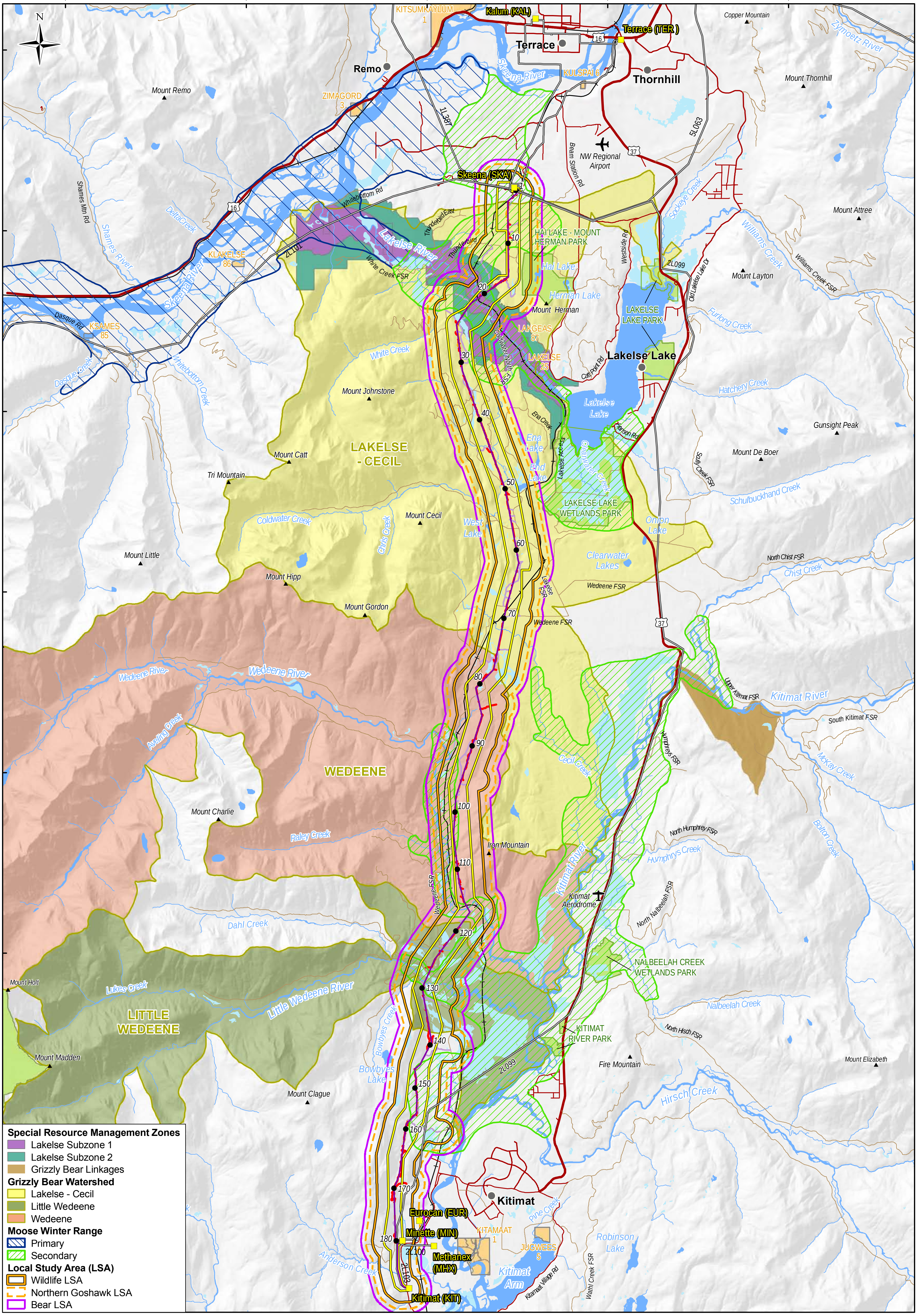
6.4 Spatial Boundaries

The LSAs for the different wildlife VCs and their subcomponents depend on the size of the species' range and the species' sensitivities to disturbance. Three different LSAs were assigned to the candidate VCs (**Table 6.4-1**, **Figure 6.4-1**); these LSAs delineate the spatial boundaries for assessments of existing conditions and Project effects.

Table 6.4-1: Local Study Areas for Candidate Valued Wildlife Components and Subcomponents, Terrace to Kitimat Transmission Project, 2015

LSA Size Class	LSA Description	Valued Component / Subcomponent	Rationale
1	Project Study Area plus a 500 m extension on either side of the engineering boundary and proposed new access and reconstruction roads	• Landbirds / Olive-sided Flycatcher, Rusty Blackbird, Common Nighthawk, Sooty Grouse • Waterbirds / Marbled Murrelet • Raptor / Western Screech-owl • Furbearers / Pacific marten • Ungulates / moose • Bats / Keen's myotis • Amphibians / western toad, coastal tailed frog	• Species have relatively small ranges or territories. • Moose have home ranges of 5 km^2–10 km^2 (Sopuck et al. 1997); however, most effects of linear features such as forest roads disappear between 100 m–250 m (Laurian et al., 2012). Hunting success for moose has been shown to be greatest 500 m from a road (Daust and Morgan, 2013). • Species sensitivity to disturbance known to occur within a 500 m distance E.g. Olive-sided Flycatcher (COSEWIC, 2007a), Rusty Blackbird (Powell et al., 2010b), Pacific marten (Poole et al., 2004), Keen's myotis (Waldien and Hayes, 2001), coastal tailed frog (COSEWIC, 2011), and western toad (Bartelt et al., 2004). • Influence of Project activities not expected to extend beyond 500 m.
2	Project Study Area plus a 800 m extension on either side of the engineering boundary and proposed new access and reconstruction roads	• Raptor / Northern Goshawk	• Species has moderate-sized range or territory. • Influence of Project activities expected to extend to 800 m (Zevit and Fenneman, 2012).
3	Project Study Area plus a 1000 m extension on either side of the engineering boundary and proposed new access and reconstruction roads	• Bears / grizzly bear and Kermode bear	• Species have relatively large ranges or territories. • Kermode bears have home ranges of up to 7 km^2 (Horn et al., 2009) and effects from roads and trails may cause avoidance of up to 1 km (Parsons, 2006; Kasworm and Manley, 2009). • Grizzly bear in the Kalum LRMP area have home ranges of 100 km^2–250 km^2 (males) and 25 km^2–75 km^2 (females) (Government of BC, 2002b) and effects of linear features such as roads and trails may cause avoidance of up to 1 km (Kasworm and Manley, 2009).

Notes: km^2 = square kilometre; LSA = Local Study Area; m = metre; ROW = right-of-way.



Legend

- Populated Place
- Existing Substation
- Existing Transmission Line
- Highway
- Arterial
- Local Road
- Forest Service Road
- Railway
- Watercourse
- Waterbody
- Wetland
- Park
- First Nation Reserve

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
DataBC Data
Distribution Service
Open Government License
(http://www.data.gov.bc.ca/)

CLIENT: Prepared for BC Hydro

PROJECT: Terrace to Kitimat Transmission Project (TKTP)

TITLE: Wildlife Local Study Area Boundaries

DATE:	ANALYST:	QA/QC:	
September, 2016	MY	KT	**Figure** 6.4-1

GIS FILE: 09-03-018_WildlifeLSA_v4

JOB No: VE52379

COORDINATE SYSTEM: NAD 1983 UTM Zone 9N

amec foster wheeler

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6.5 Wildlife Studies

6.5.1 Methods

Descriptions of the existing condition of wildlife values within and surrounding the Project area are based on the 2014 desktop overview assessment (AMEC, 2014) and 2015 field surveys.

6.5.1.1 Desktop Overview Assessment

A desktop review was conducted to gather information on wildlife species and wildlife habitat in the study area. This review was completed to identify issues concerning legally designated species; species of conservation, First Nations and stakeholder concern; protected areas; and important habitats. Further details on information sources reviewed and the results of the review are available in AMEC (2014). The results of the 2014 review were updated for this report where required.

6.5.1.2 Field Surveys

A variety of field surveys was conducted to address wildlife issues and aid in the selection of VCs for the assessment of potential Project effects. Survey methodologies were selected to best suit the wildlife taxa of concern, regional biophysical conditions, the location and nature of the Project and goals of this ESER. Survey methodologies followed the inventory protocols developed by the provincial Resources Information Standards Committee (RISC) if available (**Table 6.5-1**).

Table 6.5-1: Wildlife Field Surveys conducted in the Local Study Area in 2015, Terrace to Kitimat Transmission Project

Wildlife Issue / Candidate Valued Component / Subcomponents	Survey Type	Inventory Method
Landbirds		
Breeding birds	Point count survey	Variable radius point count survey; Inventory Methods for Forest and Grassland Songbirds (RISC, 1999a).
Common Nighthawk	Acoustic detector surveys	Automated detector variable radius point counts; Inventory Methods for Nighthawks and Poorwills (RISC, 1998a).
Sooty Grouse	Point count survey	Point counts of undefined radius; Standardized Inventory Methodologies for Components of British Columbia's biodiversity: Upland Gamebirds, Grouse, Quail and Columbids, Version 1.1 (RISC, 1997).
Waterbirds		
Marbled Murrelet	Radar survey	Horizontal and vertical radar surveys and audio-visual surveys; Inventory Methods for Marbled Murrelet Radar Surveys, Version 1.0 (RISC, 2006b).

Wildlife Issue / Candidate Valued Component / Subcomponents	Survey Type	Inventory Method
Raptors		
Western Screech-owl	Call playback surveys	Inventory Methods for Owl Surveys, Version 2 (RISC, 2006a).
Northern Goshawk	Call playback surveys	Inventory Methods for Raptors, Version 2.0 (RISC, 2001a).
Bears		
Grizzly bear	Incidental observations	n/a
Kermode bear	Incidental observations	n/a
Ungulates		
Moose	Incidental observations	n/a
Furbearers		
Pacific marten	Wildlife camera trapping; Incidental observations	Wildlife camera trapping was a small pilot project involving 10 cameras, with 14–18 trap days each.
Bats		
All bats / Keen's myotis	Acoustic detector surveys	Inventory Methods for Bats, Version 2 (RISC. 1998).
Amphibians		
Pond breeding amphibians / Western toad	Audio, time/area-constraint searches; larval surveys	Inventory Methods for Pond-breeding Amphibians and Painted Turtle, Version 2.0 (RISC, 1998d).
Coastal tailed frog	Time-constraint searches	Inventory Methods for Tailed Frog and Pacific Giant Salamander, Version 2.0 (RISC, 2000).
Selected species	Wildlife habitat ratings	Ratings conducted at TEM plots for all candidate VCs, except trumpeter swan; British Columbia Wildlife Habitat Rating Standards, Version 2.0 (RISC, 1999b)
All species	Recording of all incidental observations	n/a

Notes: n/a = not applicable; RISC = Resource Inventory Standards Committee; TEM = Terrestrial Ecosystem Mapping; VC = Valued Component.

6.5.1.2.1 Landbirds

For this assessment, the category "landbirds" consists of forest, grassland, upland game birds and shorebirds. Systematic field surveys were conducted for breeding birds, common nighthawk and sooty grouse. Additional occurrence data for landbirds were collected through incidental observations.

6.5.1.2.1.1 Breeding Birds

Surveys for species presence and distribution within the LSA (LSA size class 1; **Table 6.4-1**) during the breeding season followed the point count protocol described in the RISC inventory methods for forest and grassland songbirds (RISC, 1999a). This type of survey enables identification of a wide range of bird species along transects (Ralph et al., 1995).

Locations of point count stations (**Figure 6.5-1**) were determined through simple random sampling, (using the “Genrandompnts” tool of the Geospatial Modelling Environment program (Spatial Ecology LLC, 2015)). A 5 m buffer was placed around all roads and point count stations were randomly located outside of the buffer and within the LSA, maintaining a minimum distance of 300 m between stations. A total of 249 point counts were conducted at 67 stations between June 2 and June 12, 2015. All stations were surveyed between two and four times, and over 74% of the stations were surveyed four times. During the surveys, temperatures varied between 5°C and 19°C, there was no precipitation except for drizzle at 11 of the 67 stations and wind was less than 3 (on the Beaufort scale) for all surveys. Surveys were not conducted when wind speed exceeded approximately 20 km per hour (>4 on the Beaufort scale) or during rain or snowstorms.

Surveys started 30 minutes before sunrise and continued until 4 hours after sunrise. Each point count was 5 minutes in length and the date, time, location (UTM East and North), cloud cover, cloud height, wind speed, wind direction, precipitation and temperature were recorded at the start of each point count. When one or more birds were detected, species, number of individuals, age, sex and distance from and direction of the detection were recorded.

During the point count surveys, all birds seen or heard during each 5-minute count period were identified and recorded. Birds observed between stations or before/after the count period were recorded as incidental sightings. In addition, breeding birds detected during other surveys were recorded as incidental observations.

6.5.1.2.1.2 Common Nighthawk

Surveys for Common Nighthawk presence and distribution within the LSA (LSA size class 1; **Table 6.4-1**) during the breeding season followed a modified point count protocol described in the RISC inventory methods for Nighthawks and Poorwills (RISC, 1998a); the modification involved the use of acoustic recording devices instead of surveyors recording data. This type of survey enables identification of crepuscular (i.e., those active at sunrise and sunset) birds.

Nighthawk calls were recorded using four “Song Meter” SM2 and one SM3+ acoustic detector (Wildlife Acoustics, Inc.). The detectors were placed in forest openings within or near wetlands or along anthropogenic features (e.g. roads or cut-lines) to detect Nighthawks during foraging (**Figure 6.5-1**). The SM2 detectors were set up at least 1.5 m above ground and the SM3 detector was 3 m above ground, with the microphones directed towards or along the targeted openings. The detectors were programmed to turn on approximately 1 hour before sunset, turn off at sunrise and to record sounds only between 0 kHz and 12 kHz. Sound data were analyzed using Kaleidoscope software (Kaleidoscope Pro 3 Version 3.1.1, Wildlife Acoustics, Inc.). A total of 19 survey stations (**Figure 6.5-1**) were surveyed between June 2 and June 17, 2015. All stations were surveyed once between two and six evenings, and over 63% of the stations were surveyed five nights. Each point count was continuous in length, and each detection included the date, time and location (UTM East and North).

6.5.1.2.1.3 Sooty Grouse

Surveys for Sooty Grouse presence and distribution within the LSA (LSA size class 1; **Table 6.4-1**) during the breeding season followed the point count protocol described in the RISC inventory methods for upland game birds (RISC, 1997). This type of survey enables identification of Sooty Grouse across a landscape.

Locations of point count stations (**Figure 6.5-1**) were determined through simple random sampling (using the "Genrandompnts" tool of the Geospatial Modelling Environment program (Spatial Ecology LLC, 2015)). A 5 m buffer was placed around all roads and point count stations were randomly located outside of the buffer and within the LSA maintaining a minimum distance of 1 km between stations. A total of 176 point counts were conducted at 45 stations between May 2 and May 10, 2015. All stations were surveyed multiple times, and over 95% of the stations were surveyed at least four times. During surveys, temperatures varied between -1°C and 11°C, there was no precipitation except for drizzle at 16 of the 178 point count visits and wind was less than 3 (on the Beaufort scale) for all surveys. Surveys were not conducted when wind speed exceeded approximately 20 km per hour (>4 on the Beaufort scale) or during rain or snowstorms.

Surveys started 30 minutes before sunrise and continued until 2 hours after sunrise. Each point count was 3 minutes in length and the date, time, location (UTM E and N), cloud cover, cloud height, wind speed, wind direction, precipitation and temperature were recorded at the start of each session. When one or more birds were detected, species, number of individuals, age, sex and distance from and direction of the detection were recorded.

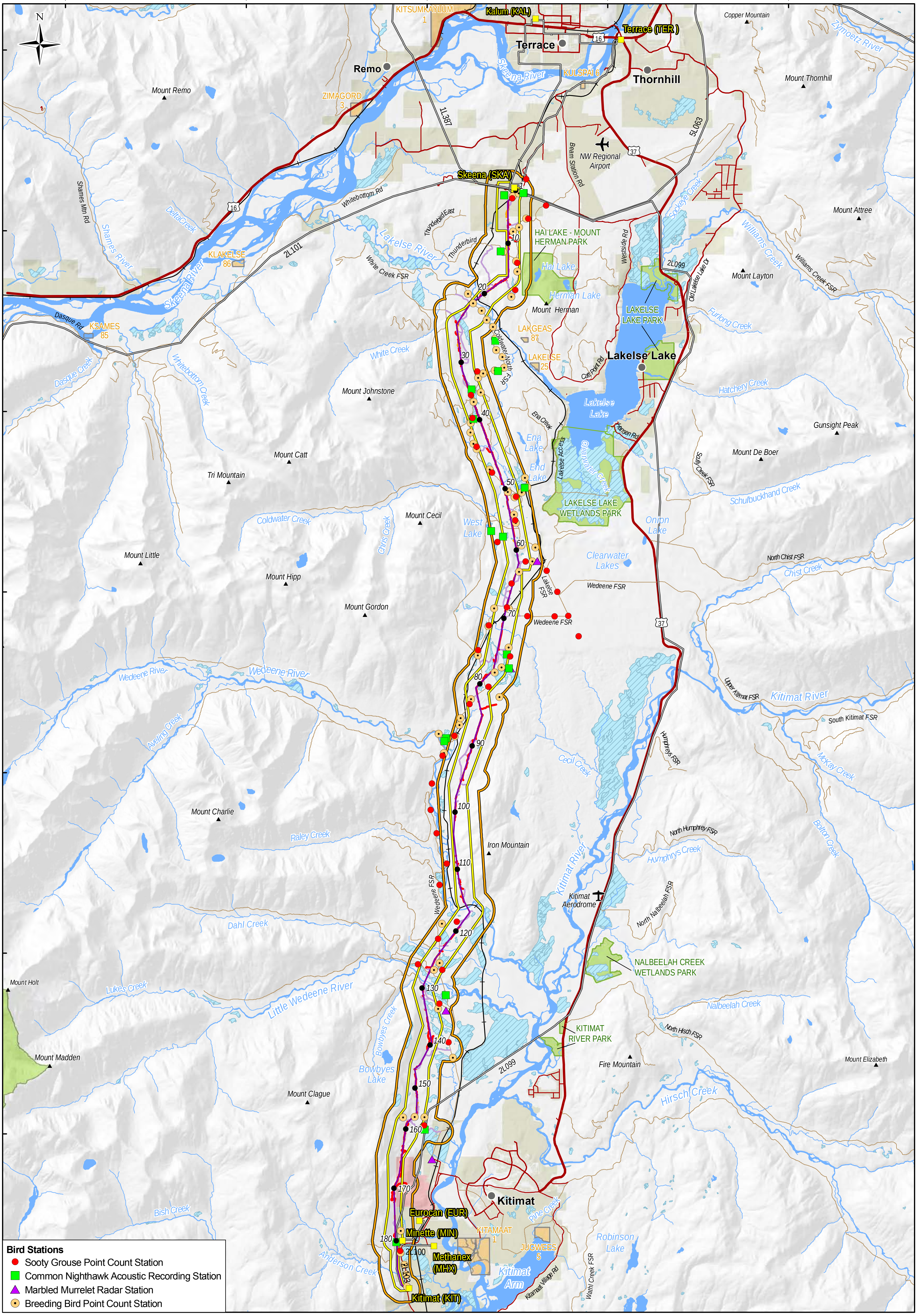
During the point count surveys, all birds seen or heard during each 3-minute count period were identified and recorded. Sooty Grouse observed between stations or before/after the count period were recorded as incidental sightings. In addition, Sooty Grouse detected during other surveys were recorded as incidental observations.

6.5.1.2.2 Waterbirds

Systematic field surveys for waterbirds were conducted only for the Marbled Murrelet, a species at risk. Systematic surveys were not conducted for Trumpeter Swan, primarily because its breeding and overwintering habitat does not overlap with the LSA. Waterbird species observed during other field surveys were recorded as incidental observations.

6.5.1.2.2.1 Marbled Murrelet

Horizontal radar survey methods followed the RISC (2006) protocol. Vertical radar surveys, not described in the standards, followed provisional methods developed by B.K. Schroeder Consulting with guidance from Stumpf et al. (2011). Surveys were conducted from May 19 to May 28, 2015. This period falls within the core nesting period (May 5 to August 5) identified by the Pacific Seabird Group for British Columbia (Evans et al., 2003). Radar observations were made during the near dawn activity period for Marbled Murrelets from 120 minutes before to 60 minutes after sunrise. This period encompasses the known peak of daily Murrelet activity (Cooper et al., 1996; Burger, 1997).



Legend

- Populated Place
- Existing Substation
- Existing Transmission Line
- Highway
- Arterial
- Local Road
- Forest Service Road
- Railway
- Watercourse
- Waterbody
- Wetland
- Park
- First Nation Reserve
- Private Parcel
- Sandhill Private Parcel

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary
- Wildlife Local Study Area

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
DataBC Data
Distribution Service
Open Government License
(http://www.data.gov.bc.ca/)

CLIENT: Prepared for BC Hydro

PROJECT: Terrace to Kitimat Transmission Project (TKTP)

TITLE:

Landbird and Waterbird Survey Stations

DATE:	ANALYST:	QA/QC:	
September, 2016	MY	RS	Figure 6.5-1

GIS FILE: 09-03-012_bird_station_v3

JOB No: VE52379

COORDINATE SYSTEM: NAD 1983 UTM Zone 9N

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Locations of radar stations (**Table 6.5-2**, **Figure 6.5-1**) were selected based on a review of available mapping layers (e.g. TEM, Environment Canada critical habitat mapping), road access and visual assessment from the ground. Suitable openings to facilitate adequate radar coverage were limited in the study area; however, the locations found were well spaced along the Project area and provided good vantages across the width of it. Five locations (**Table 6.5-2**) were surveyed for two dawn surveys where practicable. The location at the entrance to the Kitimat Valley (Radar ID KIT-R1, **Table 6.5-2**) was surveyed for three dawn surveys and one dusk survey. Using two radar systems, a total of 10 dawn and 1 dusk radar surveys were completed concurrently at each observation location to characterize Marbled Murrelet movements, flight paths and flight heights.

Audio-visual surveys were conducted concurrent with radar surveys near the same location. Marbled Murrelets and all other birds were documented to help interpret radar observations, focusing on fast flying species that could be confused with Marbled Murrelets on radar. For all visual detections, observers collected the following data: time, number of individuals seen, closest horizontal distance from the observer, initial and final directions to the bird detections, flight heading, flight behaviour and estimated height above observer. Additional notes were made of details such as water, bird or rain noise affecting hearing ability of the observer or fog affecting visibility by the observer. Detailed methods of all survey components are provided in **Appendix D.2**.

Table 6.5-2: Locations of Marbled Murrelet Radar Stations along the Study Area, Terrace to Kitimat Transmission Project, 2015

Study Area	Radar Station ID	UTM Coordinates			Elevation (m)
		Zone	Easting	Northing	
KITIMAT	KIT-R1	9 U	519937	5982582	10
KITIMAT	KIT-R2	9 U	520830	5997463	80
KITIMAT	KIT-R3	9 U	523695	6012607	193
KITIMAT	KIT-R4	9 U	524877	6017366	213
KITIMAT	KIT-R5	9 U	520219	5990873	12

Notes: m = metre; UTM = Universal Transverse Mercator.

6.5.1.2.3 Raptors

Systematic field surveys were conducted for two raptor species designated as Species at Risk—the diurnal Northern Goshawk and the nocturnal Western Screech-owl. Raptor species observed during other field surveys were recorded as incidental observations.

6.5.1.2.3.1 Northern Goshawk

Surveys for Northern Goshawk presence and distribution within the LSA (LSA size class 2; **Table 6.4-1**) followed the call playback protocol described in the RISC inventory methods for raptors (RISC, 2001a). Locations of survey stations (**Figure 6.5-2**) were determined through simple random sampling (using the “Genrandompnts” tool of the Geospatial Modelling Environment program (Spatial Ecology LLC, 2015)). A 5-m buffer was placed around all roads and call playback stations were randomly located outside that buffer but within the LSA, maintaining a minimum distance of 400 m between stations.

Call playback was performed during the period June 2 to June 10, 2015 (using a Foxpro Firestorm wildlife caller; FOXPRO Inc.). The species' alarm call was played as this call elicits the highest detection rates from Northern Goshawk adults during the nesting period. Between one and four rounds of surveys were completed at 55 stations, with over 60% of the stations receiving three or four visits. At each station, after an initial 2-minute of quiet time used to listen for spontaneous calling, recorded calls were played three times for 20 seconds followed by a 30-second listening period. After the last call, surveyors continued listening for responses for an additional 5 minutes.

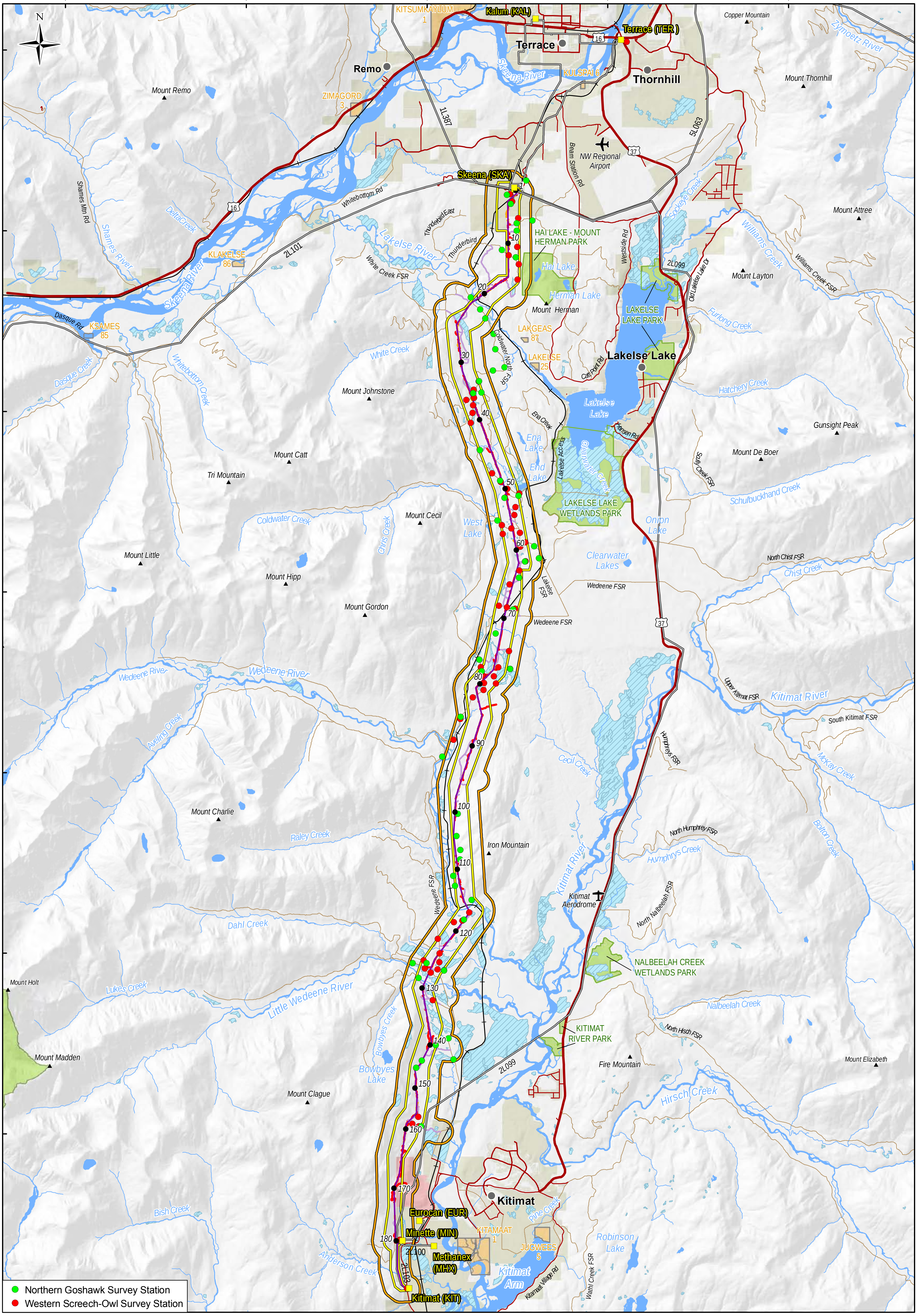
For any response, the time, species, sex, age and type of response (visual/aural) were recorded when possible. In addition, an estimate of initial distance, direction to the bird from the survey station and direction of departure (if a bird was observed) were recorded.

6.5.1.2.3.2 Western Screech-owl

Surveys for Western Screech-owl presence and distribution within the LSA (LSA size class 1; **Table 6.4-1**) followed the call playback protocol described in the RISC inventory methods for raptors (RISC, 2006a). Locations of survey stations (**Figure 6.5-2**) were determined through simple random sampling (using the "Genrandompnts" tool of the Geospatial Modelling Environment program (Spatial Ecology LLC, 2015)). A 5-m buffer was placed around all roads and call playback stations were randomly located outside of the buffer but within the LSA maintaining a minimum distance of 300 m between stations.

Call playback was performed during the period May 1 to May 8, 2015 (using a Foxpro Firestorm wildlife caller; FOXPRO Inc.). The species' alarm call was played as this call elicits the highest detection rates from Western Screech-owl adults during the nesting period. Between one and four rounds of surveys were completed at 62 stations, with over 60% of the stations receiving three or four visits. At each station, one minute of calls was played immediately upon arrival after which a pause of 4 minutes followed to listen for any responses. This pattern was repeated twice more for a total survey time of 15 minutes per station.

For any response, the time, species, sex, age and type of response (visual/aural) were recorded when possible. In addition, an estimate of initial distance, direction to the bird from the survey station and direction of departure (if a bird was observed moving) were recorded.



Legend

Populated Place	Watercourse
Existing Substation	Waterbody
Existing Transmission Line	Wetland
Highway	Park
Arterial	First Nation Reserve
Local Road	Private Parcel
Forest Service Road	Sandhill Private Parcel
Railway	

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary
- Wildlife Local Study Area

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
DataBC Data
Distribution Service
Open Government License
(http://www.data.gov.bc.ca/)

CLIENT:
Prepared for BC Hydro

PROJECT:
Terrace to Kitimat Transmission Project (TKTP)

TITLE:
Raptor Survey Locations

DATE:	ANALYST:	QA/QC:	
September, 2016	MY	RS	**Figure** 6.5-2

GIS FILE: 09-03-20_raptor_survey_v3

JOB No: VE52379

COORDINATE SYSTEM: NAD 1983 UTM Zone 9N

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6.5.1.2.4 Bears

No systematic surveys were conducted for grizzly bear and Kermode bear because field studies on bears require a level of effort beyond the scope of this wildlife assessment. Incidental observations were recorded for bear species throughout the 2015 survey period.

6.5.1.2.5 Ungulates

Ungulates were part of a winter tracking survey that was initiated in March 2015. Due to adverse snow and weather conditions, however, this survey could not be completed. While systematic data collection was not possible during the survey period, anecdotal information on winter wildlife occurrence was collected during three days on March 6, March 11 and March 12, 2015; these observations were reported as incidental observations. Other incidental observations were recorded for ungulate species throughout the 2015 survey period.

6.5.1.2.6 Furbearers

Furbearer species were part of a winter tracking survey that had been initiated in March 2015. Due to adverse snow and weather conditions, however, this survey could not be completed. While systematic data collection was not possible during the survey period, anecdotal information on winter wildlife occurrence was collected during three days on March 6, March 11 and March 12, 2015. Incidental observations were recorded for furbearer species throughout the 2015 survey period.

Camera-trapping surveys of small to medium terrestrial mammals (including the smaller furbearer species) can provide a cost-effective survey technique, especially when species' presence in an area is the main objective of a survey (De Bondi et al., 2010). A pilot study was conducted in 2015 for small mammals. For this initiative, 10 cameras (Recoynx HyperFire HC600, Recoynx© Inc.) were set up **(Figure 6.5-3**), with 14 and 18 trap days each. Sites were selected to test the protocol and therefore were located in habitat types suitable for small mammals and within 50 m of roads. Using camera traps to detect small mammals can be challenging with respect to species identification (Glen et al., 2013); however, for larger species such as marten, identification is relatively reliable. The methodology used was based on published literature on the topic (Hobson and Villette, 2011; Glen et al., 2013, Posthumus et al., 2015). Two types of installations were used; both setups involved a camera mounted on a wooden frame 1.2 m above the ground and facing towards the ground. To calibrate the field of view and height of the camera, a ruler was placed on the ground in the centre of the field of view. Both installations had the same basic setup but one type had the addition of four 8-ft x 1-ft-long boards in the form of a cross to act as funnels under the camera, which was an additional step developed specifically for this pilot study.

6.5.1.2.7 Bats

Bats were surveyed within the LSA by way of sound recordings of their echolocation calls (RISC, 1998c) using four "Song Meter" SM2 and one SM3+ acoustic bat detector (Wildlife Acoustics, Inc.). The detectors were placed in forest openings within or near wetlands or along anthropogenic features (e.g. roads or cut-lines) to detect bats during foraging (**Figure 6.5-3**). The SM2Bat detectors were set up at least 1.5 m above ground and the SM3Bat detector was 3 m above ground, with the microphones directed towards or along the targeted openings. The detectors were programmed to turn on at sunset, turn off at sunrise and record sounds only between 0 kHz and 384 kHz. Sound data were analyzed using Kaleidoscope software (Kaleidoscope Pro 3 Version 3.1.1, Wildlife Acoustics, Inc.). A total of 19 survey stations were surveyed between June 2 and June 17, 2015.

6.5.1.2.8 Amphibians

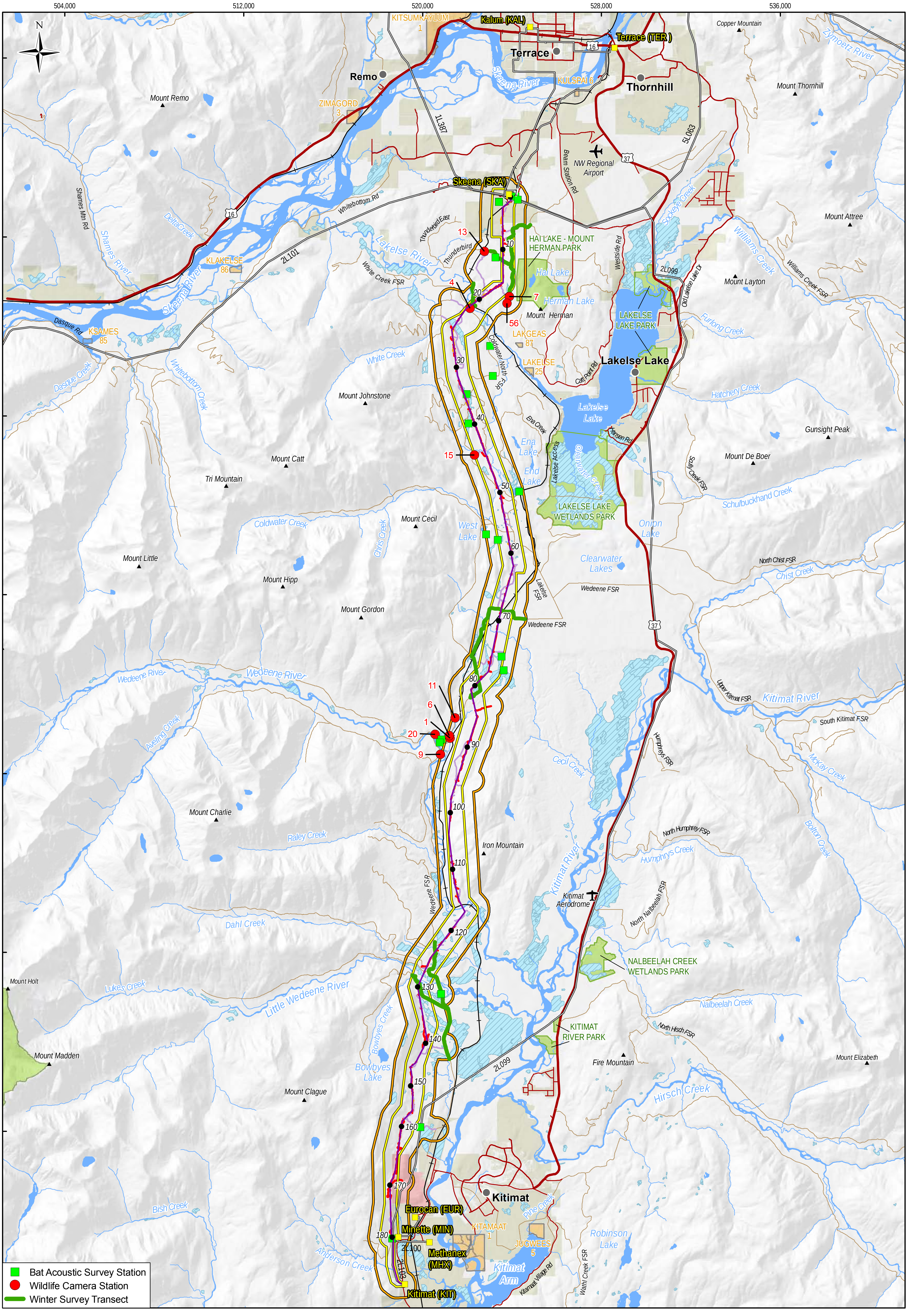
Two types of amphibians occur in the LSA: pond-breeding amphibians and coastal tailed frog. While all pond-breeding amphibians can be surveyed together, the coastal tailed frog occurs in stream habitat and requires a different survey method.

6.5.1.2.8.1 Pond-breeding Amphibians – Western toad

Visual encounter surveys (RISC, 1998d) were used to inventory presence of pond-breeding amphibian species at suitable breeding habitats within the LSA. Incidental sightings of any amphibians noted during other surveys were also recorded.

Suitable breeding habitat for western toads does not appear on existing datasets (e.g. Freshwater Atlas (BC MFLNRO, 2015a)) due to its size, ephemeral nature or lack of spatial resolution. To locate potential western toad breeding habitat and breeding western toads, a combination of area searches and modified time-constrained surveys was used (RISC, 1998d).

A grid of 100 m x 100 m cells was overlaid on the study area and 45 cells were selected at random to be searched for western toad breeding habitat (e.g. ponds, marshes or water-filled ditches) (**Figure 6.5-4**). Surveyors conducted area searches of the 100 m x 100 m, first for potential breeding habitat and then for any indicators of western toad breeding activity (i.e. eggs, tadpoles or adults). A total of 16 potential breeding habitats were surveyed between June 2 and June 17, 2015. Time-constrained surveys were modified from RISC standards by using a shortened timeframe for searching a waterbody, depending on the size of the waterbody. Location and size data were recorded for all potential breeding habitats of western toads, and any pond-breeding amphibians detected were recorded. For each detection, information recorded included species, age, gender, UTMs, date and time.



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Legend

- Populated Place
- Existing Substation
- Existing Transmission Line
- Highway
- Arterial
- Local Road
- Forest Service Road
- Railway
- Watercourse
- Waterbody
- Wetland
- Park
- First Nation Reserve
- Private Parcel
- Sandhill Private Parcel

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary
- Wildlife Local Study Area

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
DataBC Data
Distribution Service
Open Government License
(http://www.data.gov.bc.ca/)

CLIENT: Prepared for BC Hydro

PROJECT: Terrace to Kitimat Transmission Project (TKTP)

TITLE: Mammal Survey Locations

DATE:	ANALYST:	QA/QC:	
September, 2016	MY	RS	**Figure** 6.5-3

GIS FILE: 09-03-21_winter_tracking_v3

JOB No: VE52379

COORDINATE SYSTEM: NAD 1983 UTM Zone 9N

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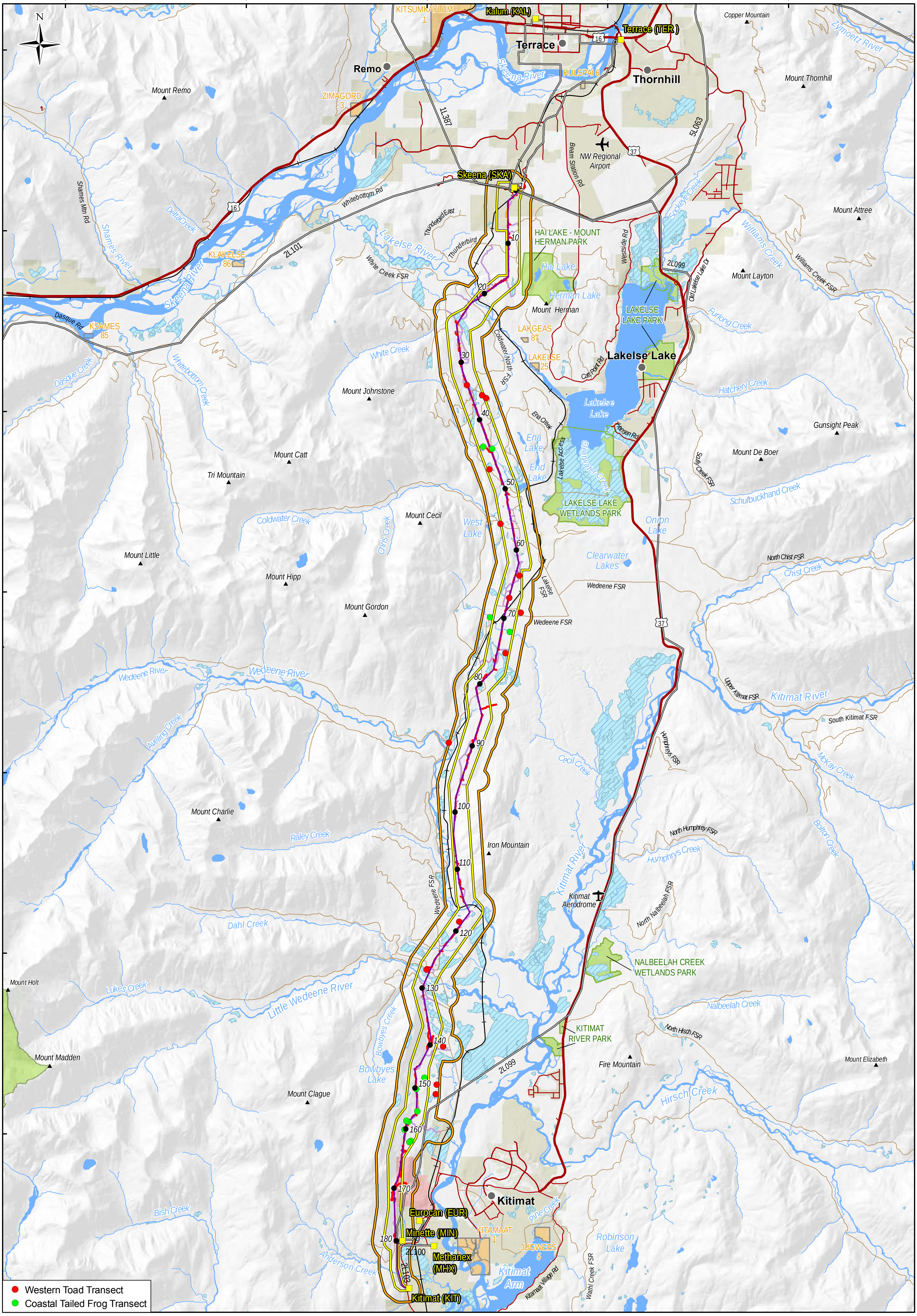

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Last updated by willem.van-riet

Legend

- Populated Place
- Existing Substation
- Existing Transmission Line
- Highway
- Arterial
- Local Road
- FSR
- Railway
- Watercourse
- Waterbody
- Wetland
- Park
- First Nation Reserve
- Private Parcel
- Sandhill Private Parcel

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary
- Wildlife Local Study Area

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
DataBC Data
Distribution Service
Open Government License
(http://www.data.gov.bc.ca/)

CLIENT: Prepared for BC Hydro	PROJECT: Terrace to Kitimat Transmission Project (TKTP)
TITLE: Amphibian Survey Stations	DATE: September, 2016 — ANALYST: MY — QA/QC: RS — Figure 6.5-4
	GIS FILE: 09-03-019_amphibian_survey_v3
	JOB No: VE52379
	COORDINATE SYSTEM: NAD 1983 UTM Zone 9N

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6.5.1.2.8.2 Coastal Tailed Frog

Surveys for presence of coastal tailed frogs in the LSA were conducted as time-constrained searches according to the RISC (2000) inventory methods. Survey locations (**Figure 6.5-4**) were selected based on preliminary habitat modelling to identify potentially suitable habitat, using criteria described in COSEWIC (2011). Surveys were conducted along transects in 12 different streams from June 17 to June 19, 2015. The coastal tailed frog's habitat was described on Stream Site Cards (DFO and MOE, 1989).

6.5.1.3 Wildlife Habitat Descriptions and Suitability Modelling

The description of habitat requirements and development of habitat suitability models for each wildlife VC and subcomponent involved a four-step process: preparing species accounts, building preliminary habitat suitability models, field ratings of habitat suitability and adjusting the preliminary model based on field ratings and species detections.

6.5.1.3.1 Species Accounts

Background information on each candidate VC was collected through a literature review and summarized in species accounts (**Appendix D.3-1 to D.3-11**) with respect to geographic distribution, life requisites, seasonal use of habitats, limiting factors and habitat attributes for each species within their geographic range (RISC, 1999b). Species accounts were developed with particular emphasis on the ecological context of the LSA; however, information on biology and habitat preferences in regional, provincial or other contexts was also included where needed. Information from species accounts was then used to determine the most limiting season(s) and life requisite(s) for each VC (**Table 6.5-3**). The amount of information available on specific habitat requirements influenced the selection of the rating system (i.e. the number of rating classes) most appropriate for the VC.

6.5.1.3.2 Preliminary Habitat Suitability Models

Each habitat suitability model represents a specific season and life requisite for a VC and was created based on habitat requirements identified in the species account. Specific criteria used to create each model were limited to datasets (e.g. Freshwater Atlas, TEM) that were available and suitable for each VC. Habitat suitability models were initially written and then created with "ModelBuilder" in the software program "ArcGIS v. 10.2" using spatial tools (e.g. buffer, intersect) and Structured Query Language–based queries. Habitat suitability models followed RISC (1999) standards; however, some modifications were made, including:

- Field ratings took place prior to the creation of the preliminary habitat suitability model, and the preliminary ratings table was adjusted to include only features relevant for each model; and
- Two class models followed an optimal/sub-optimal framework (i.e. optimal habitat was the equivalent to high to moderate, and sub-optimal was the equivalent to low and nil).

Modifications were made to increase efficiency, to reflect knowledge of VC biology or habitat preferences or to accommodate the scope of the Project.

Table 6.5-3: Indicator Species of Valued Components used for Habitat Suitability Modelling by Season and Life Requisite and Respective Rating Systems, Terrace to Kitimat Transmission Project, 2015

Species	Season	Life Requisite	Ratings System	Appendix
Olive-sided Flycatcher	Growing	Reproducing	2 Class	D.3-1
Rusty Blackbird	Growing	Reproducing	2 Class	D.3-2
Marbled Murrelet	Growing	Reproducing	4 Class	D.3-3
Northern Goshawk	Growing	Reproducing	4 Class	D.3-4
Grizzly Bear	Spring	Feeding	4 Class	D.3-5
	Fall	Feeding	4 Class	
Kermode American Black Bear	Spring	Feeding	4 Class	D.3-6
	Fall	Feeding	4 Class	
Moose	Winter	Living	4 Class	D.3-7
	Growing	Reproducing	4 Class	
Pacific Marten	Winter	Living	4 Class	D.3-8
Keen's Myotis	Growing	Living	2 Class	D.3-9
Western Toad	Growing	Living	2 Class	D.3-10
Coastal Tailed Frog	Growing	Living	2 Class	D.3-11

6.5.1.3.3 Field Ratings

Habitat models are limited to the existing knowledge of the species' habitat preferences used to develop the models, which limits their ability to predict actual field conditions. Field-testing tests the habitat suitability model by evaluating a variety of habitats predicted by the models against actual field observations (RISC, 1999). Field-testing includes collection of data describing biophysical conditions, importance of wildlife habitat features and wildlife use of an area.

During the spring of 2015, preliminary species accounts were prepared and rating schemes selected for the candidate VCs and respective subcomponents. A combination of seasons and life requisites were used for determining Wildlife Habitat Rating (WHR) in the field. For all candidate VCs and subcomponents, except coastal tailed frog, field assessments were conducted from July 3 to July 19, 2015, in conjunction with ecosystem and soils mapping. At each of 78 TEM field plot locations, a wildlife surveyor rated the habitat for the seasons and life requisites of species selected for modelling. Data were collected according to a four- or two-class rating system using the digital version of the Wildlife Habitat Assessment field cards (FS 882 (5) HRE 98/5) built with "IForm Builder" (Zerion Software).

The number of VCs and subcomponents, seasons, life requisites and number of rating classes were adjusted after the VC list had been created and before the final modelling process (**Table 6.5-3**). The data collected in the field were compared to the preliminary ratings table and the ratings assumptions. Plots with final suitability rating based on the Plot-in-Context rating were used to adjust the value of that specific polygon.

6.5.1.3.4 Habitat Suitability Model

Each habitat suitability model represents a specific season and life requisite for a VC and was created based on habitat requirements identified in the species account. Specific criteria used to create each model were limited to datasets (e.g. Freshwater Atlas, TEM) that were available and suitable for each VC. Habitat suitability models were initially written and then created with “ModelBuilder” in the software “ArcGIS v. 10.2” using spatial tools (e.g. buffer, intersect) and Structured Query Language–based queries. Habitat suitability models generally followed RISC (1999) standards; however, some modifications were made to increase the efficiency and effectiveness of the models, incorporate knowledge of VC biology or habitat preferences and accommodate the scope of the Project. These modifications included:

- Field ratings took place prior to the creation of the preliminary habitat suitability model;
- The preliminary ratings table was adjusted to include only features relevant for each model; and
- Two class models followed an optimal/sub-optimal framework (i.e. optimal habitat was the equivalent to moderate and high, and sub-optimal was the equivalent to nil and low of the four-class model).

6.5.1.3.5 Ratings Adjustments

Following the creation of each initial model, rated polygons were compared with field ratings and detections from baseline wildlife surveys to determine accuracy. Models were subsequently adjusted if major deviations from field ratings or baseline survey detections were noted and the source of the deviation could be identified. Plot-in-context field ratings were assumed to be correct and were used to adjust individual polygons.

6.5.1.3.6 Sources of Error and Limitations

Potential classification errors and limitations exist with field ratings, model creation and existing datasets. Examples of potential errors include classification errors within the field ratings influenced by lack of knowledge of the habitat outside of the site or model-based errors associated with lack of knowledge about specific features associated with individual polygons. Shortfalls in the knowledge of a VC’s biology at the local or regional level can limit the confidence of models. Dataset issues also constrained some models and reduced the ability to use some variables (e.g. terrestrial ecosystem mapping did not include canopy cover) or reduced the certainty in other variables (e.g. stream width information was based on small sample sizes that may not have been representative).

6.5.2 Existing Condition

Results of the desktop overview assessment of the study area and surrounding environment are presented in AMEC (2014). The following sections provide three types of results: field survey summaries, information from other local studies and results of habitat descriptions and suitability modelling for the candidate VC subcomponent species (which are detailed in **Section 6.6.1**).

6.5.2.1 Landbirds

A total of 249 point counts at 69 stations for breeding birds, 19 acoustic survey sessions for Common Nighthawk and 178 point counts at 45 stations for Sooty Grouse were conducted during summer of 2015. Based on these surveys and incidental observations in the LSA, 76 species (**Appendix D.1**), including seven listed species (**Table 6.5-4**) were confirmed. Five of the seven listed species (exceptions are Black Swift and Short-billed Dowitcher) had been identified during wildlife issue scoping (**Table 6.3-1**).

Table 6.5-4: Legally Designated Landbird Species and Species of Conservation Concern Confirmed in the Local Study Area, Terrace to Kitimat Transmission Project, 2015

	Federal Designation			Provincial Designation
Common Name	***SARA*** **Schedule 1**	**COSEWIC**	***MBCA*** **Species**	**BC CDC List**
Band-tailed Pigeon	Special Concern	Special Concern	Yes	Blue
Barn Swallow	-	Threatened	Yes	Blue
Black Swift	-	Endangered	Yes	Blue
Common Nighthawk	Threatened	Threatened	Yes	Yellow
Olive-sided Flycatcher	Threatened	Threatened	Yes	Blue
Rusty Blackbird	Special Concern	Special Concern	No	Blue
Short-billed Dowitcher	-	-	Yes	Blue

Notes: *SARA* = *Species at Risk Act*; COSEWIC = Committee on the Status of Endangered Wildlife in Canada; *MBCA* = *Migratory Bird Convention Act*; BC CDC = British Columbia Conservation Data Centre; BC CDC Blue-listed = species of Special Concern; BC CDC Yellow-listed = species apparently secure and not at risk.

6.5.2.1.1 Breeding Birds

Based on an analysis conducted by the BC Breeding Bird Atlas, a total of 111 species were expected to breed in the nine sampling squares of the Breeding Bird Atlas (09WA10; 09WA20 through 09WA23; and 09WV18, 19, 28, 29) that overlap with the wildlife LSA (Bird Studies Canada, 2015). With the exception of ptarmigan species that range at elevations higher than that of the LSA, all these species can potentially occur in the LSA. Two of these species—Olive-sided Flycatcher and Rusty Blackbird—were selected as subcomponents of the landbirds VC for the Project effects assessment and are therefore the focus of the assessment presented below.

The Olive-sided Flycatcher is of federal and provincial conservation concern (**Table 6.5-4**). Factors causing the decline in Olive-sided Flycatchers are not known, but it is thought that habitat loss, habitat change and declines in aerial insect availability (food source) may be responsible (Nebel et al., 2010). Clear-cuts have recently been found to act as population sinks, as birds nesting in disturbed areas show half the breeding success of those nesting in natural areas (Robertson and Hutton, 2007). It has been speculated that widespread use of insecticides may be responsible for declines and changes in aerial insect composition over the last 100 years (COSEWIC, 2007a).

The Olive-sided Flycatcher typically inhabits coniferous and mixed-coniferous forest during the breeding season (Altman and Sallabanks, 2000; COSEWIC, 2007a; Kotliar, 2007). The species is a frequent user of moist/wet conifer forest, lake/pond and riparian habitat types (BC CDC, 2015) Detailed information on its ecology and habitat requirements is provided in the Olive-sided Flycatcher species account (**Appendix D.3-1**).

The Rusty Blackbird is also of federal and provincial conservation concern (**Table 6.5-4**). Factors that have affected Rusty Blackbird populations appear to be largely related to habitat. Much of their wintering habitat (80%) has been destroyed over the last 150 years, and blackbirds wintering in these habitats have also been taken incidentally through bird control programs, although overall numbers taken are not known (COSEWIC, 2006). Approximately 5% of breeding habitat across the southern part of the Canadian breeding range has been lost due to human pressures, and an additional 4% is anticipated to be lost over the next 50 years (COSEWIC, 2006).

The Rusty Blackbird is a frequent user of moist/wet conifer forest, lake/pond and wetland habitat types (BC CDC, 2015). It breeds across the north and central interior regions of the province and occasionally overwinters in southwest BC (Campbell et al., 2001). Breeding habitat is primarily muskeg and boreal forest, with birds typically found in bogs, riparian areas and edges of ponds and lakes or sometimes streams (Avery, 1995; Whitaker and Montevecchi, 1999). Beaver ponds, especially those with downed trees and emergent vegetation, provide high quality habitat (COSEWIC, 2006). This species is known to nest colonially in high quality habitat, although in BC most nest sites involve single pairs (Campbell et al., 2001). Detailed information on its ecology and habitat requirements is provided in the Rusty Blackbird species account (**Appendix D.3-2**).

6.5.2.1.1.1 Field Survey Results

A total of 53 breeding landbird species were detected during the point count surveys and an additional 21 species were detected incidentally during the breeding season (**Appendix D.1**). The 73 species detected in the LSA during the breeding season represent 67% of the 111 species expected by the BC Breeding Bird Atlas to be breeding in the area. At the point count stations, the five most often recorded species (as a percentage of the 67 stations) were Warbling Vireo (81%), Yellow-rumped Warbler (70%), Swainson's Thrush (63%), American Robin (63%), and Dark-eyed Junco (52%).

Ten Olive-sided Flycatchers were detected at four locations within the LSA, five during point counts and five incidentally (**Appendix D.4-1**). Multiple detection sites were recorded within a large wetland complex between structures 36 and 39. The northernmost detection was along the Thunderbird FSR near structure 9 between two parallel creeks. No Olive-sided Flycatchers were detected south of West Lake Recreation Site (structure 56). All of the detections were between 130 m and 220 m in elevation, which is consistent with the known elevation range from sea level to 2,200 m for this species.

A total of 11 Rusty Blackbirds were detected at eight locations within the LSA, two during point counts and nine incidentally (**Appendix D.4-2**). Most of the Rusty Blackbirds detections were north of the Wedeene River and Lone Wolf Creek confluence. Most detections were at large wetland complexes, including two west of Lakelse Lake (structures 34 to 35), two near End Lake (structures 50 to 51) and two at the confluence of the Wedeene River and Lone Wolf Creek (structure 90). One detection was located on a small wetland adjacent to the Lakelse River (parallel to structure 29). The southernmost detection was recorded in a wetland complex approximately 20 km north of Kitimat (near structure 142). All of the detections were between 40 m and 180 m in elevation, which is consistent with the known elevation range from sea level to 1,500 m for this species.

Breeding bird survey and incidental observation of other listed species included six Band-tailed Pigeons detections at six different sites, two Barn Swallow detections at one site and eight Black Swift detections at eight different sites. The Short-billed Dowitcher was detected during Marbled Murrelet radar surveys at radar station R1 (**Appendix D.2**).

6.5.2.1.1.2 Species Information from Other Studies

The BC Breeding Bird Atlas reported a total of 73 species for the nine sampling squares that overlap with the Project LSA. Those 73 species represent 66% of the 111 species expected by the Breeding Bird Atlas to be breeding in the area. The total number of 73 breeding bird species detected by the Breeding Bird Atlas is almost identical to the total number of 73 breeding bird species detected during the TKTP surveys.

Olive-sided Flycatchers have been reported throughout the Kitimat Valley, including the Lakelse Lake area; the species is classified as an uncommon summer resident in the valley, however (Horwood, 1992). Baseline surveys for the LNG Canada Export Terminal Project (Stantec, 2014) and Rio Tinto Alcan terminal expansion (WorleyParsons Resources and Energy, 2015) detected the Olive-sided Flycatcher south of Kitimat in 2013. This species was not detected in the Kitimat Valley during baseline surveys for the Pacific Trail Pipeline and Northern Transmission Line Projects (Westland Resource Group Inc., 2007; Rescan™ Tahltan Environmental Consultants, 2010).

The federally and provincially listed Band-tailed Pigeon (**Table 6.5-4**) was detected during the 2008–2012 BC Breeding Bird Atlas surveys within sampling square 09WA23 (Bird Studies Canada, 2015), which overlaps with the northern tip of the LSA. This species was also detected in Coastal Closed Forest and Coastal Scrub Forest habitats during 2006 baseline surveys for the Pacific Trails Pipeline Project (Westland Resource Group Inc., 2007).

Records of 11 bird species of conservation or management concern (**Table 6.5-5**) have been posted on eBird (Cornell Lab of Ornithology, 2015) for the Kitimat Valley between 2006 and 2015. All records are within 1.2 km and 11.4 km of the LSA. The Bank Swallow, not confirmed in the Project LSA in this report, is listed as Threatened by COSEWIC and the Great Blue Heron, also not in the Project LSA assessed in this report, is listed as Special Concern by COSEWIC and *SARA* and is Blue-listed in BC.

Table 6.5-5: eBird Records of Landbird Species of Conservation or Management Concern near the Local Study Area, Terrace to Kitimat Transmission Project

Landbird Species	Year/Month of Detection (Number of Individuals)	Detection Location[1]
Band-tailed Pigeon	2014/April (3)	New Remo
	2008/May-2015/June (2-25)	Terrace
	2008/May	Kitselas Road
	2008/May-2015/May (1-17)	Thornhill
	2010/May-2013/May (2-12)	Old Lakelse Lake Drive - Terrace
	2006/April-2015/May (1-8)	BC Breeding Bird Atlas Square
	2011/April-2015/April (2-6)	Kitimat
Bank Swallow	2008/September-2009/August (1-4)	Kitimat Estuary
	2014/June (1)	Minette Bay Marina
	2015/July (5)	New Remo
	2014/July (2)	Dutch Valley - Terrace
Barn Swallow	2014/May-2015/July (1-15)	New Remo
	2013/June-2015/May (2-4)	Dutch Valley - Terrace
	2013/August-2015/July (5-8)	Kitimat
	2015/July (5)	Kitimat Estuary
	2014/September-2015/August (1-10)	Kitimaat Village
	2015/May (10)	Minette Bay
	2015/May-August (6-15)	Minette Bay Marina
Black Swift	2014/May (5)	Deep Creek Drive - Terrace
	2015/June (1)	Terrace
	2013/July (3)	Lakelse Lake Provincial Park Picnic Site
	2010/July	Lakelse Lake Provincial Park
	2008/June	Upper Kitimat River
	2013/July (3-5)	Kitimat
	2015/July (20)	Kitimat Estuary
Common Nighthawk	2015/June (1-2)	Deep Creek Drive - Terrace
	2014/July (10)	Terrace
	2012/July-2014/August (1-20)	Thornhill
	2014/June (1)	Terrace Airport
	2015/June (3)	Kitimat
	2015/July (3)	Kitimat Hatchery Access Rd
	2015/July (1)	Kitimat Estuary
Great Blue Heron	2009/February (2)	Old Remo
	2010/April-2015/November (1-5)	New Remo
	2013/March (4)	Terrace Sewage Treatment Plant
	2008/June-2010/October (1-6)	Terrace
	2006/December (1)	Queensway - Terrace
	2012/November-2015/December (1-4)	Thornhill

Landbird Species	Year/Month of Detection (Number of Individuals)	Detection Location[1]
	2006/March (1)	Lakelse Lake Hot Springs
	2009/February-2015/May (3-8)	Kitimat
	2006/January-2013/November (1-8)	Eurocan Lagoons – Kitimat
	2006/December-2010/November (1-17)	Alcan Pond – Kitimat
	2008/December-2015/December (1-8)	Methanex Oxbow – Kitimat
	2011/December-2015/August (1)	Alcan Beach – Kitimat
	2009/February-2011/December (10-18)	Alcan Old Yacht Basin – Kitimat
	2006/January-2014/November (1-37)	Kitimat Estuary
	2012/April-2015/July (2-10)	Minette Bay
	2012/March-2015/May (1-10)	Minette Bay Marina
	2011/April-2015/December (1-14)	Kitimaat Village
Marbled Murrelet	2015/May (2-7)	Kitimat
	2010/January (2)	Alcan Beach – Kitimat
	2013/November-2015/May (2-3)	Minette Bay Marina
	2011/April-2015/July (2-43)	Kitimaat Village
Northern Goshawk	2010/October (1)	New Remo
	2010/October-2015/December (1)	Terrace
	2013/February-2015/April (1)	Kitimat
	2013/April (1)	Kitimat Estuary
Olive-sided Flycatcher	2008/May (1)	New Remo
	2008/May (2)	Kitselas Road
	2015/June (2)	Kitimat Estuary
Rusty Blackbird	2013/October-2015/July (1)	New Remo
Trumpeter Swan	2008/April-2015/March (1-27)	New Remo
	2010/October-2015/December (4-12)	Terrace
	2006/December (2)	Jackpine Flats – Terrace
	2011/October-2014/April (5-27)	Lakelse Lake Provincial Park Picnic Site
	2006/December-2013/February (2-15)	Lakelse Lake
	2006/December (5)	Terrace-Kitimat
	2009/March-2013/February (2-60)	Kitimat
	2006/January-2013/November (2-12)	Eurocan Lagoons – Kitimat
	2006/December-2009/December (3-4)	Alcan Pond – Kitimat
	2015/November-December (2-15)	Methanex Oxbow – Kitimat
	2006/January-2015/January (1-44)	Kitimat Estuary
	2011/February-2015/March (2-33)	Minette Bay
	2008/February-2013/March (4-46)	Kitimaat Village

Source: eBird website (Cornell Lab of Ornithology, 2015).

6.5.2.1.1.3 Habitat Information

Critical habitat of Olive-sided Flycatcher has not been identified in the *SARA* Recovery Strategy (Environment Canada, 2015a). Within the LSA, Olive-sided Flycatchers appeared to prefer areas within a mosaic of mature/immature forest that was in proximity to a wetland.

Examination of the locations revealed that the detections during the point count surveys could represent four territories. Although nesting was not confirmed, the species' regular presence in the Kitimat Valley during the breeding season suggests it likely nests in suitable habitat across the LSA. Based on the 2015 field survey, there appear to be two main concentrations of Olive-sided Flycatchers within the LSA: from Terrace south to Lakelse Lake (structures 2 to 50) and between structures 76 and 117 (**Appendix D.4-1**).

The Rusty Blackbird does not currently have a *SARA* Recovery Strategy and critical habitat has not been identified in the species' Management Plan (Environment Canada, 2015b). The 2015 field survey detections indicate Rusty Blackbirds are nesting in wetlands of the Kitimat Valley (**Appendix D.4-2**).

Habitat suitability mapping for Olive-sided Flycatcher and Rusty Blackbird (criteria provided in **Appendix D.3-1 and D.3-2**) shows that a relatively small amount of the LSA can currently be considered suitable habitat (**Table 6.5-6**; **Appendix D.4-1** and **D.4-2**, respectively). Five detection sites of Olive-sided Flycatcher were within or on the edge of areas modelled as suitable habitat and all but one of the other sites were within 50 m of areas modelled as suitable habitat (**Appendix D.4-1**). One detection was located over 900 m from any habitat identified as suitable.

Table 6.5-6: Potential Suitable Reproducing Habitat for Olive-sided Flycatcher and Rusty Blackbird within the Local Study Area during the Growing Season, Terrace to Kitimat Transmission Project, 2015

Species	Amount of Suitable Habitat within LSA (ha)	Total LSA (ha)	Proportion of LSA that is Suitable Habitat (%)
Olive-sided Flycatcher	1,336	10,520	12.7
Rusty Blackbird	1,898	10,520	18.0

Notes: ha = hectare; LSA = Local Study Area; % = percent.

Rusty Blackbirds were detected within wetlands or within the modelled forest habitat adjacent to wetlands (**Appendix D.4-2**). Seven out of the eight detections were within the CWHws1 and one within the CWHvm BGC subzone. Two of the detections along the Lakelse FSR 1021 (parallel to structures 27 and 31, respectively) and two detections near the Wedeene River (parallel to structure 90) are now outside of the LSA but were located within the LSA based on an earlier version of the provisional access road layout.

Patches of suitable habitat for the Olive-sided Flycatcher occur from Terrace south to Lakelse Lake (structures 2 to 50) and between structures 76 and 117. The largest contiguous area of suitable habitat occurs between structures 84 and 117. Suitable habitat for the Rusty Blackbird is found throughout the LSA in a branched and patchy pattern following the alignment of wetland complexes and watercourses.

6.5.2.1.2 Common Nighthawk

The Common Nighthawk is a federally listed Species of Conservation Concern (**Table 6.5-4**). Multiple threats have been identified as reasons for the decline in numbers; however, none has been directly linked to it (COSEWIC, 2007b). Two possible reasons appear to be reduced availability of insect prey and loss of breeding habitat.

The Common Nighthawk frequently uses forest, grassland/shrub, wetland and lake/pond habitat types (BC CDC, 2015). The species nests on the ground in a wide range of open, vegetation-free habitats, including recently harvested forests, burnt-over areas, rocky outcrops, grasslands, pastures, wetlands and river banks (COSEWIC, 2007b). The Common Nighthawk is an aerial insectivore that forages primarily at dawn and dusk and at night.

6.5.2.1.2.1 Field Survey Results

Acoustic recording devices detected Common Nighthawks at three stations (**Figure 6.5-1**). Detection sites were located near the Lakelse River north to the SKA substation. Two detections were at wetlands and one in a grassy clearing. No Common Nighthawks were detected incidentally.

6.5.2.1.2.2 Species Information from Other Studies

The Common Nighthawk was detected during the 2008–2012 BC Breeding Bird Atlas surveys within sampling square 09WA23 (Bird Studies Canada, 2015), which overlaps the northern tip of the LSA. Multiple records have been posted on eBird (Cornell Lab of Ornithology, 2015) for the Kitimat Valley. Detections near the LSA are from the Terrace Airport and the City of Kitimat. The detections have been of mostly single birds with the exception of one group of three individuals, and were recorded during the months of June and July in 2014 and 2015.

Nonbreeding Common Nighthawks have been reported in the Kitimat Valley (Campbell et al., 1990). No Nighthawks were detected in the Kitimat Valley during baseline surveys for the Pacific Trails Pipeline Project (Westland Resource Group Inc., 2007) or during surveys around the town of Kitimat for the Alcan Rio Tinto expansion (WorleyParsons Resources and Energy, 2015).

6.5.2.1.2.3 Habitat Information

Wildlife suitability ratings were recorded in the field; however, wildlife habitat suitability modelling was not done for the Common Nighthawk as it was not selected as a VC for the Project effects assessment (see **Section 6.6.1**).

6.5.2.1.3 Sooty Grouse

The Sooty Grouse is not currently a Species of Conservation Concern. It was a provincially Blue-listed species during the Project’s issue scoping phase; however, this conservation status rank was subsequently changed to Yellow or “apparently secure and not at risk of extinction” (BC CDC, 2015).

The Sooty Grouse frequently uses mesic and moist/wet conifer forest habitat types (BC CDC, 2015). It nests in scraped depressions on the ground under some type of vegetative cover concealment and forages primarily on conifer needles, berries and other plant material.

6.5.2.1.3.1 Field Survey Results

During the Sooty Grouse point count surveys, a total of 104 detections at 33 point count stations were recorded. In addition, the Sooty Grouse was detected 74 times during the breeding bird surveys and five times incidentally during other surveys. Detection sites were located throughout the length of the provisional transmission line route in a variety of habitat types.

6.5.2.1.3.2 Species Information from Other Studies

Sooty Grouse were detected during the 2008–2012 BC Breeding Bird Atlas surveys within sampling squares 09WA22 and 09WA23 (Bird Studies Canada, 2015), the two most northern squares overlapping the LSA. An additional record has been posted on eBird (Cornell Lab of Ornithology, 2015) for the Kitimat Valley. A single Sooty Grouse was detected near Kitimat Airport in early May 2015.

Sooty Grouse are described as an uncommon resident in the Birds of Kitimat, noting that they had been heard drumming on Clague Mountain but no evidence of nesting had been found (Horwood, 1992). The species was also detected during baseline surveys for the Alcan Rio Tinto expansion (WorleyParsons Resources and Energy, 2015) and the Pacific Trails Pipeline Project (Westland Resource Group Inc., 2007).

6.5.2.1.3.3 Habitat Information

Wildlife suitability ratings were recorded in the field; however, wildlife habitat suitability modelling was not done for the Sooty Grouse as it was not selected as a VC for the Project effects assessment (see **Section 6.6.1**).

6.5.2.2 Waterbirds

Waterbirds as a group (i.e. seabirds, ducks, grebes, swans and gulls) were not sampled systematically, except for Marbled Murrelets, as the selected subcomponent (indicator) species. Based on the 2015 Marbled Murrelet surveys and incidental observations in the LSA, a total of 14 waterbird species (**Appendix D.2**), including four listed species (Marbled Murrelet, Western Grebe, Surf Scoter, and Double-crested Cormorant) were confirmed. The Western Grebe is listed by COSEWIC as Special Concern and is provincially Blue-listed. The Surf Scoter and Double-crested Cormorant both are not federally listed but are provincially Blue-listed. All three species are a federal responsibility under the *MBCA*. The Marbled Murrelet is described in detail in **Section 6.5.2.2.1** below.

Records of three waterbird Species of Conservation or Management Concern have been posted on eBird (Cornell Lab of Ornithology, 2015) for Kitimat-Minnette: 8 Surf Scoters and 10 Western Grebes in October 2014 and 10 California Gulls in July 2015. The California Gull, not confirmed in the LSA, is a provincially Blue-listed species.

Lakelse River is an important watercourse intersecting the LSA, in part due to its frequent use by waterbirds. Other waterbodies and watercourses within the LSA that are frequented by waterbirds include Wedeene River and Little Wedeene River (Horwood, 1992).

6.5.2.2.1 Marbled Murrelet

The Marbled Murrelet is designated as Threatened by COSEWIC and *SARA*, provincially Blue-listed (BC CDC, 2015), a species of First Nations concern, and a federal responsibility under the *MBCA* (Government of Canada, 1994). It is a widespread breeder in old coastal forests but has lost 35%–50% of breeding habitat as a result of logging, urbanization, and agricultural development. The remaining habitat is being fragmented by further clearing and road building, which may result in further loss of breeding habitat and increased nest predation.

The species forages in the nearshore marine environment and nests primarily in old growth forests along coastal BC. Detailed information on its ecology and habitat requirements is provided in the Marbled Murrelet species account (**Appendix D.3-3**). The following sections summarize the results of a radar field survey conducted from May 19 to May 28, 2015. A detailed report of the 2015 Marbled Murrelet survey is provided in **Appendix D.2**.

6.5.2.2.1.1 Field Survey Results

Horizontal radar surveys at five survey locations (**Appendix D.4-3**) documented the movement of Marbled Murrelets adjacent to and along the provisional TKTP route in the Kitimat Valley. During 10 dawn horizontal radar surveys, a total of 436 Marbled Murrelets were detected, with 292 estimated as incoming (landward) and 136 estimated as outgoing (seaward). Detections per dawn survey ranged from 16 to 144, combining incoming, outgoing and other behaviours. Pre-sunrise incoming counts, ranged from 2 to 112 per survey. Survey station R5 (**Appendix D.4-3**) had the highest incoming count of 112; this count may be an underestimate as the radar is limited to covering only approximately one-third of the Kitimat catchment area at R5. During one dusk horizontal radar survey at survey station R1 (**Appendix D.4-3**), a total of 48 Marbled Murrelets were detected with 47 of those estimated as incoming (i.e., flying northward).

Vertical radar surveys at five survey locations (**Appendix D.4-3**) characterized flight heights of Marbled Murrelets along parts of the provisional TKTP route. For all detections combined, the average flight height above ground level was 403 m (SD=199 m, n=158), ranging from 23 m to 1,059 m. The lowest flight heights were measured at the head of Douglas Channel inlet at survey station R1, where Murrelets were observed at 23 m and 35 m. For inland locations along the provisional TKTP route, the minimum height observed was 81 m above ground level at survey station R3. Mean flight heights during dawn surveys ranged from 251 m to 689 m (**Appendix D.2**). During one dusk radar survey, mean flight height of Marbled Murrelets was 543 m (SD=254 m, n=10), ranging from 168 m to 914 m. Weather was mostly calm and clear during the whole sampling period.

Audio-visual observations, conducted concurrently to the radar surveys at the five survey stations, revealed presence of Marbled Murrelets at three of the five locations: R1, R2 and R4 (**Appendix D.4-3**). No 'occupied behaviours' (i.e. birds observed flying at or below canopy tree level and/or accessing a tree or forest patch) were observed. Marbled Murrelets were difficult to detect during the sampling period, likely due to the combination of relatively low levels of activity, as confirmed by the radar survey, and a steady, clear weather pattern. However, a total of 94 Marbled Murrelets were present on the water during all four dawn (24, 39, and 27) and dusk (4) surveys at the coastal survey station R1, and these birds were observed flying in and out of the Kitimat watershed. One Marbled Murrelet was observed taking off from the water, at first flying down inlet and then turning up inlet in a large arc as it gained altitude before continuing up the Kitimat Valley. Two Marbled Murrelets, detected at inland station R4, were flying at or near ridgeline heights far across the Kitimat Valley and were not detected on radar.

In summary, the 2015 radar and audio-visual surveys showed that a low to moderate number of Marbled Murrelets fly into the Kitimat River watershed during the nesting season. Flight heights of commuting Murrelets indicate that the birds are generally flying much higher than the proposed 30 m or 60 m height of the transmission line as the minimum-recorded flight height within the LSA was 81 m.

6.5.2.2.1.2 Species Information from Other Studies

The Marbled Murrelet was detected during the 2008–2012 BC Breeding Bird Atlas within sampling square 09WV18 (Bird Studies Canada, 2015), which overlaps the southern tip of the LSA.

Approximately 30 km southwest of the Kitimat watershed entrance along Douglas Channel is Gilttoyees Creek, a watershed approximately 30% of the size (61,183 ha) of the Kitimat watershed but with a higher proportion of intact old forest (i.e. nesting habitat) remaining. In this watershed, Bertram et al. (2015) reported high incoming counts of 540 Marbled Murrelets. Some studies show a close relationship between Marbled Murrelet abundance and the amount of potential suitable nesting habitat (Burger and Waterhouse, 2009; Raphael et al., 2011); the lower numbers observed in the Kitimat River watershed may therefore be indicative of a relatively low amount of suitable habitat remaining in this watershed.

6.5.2.2.1.3 Habitat Information

Critical Marbled Murrelet nesting habitat, as per BC Model in the *SARA* recovery strategy (Environment Canada, 2014), overlaps with the LSA (**Appendix D.4-3**). The BC Model and the Habitat Suitability Model used in this assessment (see below) are fairly consistent with respect to capturing high suitability habitat but differ to some extent in that 1,184 ha are included in the BC Model but are rated nil or low suitability habitat and 302 ha are rated moderate or high suitability habitat that were not identified by the BC Model (**Appendix D.4-3**). These classification differences are based on difference in model methodology in that (1) this habitat suitability model utilized the LSA-derived TEM dataset instead of the provincial VRI dataset that was used for the BC Model, (2) this model used the parameter structural stage instead of age class and tree height class used by the BC Model and (3) this model did not use canopy closure class because it was not available. We consider the habitat suitability model used in this assessment a refinement of the BC Model.

Habitat Suitability Mapping

Habitat suitability mapping for Marbled Murrelet (criteria provided in **Appendix D.3-3**) shows that 921 ha, or 8.8%, of the LSA can be considered moderate and high suitability habitat (**Table 6.5-7**; **Appendix D.4-3**). The area mapped was within the 500 m LSA.

Moderate and high suitability habitat for nesting Marbled Murrelets is fragmented throughout the LSA, with the following notable exceptions of more contiguous patches: west of structures 28 to 41, structures 59 to 64, structures 129 to 178 and Kitimat substation and east of structures 96 to 113 (**Appendix D.4-3**). The provisional transmission line ROW crosses through moderate and high suitability Marbled Murrelet nesting habitat at or between the following structure locations: 22, 31, 39–41, 83–84, 146–148, 162–165 and 170–173 (**Appendix D.4-3**).

Table 6.5-7: Potential Suitable Reproducing Habitat for Marbled Murrelet within the Local Study Area during the Growing Season, Terrace to Kitimat Transmission Project, 2015

Habitat Suitability	Area (ha)	Proportion of Total LSA[1] (%)
Nil	5,937	56.4
Low	3,662	34.8
Moderate	568	5.4
High	353	3.4

Notes: ha = hectare; LSA = Local Study Area; % = percent.
[1]Total LSA = 10,520 ha.

6.5.2.2.2 Trumpeter Swan

The Trumpeter Swan is not a Species of Conservation Concern but is a management priority species under the Kalum LRMP (Government of BC, 2002b). Trumpeter Swans have rebounded from their low numbers and have been increasing since the beginning of the 20th Century when the species was close to extinction. The Pacific Coast Population breeds mainly in interior and coastal south-central Alaska with smaller numbers in the Yukon Territory and northwest BC (Pacific Flyway Council, 2006). In 2010, there were nearly 26,800 Trumpeter Swans in the Pacific Coast Population, with 95% in Alaska and 5% in western Yukon and northwestern BC. Most of the swans winter in Washington and BC (The Trumpeter Swan Society, 2015).

6.5.2.2.2.1 Field Survey Results

No systematic field surveys were conducted as part of this Project and no Trumpeter Swans were detected incidentally.

6.5.2.2.2.2 Species Information from Other Studies

The Trumpeter Swan overwinters in the Kitimat Valley. Horwood (1992) notes that the overwintering swans start to arrive in the valley in September with the majority arriving from late October to early November. The flock size that overwinters on Lakelse Lake was assessed at 125 to 130 individuals (Horwood, 1992). During the 2005 Christmas Bird Count, 187 Trumpeter Swans were counted on and around Lakelse Lake when the lake remained mostly open all winter and the swans were able to feed on the aquatic plant *Elodea* (The Trumpeter Swan Society, 2006). An article in the Northern Sentinel reported that every year around 40 Trumpeter Swans overwinter in close proximity to Kitimat with more than double that amount on Lakelse Lake (Horwood, 2013).

Three Trumpeter Swan records have been posted on eBird (Cornell Lab of Ornithology, 2015): four individuals at New Remo in March 2015, five individuals at Lakelse Lake Provincial Park (picnic site) in April 2014 and 30 individuals at Lakelse Lake Hot Springs in March 2006.

6.5.2.2.2.3 Habitat Information

The loss of quality wintering habitat is one of the most critical and immediate challenges facing the Pacific Coast Trumpeter Swan Population (The Trumpeter Swan Society, 2015). The Trumpeter Swan Society has identified important wintering sites, which include agricultural areas along the coast (Pacific Flyway Council, 2006). After lead poisoning, the loss of quality wintering habitat is the leading human-related cause of Trumpeter Swan mortality throughout its wintering range.

Wintering Swans seek out ice-free sites where vegetation is available, including freshwater streams, rivers, springs and reservoirs. In the Pacific Northwest, swans roost and feed in estuaries. Wintering Swans may forage in croplands and pasture. The Swans' movements in the Kitimat Valley are dictated by winter temperatures and corresponding amount of open water. In years with very cold winters, Swans leave the primary overwintering sites of Lakelse Lake and Lakelse River and fly to Kitsumkalum Lake northwest of Terrace or along the Skeena River (Horwood, 1992). Habitat suitability modelling was not undertaken for this species because Trumpeter Swans do not breed or overwinter in the LSA and loss and alteration of Trumpeter Swan habitat is not a potential Project effect.

6.5.2.3 Raptors

Based on the 2015 breeding bird survey (**Section 6.5.2.1.1**), which included raptors, species-specific raptor surveys and incidental observations in the LSA, nine raptor species, including two listed species (Northern Goshawk and Western Screech-owl), were confirmed (**Appendix D.1**). Other records of listed species in relatively close proximity of the LSA have been posted on eBird: a Peregrine Falcon *pealei* subspecies at New Remo in July 2015 and Short-eared Owl at Lakelse Lake Hot Springs in April 2014 (Cornell Lab of Ornithology, 2015). Both species are listed as Special Concern by COSEWIC and *SARA* and Blue-listed in BC. Both the New Remo and Lakelse Lake Hot Springs locations are approximately 6 km from the LSA.

6.5.2.3.1 Northern Goshawk

The Northern Goshawk (*laingi* subspecies) is listed as Threatened by *SARA* and COSEWIC and is Red-listed in BC (BC CDC, 2015). Coastal Goshawk populations are considered Endangered in BC, likely due to the extensive harvesting of low-elevation, old growth forests in coastal regions, including the Kitimat Valley. The most important habitats for the *laingi* subspecies are large tracts of mature or old coniferous forest with greater than 50% canopy closure (COSEWIC, 2013), which are suitable for nesting and post fledgling activities.

Goshawks are top predators and their populations are highly dependent on food availability and factors regulating foraging success. Within populations, reproductive success appears to vary greatly among years as a result of prey cycles. Northern Goshawks frequently use the forest and riparian habitat types, in particular mesic, moist/wet and mixed (deciduous/coniferous) forested, as well as riparian forest (BC CDC, 2015). The availability of breeding habitat is considered a limiting factor for Northern Goshawks (COSEWIC, 2013). Detailed information on the species' ecology and habitat requirements is provided in the Northern Goshawk species account (**Appendix D.3-4**).

6.5.2.3.1.1 Field Survey Results

Two Northern Goshawks were detected in the LSA during the 2015 field season between the Wedeene River and the Little Wedeene River; both were detected in mature forest between 125 m and 155 m in elevation. One immature Goshawk flew across a small access road (between structures 126 and 127) during road reconnaissance surveys on April 29. A second Goshawk flew into a Northern Goshawk call playback station on June 10 on the Wedeene FSR (between structures 117 and 118), approximately 21 km north of the first detection (**Appendix D.4-4**).

6.5.2.3.1.2 Species Information from Other Studies

One record of an individual Northern Goshawk detection for New Remo was posted on eBird (Cornell Lab of Ornithology, 2015) in October 2010. Three additional records in the spring of 2013 (n = 2) and 2015 (n = 1) were posted for the City of Kitimat / Kitimat River Estuary. During the fall and winter months, one Northern Goshawk detection was reported near Terrace in each of the years 2010, 2013 and 2015.

Northern Goshawks were not detected during call playback surveys for three recent industry baseline studies (i.e. Rio Tinto Alcan expansion (WorleyParsons Resources and Energy, 2015), Pacific Trails Pipeline (Westland Resource Group Inc., 2007) and Northern Transmission Line (Rescan™Tahltan Environmental Consultants, 2010)) within or near the Kitimat Valley.

6.5.2.3.1.3 Habitat Information

Habitat suitability mapping for the Northern Goshawk (criteria provided in **Appendix D.3-4**) shows that 1,652 ha, or 15.7%, of the LSA can currently be considered moderate and high suitability habitat (**Table 6.5-8**; **Appendix D.4-4**). The area mapped was within the 500 m LSA; however, an 800 m LSA (see **Table 6.4-1**) will be used to discuss other potential effects not related to habitat loss.

Table 6.5-8: Potential Suitable Reproducing Habitat for Northern Goshawk within the Local Study Area during the Growing Season, Terrace to Kitimat Transmission Project, 2015

Habitat Suitability	Area (ha)	Proportion of Total LSA[1] (%)
Nil	5,373	51.1
Low	3,496	33.2
Moderate	628	6.0
High	1,024	9.7

Notes: ha = hectare; LSA = Local Study Area; % = percent.
[1]Total LSA = 10,520 ha.

Moderate and high value nesting habitat is located intermittently along the LSA; however, there are two areas with larger areas of contiguous mosaic of moderate and high value habitat

(**Appendix D.4-4**). One of these areas is located on the east side of the LSA along the base of Iron Mountain (structures 95 to 114); the other lies between the Little Wedeene River and town of Kitimat on the west side of the LSA (structures 129 to 165).

The two Northern Goshawk detections were not within habitat modelled as moderate or high suitability (**Appendix D.4-4**). This may not be indicative of typical goshawk habitat use in the LSA, however, as the first detection was of an immature bird and the second was of an adult responding to call playback.

6.5.2.3.2 Western Screech-owl

The Western Screech-owl subspecies *kennicottii* is listed as Threatened by COSEWIC and as Special Concern by *SARA* and is provincially Blue-listed. The primary reason for the Owl's status is significant population decline related to habitat loss from logging and other developments that remove dead and defective trees (COSEWIC, 2012a).

The Western Screech-owl is a small secondary cavity nester, requiring natural tree cavities or those excavated by other species such as woodpeckers (BC MOE, 2014). The species' habitat requirements are best met in older forests that contain relatively large-sized dead and defective trees.

6.5.2.3.2.1 Field Survey Results

No Western Screech-owls were detected at the sampling stations of the systematic call playback surveys (**Figure 6.5-2**) conducted in the LSA.

A pair of Western Screech-owls was detected incidentally during Marbled Murrelet radar surveys approximately 50 m northwest of radar station R3 near a wetland (between structures 74 and 78) (**Figure 6.5-1**). Subsequent call playback at the radar station on May 24 generated responses from a pair of Screech-owls. A third detection event occurred on May 26 in the town of Kitimat when a single Screech-owl was spontaneously calling approximately 70 m northwest of Kitimat Lodge Motel.

6.5.2.3.2.2 Species Information from Other Studies

The Birds of Kitimat describe the Western Screech-owl as an accidental breeder in the Kitimat Valley (Horden, 1992). Multiple call playback surveys for the Western Screech-owl have been conducted around Kitimat and within the Kitimat Valley (Westland Resources Group Inc., 2007; WorleyParsons Resources and Energy, 2015); however, only one survey completed by Stantec in 2013 detected the species (Stantec, 2014). Call playback stations for a proposed LNG plant detected the Screech-owl calling back from an area of older forest south of Kitimat within the Kitimat River delta (WorleyParsons Resources and Energy, 2015). In that study, no records of Western Screech-owl were found north of Kitimat.

6.5.2.3.2.3 Habitat Information

No habitat suitability modelling was undertaken for Western Screech-owl for the LSA because the species was not detected during systematic surveys and not selected as a VC for Project effects assessment.

6.5.2.4 Bears

6.5.2.4.1 Grizzly Bear

Grizzly bear is a species listed as Special Concern by COSEWIC, provincially Blue-listed (BC CDC, 2015) and a Species at Risk under the IWMS (BC MOE, 2015). It is also a priority management species under the Kalum LRMP. Grizzly bear populations have declined significantly and many have been Extirpated throughout its former range. The species is highly sensitive to human disturbance and is subject to high mortality risk in areas of human activity and where roads create access. Concern for the species includes habitat fragmentation through resource development activities (COSEWIC, 2012c).

Grizzly bears frequently use the alpine/tundra, agriculture, forest, grassland/shrub, riparian, rock/sparsely vegetated rock and wetland habitat types as well as unique habitats such as avalanche tracks and estuaries (BC CDC, 2015). Certain habitat subtypes (e.g. riparian forests, bogs, and swamps); habitat elements (e.g. ant hills, old stumps, coarse woody debris); and critical habitat patches (described below) are essential habitat components within the general habitat types. Coastal grizzly bears feed on skunk cabbage and sedges in the spring and other vegetation as it becomes available. Grizzly bears will start foraging on salmon when the fish return until most of the runs are complete in late fall. Once the salmon resource is unavailable, they will return to feeding on skunk cabbage and other vegetation (BC MWLAP, 2002). Detailed information on the species' ecology and habitat requirements is provided in the grizzly bear species account (**Appendix D.3-5**).

The grizzly population that overlaps with the Project area is part of the North Coast Grizzly Bear Population Unit (GBPU). As per 2012 grizzly bear population estimate (BC MFRNRO, 2012a), this GBPU is approximately 190 bears. There is currently no hunting of grizzly bear in Management Unit 6-11 within which the Project is located (BC MFLNRO, 2014b).

Grizzly Bear Management Areas are a level of stratification, proposed under the Grizzly Bear Conservation Strategy (Government of BC, 2002b), which intends to identify lands with key habitat attributes that further the grizzly bear objective of ensuring a viable and healthy population. As part of the Kalum LRMP, two small Grizzly Bear Management Areas were identified and currently delineated as non-legal grizzly bear linkage SRMZs (**Figure 6.4-1**). These SRMZs do not overlap with the Project LSA but may be relevant in that they provide habitat linkage and movement corridors via which bears may access the LSA.

Another level of stratification for grizzly bear habitat conservation is that of Identified Watersheds. Three such watersheds that have been identified by the Kalum LRMP (Government of BC, 2002b) overlap with the LSA: Lakelse–Cecil, Little Wedeene, and Wedeene (**Figure 6.4-1**). The LRMP management objectives (Kalum LRMP, p.71–76) for these watersheds are to:

- Maintain or restore grizzly bear habitat;
- Provide an adequate supply of berry feeding;
- Protect or restore critical stand level patch habitats where they occur;
- Establish an effective monitoring and evaluation program for grizzly bear management practices and related implications;
- Monitor bear mortality to ensure that mortality from all human causes does not exceed 4% of the estimated population, that less than 30% of the kill is female and that the total kill is not area concentrated;
- Provide hunter harvest opportunities; and
- Monitor the overall effectiveness of applying the Grizzly Bear Best Management Practices.

Critical patch habitats are defined in the Kalum LRMP as “unique habitats that offer essential seasonal requisites including foraging, bedding and even denning. Critical patch habitats include herb dominated avalanche tracks with adjacent forest, non-forested fens, herbaceous riparian meadow/wetland complexes and seepage sites, skunk cabbage swamps, sub alpine parkland meadows, whitebark pine stands, salmon fishing areas and old burns or other successional areas dominated by Vaccinium (blueberry) species” (Government of BC, 2002b). Such habitats are important for grizzly bear in the identified watersheds as well as throughout their range. The Grizzly Bear Identified Watersheds Lakelse-Cecil and Wedeene (**Figure 6.4-1**) are priorities for access management planning.

Grizzly bears select den sites within the Kitimat Valley; however, the timing of the denning can depend on the availability of food and the winter temperatures. Bears are known to not den and start hibernating if they have a good food source. At Lakelse Lake, some bears have been reported not hibernating until Christmas because there is still salmon in the rivers and it is not cold enough (Orr, 2015).

6.5.2.4.1.1 Field Survey Results

No systematic survey for grizzly bears was undertaken as part of this Project. However, two incidental visual sightings were recorded for this species within the LSA during the 2015 field surveys (**Appendix D.4-5**) from the following locations:

- One adult sighted on Iron Mountain on a forested, rocky ridgeline above the Wedeene River, approximately 400 m east of structure 107 (UTM 9 U 521624 E 6004500 N; elevation = 350 m); and
- A female and two cubs sighted along a road on the west side of the town of Kitimat, approximately 800 m east of structure 174 (UTM 9 U 519390 E and 5988584 N; elevation = 25 m).

Twenty-one detections of bear sign, including scat and forage sign, were recorded (**Appendix D.4-5**) but could not be identified to either grizzly or black bear.

6.5.2.4.1.2 Species Information from Other Studies

The methods used to select important Grizzly Bear Identified Watersheds in the Kalum planning area involved several databases (Government of BC, 2002b). The central inventory was the Broad Ecosystem Unit map, which was interpreted for grizzly bear habitat capability and suitability. Distribution of bear habitat value across the plan area was greatly improved by linking the DFO's average salmon escapement data to watersheds (by salmon species). The LRMP's Grizzly Bear Working Group compiled and mapped road density, recreational user days, industrial user days and highway user days, each of which influences the "usability" or effectiveness of a watershed to provide grizzly bear habitat.

No systematic grizzly bear population surveys were conducted for any of the recent baseline surveys conducted near Terrace and the Kitimat Valley (Westland Resources Group Inc., 2007; Stantec, 2014; WorleyParsons Resources and Energy, 2015). During the large mammal baseline transects conducted beside the Kitimat River for the LNG Canada Export Terminal expansion, 20 grizzly bear tracks and one black bear track were detected (Stantec, 2014).

Talks are underway between the Province of BC (MFLNRO) and the Kitselas Band Council to establish a grizzly bear movement study between Terrace and Kitimat (Kitselas Band Council and Administration, 2015). The Kitselas First Nation has met with the Foothills Research Institute to determine the feasibility of such a study. No further information was available at this time.

6.5.2.4.1.3 Habitat Information

The detections of bear sign were found in both the CWHvm1 and CWHws1 BGC variants and were detected in a variety of habitat types, including mature forest, riparian forest, wet forest, swamp, bog and pond. Evidence of fresh digging of skunk cabbage bulbs was detected in mature forest, pond, swamp and bog. Structural stage of the detection sites ranged from structural stage 3 to 7[2].

Habitat Features

Two bear dens (species unknown) were detected within the LSA during the 2015 surveys at the following locations (**Appendix D.4-5**):

- In the old growth riparian zone on the south side of Lakelse River (this bear den was located in an old windfall stump and there were fresh signs of the presence of the bear near the den); and
- Approximately 900 m south of the confluence of Bowbyes Creek and Little Wedeene River near structure 132.

Habitat Suitability Mapping

Habitat suitability mapping for grizzly bear (criteria provided in **Appendix D.3-5**) shows that 49.0% and 91.5% of the LSA can be considered moderate and high suitability (suitable) habitat in the

[2] Structural stages 3 to 7 are defined as: Structural stages 3 to 7 are defined as: 3 = Shrub/Herb, 4 = Pole/Sapling (<40 years), 5 = Young Forest (40-80 years), 6 = Mature Forest (80-250 years), and 7 = Old Forest (>250 years) (RISC, 1998e).

spring and fall, respectively (**Table 6.5-9**; **Appendix D.4-5** and **Appendix D.4-6**). The area mapped was within the 500 m LSA; however, an LSA with a 1,000 m buffer on either side of the ROW will be used to discuss other potential effects not related to loss of habitat.

Table 6.5-9: Potential Suitable Spring and Fall Feeding Habitat for Grizzly Bear during the Growing Season within the Local Study Area, Terrace to Kitimat Transmission Project, 2015

Life Requisite – Season	Amount (ha) / Proportion[1] (%) of Rated Habitat Within the LSA			
	Nil Suitability	**Low Suitability**	**Moderate Suitability**	**High Suitability**
Feeding – Spring	433 / 4.1	4,931 / 46.9	654 / 6.2	4,502 / 42.8
Feeding – Fall	408 / 3.9	482 / 4.6	2,693 / 25.6	6,937 / 65.9

Notes: ha = hectare; LSA = Local Study Area; % = percent.
[1]Total LSA = 10,520 ha.

Suitable fall habitat is contiguous throughout the majority of the LSA, interspersed with small isolated patches of habitat identified as nil or low suitability. While the largest areas of contiguous suitable habitat within the LSA have been identified for the fall season, suitable spring habitat is generally found within the same areas identified as suitable fall habitat. Suitable spring habitat identified between the Skeena substation and End Lake (structures 1 to 50) is mostly contiguous but branched throughout the LSA. The largest area of contiguous suitable grizzly bear spring habitat is found near Iron Mountain (structures 83 to 117) but becomes more patchy south of Iron Mountain to Little Wedeene River (structures 117 to 128). Less patchy areas of suitable contiguous spring habitat occur between the Little Wedeene River and the Minette substation alongside Mount Clague (structures 128 to 175).

Road Density in Grizzly Bear Habitat

Grizzly bears are sensitive to the density of roads in their habitat. The BC 2012 Grizzly Bear Population Status report (BC MFLNRO, 2012a) identifies roads as having a adverse effect on grizzly bear habitat use when they reach a density of about 0.6 km of road per square kilometre and that this effect gets stronger when road density increases over approximately 1 km/km^2. Based on an analysis of grizzly mortality rates relative to road densities in Alberta, Boulanger and Stenhouse (2014) suggested a threshold road density value of 0.75 km/km^2 to ensure viable grizzly bear populations. Comparing these suggested thresholds to the existing road densities in the management units relevant to this Project shows that, except for the North Coast GBPU, the values are considerably above these thresholds (**Table 6.5-10**), with the Project's LSA road density more than four times the threshold value recommended by Boulanger and Stenhouse (2014).

Table 6.5-10: Total Length and Density of Roads in Grizzly Bear Management Units and the Local Study Area, Terrace to Kitimat Transmission Project, 2015

Analysis Management Unit	Area (km^2)	Existing Roads (km)	Existing Road Density (km/km^2)
Lakelse–Cecil Identified Watershed[1]	314.83	675.67	2.15
Little Wedeene Identified Watershed[1]	133.53	114.94	0.86
Wedeene Identified Watershed[1]	311.11	276.49	0.89

Analysis Management Unit	Area (km^2)	Existing Roads (km)	Existing Road Density (km/km^2)
Grizzly Bear Population Unit–North Coast	7,162.25	2,565.21	0.36
Grizzly Bear Local Study Area (1,000 m buffer)	161.95	492.09	3.04

Notes: km = kilometre; km^2 = square kilometre; LSA = Local Study Area.
[1]Kalum Land and Resource Management Plan (Government of BC, 2002b)

6.5.2.4.2 Kermode American Black Bear

Kermode bear is a rare subspecies of American black bear that inhabits forests of northwestern BC. A black bear of any color morphology (brown/cinnamon, blue/glacial) is considered a Kermode (Marshall and Ritland, 2002). The highest known incidence of occurrence of white-phase individuals within the range of this subspecies of black bear is on Princess Royal Island. It is estimated that 2.5% of black bears in the Terrace area have the white coat and display the recessive trait (Blood, 1997). Kermode bears are generally clumped in distribution within their range. There is a concentration of Kermode bears found around Terrace (Blood, 1997).

The American black bear, including the Kermode subspecies, is not a listed Species of Conservation Concern. The Kermode is, however, an animal of spiritual value to First Nations, is a priority management species under the Kalum LRMP and has been designated as the Provincial Mammal. The primary threat to black/Kermode bears is human-related mortality involving road traffic and human-bear conflict over garbage and other non-natural food sources. While the American black bear is a hunted species, the white (Kermode) and blue (Glacier) colour phases of the black bear are closed to hunting (BC MFLNRO, 2014b).

Kermode bears frequently use the alpine/tundra, anthropogenic, forest, grassland/shrub, rock/sparsely vegetated rock, and stream/river habitat types, as well as unique habitats such as avalanche tracks and estuaries (BC CDC, 2015). Key habitat factors include vertical and horizontal diversity of forest structure typically found in old growth forests (Horn et al., 2009). Habitat elements (e.g. ant hills, salmon streams, berries, old stumps, and coarse woody debris) are essential habitat components within the general habitat types.

Food abundance is the major determining factor of habitat use by Kermode bears (Amstrup and Beecham, 1976). Concurrent studies on white and black bears indicate there are proportionately more marine nutrients taken up by the white bear relative to that of the black morph, perhaps indicating more of a dependence on fish-bearing streams (Klinka, 2004). Salmon-bearing rivers, including the Kitimat River and its associated tributaries, provide important fall habitat for some black bear populations as they attempt to gain weight in preparation for hibernation. Bears will migrate from adjacent watersheds to forage on spawning salmon. Klinka and Reimchen (2009) indicate that the white morph is more efficient at capturing salmon during daylight as a result of the differential evasiveness of salmon to the two morphs, indicating a potential difference in diurnal use of a fish-bearing stream. In coastal areas, Kermode bear and grizzly bear populations overlap in this use of habitat. Grizzly bears are known to drive Kermode bears away from salmon spawning rivers, including the Kitimat River (Westland Resource Group Inc., 2007). Klinka and Reimchen (2009) note that recent and ongoing industrial deforestation of the riparian zones as well as major historical declines in salmon numbers returning to streams continue to compromise the integrity of the polymorphism of the Kermode bear.

Den site availability is another determining factor of Kermode bear habitat quality; this factor is linked to the proportion of old growth forest retained within bear habitat and on forest management practices (Blood, 1997). Detailed information on the species' ecology and habitat requirements is provided in the American black bear species account (**Appendix D.3-6**).

6.5.2.4.2.1 Field Survey Results

No systematic survey for black bears was undertaken as part of this Project. No Kermode bears were observed during the 2015 field surveys. However, five incidental visual sightings and 21 detections of sign were recorded for this species within the LSA during the 2015 field surveys (**Appendix D.4-7**) from the following locations:

- Two sightings of single adult black bears were recorded in the middle of July near the Wedeene FSR crossing of the Little Wedeene River;
- Three camera-trap detections of black bears in June at cameras 7, 9, and 56; and
- Twenty-one detections of bear sign, including scat and foraging sign, were also recorded during field work (identification of bear sign to species was not always possible and is only reported for the genus level) (**Appendix D.4-7**).

6.5.2.4.2.2 Species Information from Other Studies

Based on a desktop information review, there are no studies known to the authors that report on occurrence of black and Kermode bears in the LSA or within the Kitimat Valley.

6.5.2.4.2.3 Habitat Information

Habitat at Visual Sightings

The camera trap detections were located in the CWHws1 BGC variant and were detected in a variety of habitat types, including a swamp, riparian and wet forest. Structural stage at the detection sites was 7. The visual detections were located in the CWHvm1 BGC variant within mature and riparian forest of structural stage 7. As noted in the grizzly bear section above, evidence of fresh digging of skunk cabbage bulbs was detected in mature forest, pond, swamp and bog. Structural stage of the detection sites ranged from structural stage 3 to 7.

Habitat Features

As described in the grizzly bear section above, two bear dens were detected within the LSA during the 2015 surveys at the following locations (**Appendix D.4-7**):

- In the old growth riparian zone on the south side of Lakelse River (this bear den was located in an old windfall stump and there were fresh signs of the presence of the bear near the den); and
- Approximately 900 m south of the confluence of Bowbyes Creek and Little Wedeene River near structure 132.

Habitat Suitability Mapping

Habitat suitability mapping for Kermode bear (criteria provided in **Appendix D.3-6**) shows that 5,304 ha (50.4%) and 4,253 ha (40.4%) of the LSA can currently be considered moderate/high suitability (suitable) habitat for spring and fall feeding, respectively (**Table 6.5-11**; **Appendices D.4-7** and **D.4-8**). The area mapped was within the 500 m LSA; however, a 1,000 m buffer will be used to discuss other potential effects not related to loss of habitat.

The visual detections of black bear (**Appendix D.4-7**) in 2015 were in nil and low suitability spring habitat and low and high suitability fall habitat. The detections of black bears on the wildlife camera during the summer were in high suitability spring and fall habitat. The detections of bear sign were found in low, moderate and high suitability habitat, which can be explained by their home range size being larger than some of the modelled habitat patches and their seasonal movements.

Table 6.5-11: Potential Suitable Spring and Fall Feeding Habitat for Kermode Bear within the Local Study Area during the Growing Season, Terrace to Kitimat Transmission Project, 2015

Life Requisite – Season	Amount (ha) / Proportion[1] (%) of Rated Habitat Within the LSA			
	Nil Suitability	Low Suitability	Moderate Suitability	High Suitability
Feeding – Spring	433 / 4.1	4,783 / 45.5	1,359 / 12.9	3,945 / 37.5
Feeding – Fall	343 / 3.3	5,925 / 56.3	181 / 1.7	4,072 / 38.7

Notes: ha = hectare; LSA = Local Study Area; % = percent.
[1]Total LSA = 10,520 ha.

Generally, suitable spring and fall Kermode habitat is found within the same areas of the LSA. The most notable exception is more suitable fall than spring habitat around Skeena substation (structures 1 to 50). Between structures 50 to 83, suitable habitat is patchy with some longer branches. A large area of contiguous suitable habitat occurs near Iron Mountain (structures 83 to 117). South of structure 117 between Wedeene River and Little Wedeene River (structure 128), suitable habitat becomes patchy again. Between Little Wedeene River and Minette substation (structures 128 to 176), there are larger contiguous areas of suitable habitat on the west side of the LSA and branches of suitable habitat on the east side of the LSA.

6.5.2.5 Ungulates

Ungulate species occurring in the Kitimat Valley include moose, white-tailed deer and mule deer. No systematic surveys were completed for ungulates in 2015 (due to unsuitable snow conditions during the winter tracking survey) and the only incidental detection was that of a mule deer on Wedeene FSR near structure 138. Detections of deer tracks were recorded as incidental sign near the Little Wedeene River (structures 137 to 138); however, these could not be identified to species. An ungulate game trail was noted alongside the Lakelse River (between structures 21 and 22).

6.5.2.5.1 Moose

While this species is not considered at risk under provincial or federal legislation, it is a priority management species under the Kalum LRMP (Government of BC, 2002b), primarily due to its economic value to First Nations and non-First Nations hunters and guide outfitters. There are a number of influences (i.e. human-caused mortality, habitat quality and quantity, seasonal weather conditions, predation and disease) on moose populations that can act on a local or regional scale. The Kalum LRMP specifically notes that road access to winter ranges is a concern because of increased disturbance and poaching when ungulates are concentrated on winter range (Government of BC, 2002b).

Moose are intensely managed and hunted throughout BC, including Wildlife Management Unit 6-11 (Skeena Region) within which the Project LSA is located (MFLNRO, 2014). Following a severe winter in 2006/2007 and observed significant population decline, the Skeena Allocation Committee (representing guided and resident hunters) estimated the regional moose population at 12,000 individuals (MFLNRO, 2012). The more recent 2012/13 assessment estimated a moose density of 0.23/100km^2, a bull:cow ratio of 62 and a calf:cow ratio of 35 (BC MFLNRO, 2012b). Moose are considered relatively abundant in the LSA; however, they were uncommon before the Kitimat Valley was logged in the 1960s and 1970s. Apparently, the population increase was part of a general province-wide south and westerly range expansion (Dairmount et al., 2005).

Moose frequently use the alpine/tundra, forest, grassland/shrub, lakes, riparian and wetland habitat types. Important habitat subtypes include mesic, moist/wet and deciduous broadleaf forest, natural shrub, pond/open water, riparian gravel bar, forest, herbaceous and shrub habitats as well as bog, fen, marsh, and swamp wetlands (BC CDC, 2015). Detailed information on the species' ecology and habitat requirements is provided in the moose species account (**Appendix D.3-7**).

The Kitimat River and smaller watercourses south of the Skeena River around Terrace undergo hydrological dynamics, which include fall flooding resulting from intense storms and rain-on-snow events (McLennan 1995a). These floods are usually much shorter in duration than the spring/summer snowmelt floods, which result in long slow peaks and tend to produce high bench ecosystems rather than middle and low bench ecosystems (McLennan, 1995a). The Kalum LRMP describes areas where these functional processes exist as primary winter range for moose, including locations along major rivers and streams or large wetlands where yearly flooding and deposition of sediment maintain early-seral shrub communities (Government of BC, 2002b). While the LSA does not overlap with primary moose winter range, it does overlap with habitat identified as non-legal secondary moose winter range. The Kalum LRMP identifies objectives for secondary moose winter range as follows:

- Provide security for wintering moose populations for identified secondary moose winter range (the associated strategies will be based on operational feasibility); and
- Encourage forage production and maintain/enhance forested thermal cover on secondary moose winter range.

There are a number of influences on moose populations that can act on a local or regional scale. The status of a moose population can be affected by human harvest and human-caused mortality, habitat quality and quantity, seasonal weather conditions, predation and disease. The Kalum LRMP specifically notes that road access to winter ranges is a concern because of increased disturbance and poaching when ungulates are concentrated on winter range (MFLNRO, 2002).

6.5.2.5.1.1 Field Survey Results

No systematic surveys were completed for moose in 2015 (due to unsuitable snow conditions during the winter tracking survey). However, multiple incidental signs (tracks, bedding and scat) but no visual detections were recorded for this species within the LSA during the 2015 field surveys. During the 2015 field work for rating wildlife habitat suitability, detections of moose sign were found in 25% of 78 TEM plots distributed along the length of the LSA, except south of the Little Wedeene River (structure 129) (**Appendix D.4-9**).

A reconnaissance level winter tracking survey of the LSA in March 2015 showed that moose used the area along and near the north shore of the Lakelse River as winter range (transect 12 between structures 7 and 12). High quality winter wildlife habitat was identified in the Lakelse River valley (structure 20), with recent moose use evident in the area. Willow and red-osier dogwood are abundant and heavily browsed, indicating long-term use by moose near structure 49.

Transects between Wedeene River and Coldwater Creek (structure 85) did not detect ungulate sign where the habitat consists of even-aged hemlock stands and second-growth forest. Ungulate winter use was present but likely limited to a small number of animals in the vicinity. Transects in riparian areas north of Wedeene River detected moose and deer tracks, and a movement corridor was identified along a creek flowing out of a wetland through the riparian area (structure 81).

Good quality wildlife winter habitat was observed on the south side of the Little Wedeene River. The riparian forest along the unnamed tributary near structure 122 is likely used as a movement corridor for wildlife, based on tracks through the area. The riparian consisted of large-sized spruce, cedar, and hemlock trees interspersed with alder. The understory in the riparian zone consisted primarily of red-osier dogwood, elderberry, willow, alder and huckleberry. Moose appear to use the Little Wedeene River valley as a movement corridor as evidenced by moose passing through the area (i.e. tracks moving through; no sign of bedding down or prolonged use).

6.5.2.5.1.2 Species Information from Other Studies

Surveys conducted by the BC MFLNRO between 2011 and 2013 within other areas of the Skeena Region have focused on the Bulkley Valley Lakes District population and the Kispiox population (BC MFLNRO, 2014c). In the Bulkley Valley Lakes population, numbers have declined from 2004 by 20%. The Kispiox population results were similar to those obtained during the previous 1999 survey. During the winter of 2011/2012, there was a repeat survey conducted near Terrace on the Lower Skeena Islands and the population estimate generated was considered similar to the last estimate obtained in 1997 (BC MFLNRO, 2014c).

Three moose studies with collared animals in relatively close proximity to the LSA were located in the Nass Wildlife Area, the Besa-Prophet area and the Muskawa-Kechika Management Area (Rescan^{TM} Tahltan Environmental Consultants, 2010). Most of the collared moose from the three areas were identified as migratory (Demarchi, 2003; Gillingham and Parker, 2008a; Gillingham and Parker, 2008b). In the Nass Wildlife Area, at least 71% moose migrated ≤75 km from summer to winter range and crossed the Nass River at several key locations (Demarchi, 2003). In the Besa-Prophet study, collared moose migrated from summer to winter habitat but also moved to lower elevations from winter to late winter (Gillingham and Parker, 2008b). Migratory behaviour in moose is apparently learned, as young individuals follow the movement patterns of their mothers, both in terms of seasonal home ranges and migration routes (Sweanor and Sandegren, 1989). As a result, migratory movements often follow traditional routes using the same migration corridor every year but patterns of migration may vary from year to year, depending on extent and duration of snowfall (Bowyer et al, 2003).

Moose winter range within the wildlife study area for the Northwest Transmission Line, which included the Terrace area, was described as consisting primarily of low-elevation, wetland-timber complexes; floodplains of main rivers and large tributary streams adjacent to coniferous stands; and relatively high elevation areas with low snow packs (Rescan™ Tahltan Environmental Consultants, 2010). During winter baseline surveys for the Pacific Trails Pipeline Project (Westland Resource Group Inc., 2007), moose were detected using the valley bottoms of the lower Kitimat Valley for feeding and security cover (Westland Resource Group Inc., 2007).

During baseline mammal transect surveys between 2012 and 2013 for the LNG Canada Export Terminal Project; the majority of moose sign was detected just north of the proposed terminal along the west bank of the Kitimat River (Stantec, 2014). No moose were detected by wildlife cameras as part of the systematic baseline surveys for the Rio Tinto Alcan terminal expansion; however, they were detected incidentally (WorleyParsons Resources and Energy, 2015).

6.5.2.5.1.3 Habitat Information

Habitat at Incidental Detections

Twenty-seven detections of moose sign were found in both the CWHvm1 and CWHws1 BGC variants and were detected in a variety of habitat types, including mature forest, riparian forest, wet forest, dry forest and bog. Evidence included browse, pellets and tracks. Structural stage of the detection sites ranged from structural stage 2 to 7. No incidental detections were made south of the Little Wedeene River valley (structure 129).

Habitat Features

One moose bedding area was detected within the LSA during the 2015 surveys. The bed was within the riparian forest structural stage 6 on the north side of Little Wedeene River at 68 m. No mineral licks or wallows were detected within the LSA.

Habitat Suitability Mapping

Habitat suitability mapping for moose (criteria provided in **Appendix D.3-7**) shows that 5,440 ha (51.7%) of the LSA can currently be considered moderate and high suitability habitat for living-winter and 4,211 ha (40%) of the LSA can currently be considered moderate and high suitability habitat for reproducing-growing (**Table 6.5-12**; **Appendix D.4-9** and **Appendix D.4-10**). The area mapped was within the 500 m LSA. The habitat analysis identified moderate and high value winter and growing season habitat along the length of the LSA (**Appendix D.4-9** and **Appendix D.4-10**). Generally, the suitable habitat for both seasons is found within the same areas of the LSA. The two largest areas of contiguous suitable moose habitat for both seasons are found at Iron Mountain (structures 83 to 117) and Mount Clague (structures 128 to 175).

Twenty-seven visual detections of moose sign occurred during the summer months, and, when overlaid on the habitat suitability maps for both the growing and winter season, occurred within low, moderate and high value habitat (**Appendix D.4-10**). The age of the sign could not be determined for all of the detections, however, and therefore it was overlaid on the maps for both seasons. Only four and five out of the 27 detections were outside (>500 m) of suitable growing and winter season habitat, respectively.

Table 6.5-12: Potential Suitable Living-Winter and Reproducing-Growing Habitat for Moose within the Local Study Area, Terrace to Kitimat Transmission Project, 2015

Life Requisite – Season	Amount (ha) / Proportion[1] (%) of Rated Habitat Within the LSA			
	Nil Suitability	Low Suitability	Moderate Suitability	High Suitability
Living – Winter	623 / 5.9	4,456 / 42.4	5,012 / 47.6	428 / 4.1
Reproducing – Growing	600 / 5.7	5,709 / 54.3	3,681 / 35.0	530 / 5.0

Notes: ha = hectare; LSA = Local Study Area; % = percent.
[1]Total LSA = 10,520 ha.

6.5.2.6 Furbearers

Furbearers occur throughout the Kitimat Valley and are an important ecological resource as well as cultural and economic resources for both First Nations and non-First Nations trappers. The main species harvested in the Kalum LRMP plan area are Pacific marten, Canada lynx and American beaver. Marten and beaver accounted for over 90% of trapping revenues in the Kalum LRMP area, which accounts for 22% of marten harvested in the Skeena region (Government of BC, 2002b). BC MOE harvest data collected between 1985 and 2003 show that marten represented 58% of the total number of animals harvested in the Skeena Region (Rescan™ Tahltan Environmental Consultants, 2010).

In the LSA, beaver and lynx were detected incidentally during the 2015 field season. During the winter tracking surveys, beaver were detected around the Lakelse River; during summer, beaver were detected north of the Lakelse River and between the Lakelse River and Coldwater Creek. During winter tracking, detections of lynx tracks were recorded in the riparian areas of the Lakelse River and Little Wedeene River but not the Wedeene River. The furbearer species of Conservation Concern in the LSA are fisher and wolverine, both provincially Blue-listed and designated Species at Risk under the IWMS; wolverine is also listed as Special Concern by COSEWIC. No detections were recorded for the fisher or wolverine during the 2015 field studies.

6.5.2.6.1 Pacific marten

While this species is not considered at risk under provincial or federal legislation, it is a priority management species under the Kalum LRMP (Government of BC, 2002b). The harvest of marten is important to local residents, including First Nations. The Pacific marten is a Harvest Class 1 Species under the BC Fur Management Program, which means it can be managed on the basis of an individual trapline because its home range is small enough for a viable population to be contained within one trapline area (Hatler et al., 2003).

Pacific marten usually occurs in dense deciduous, mixed or (especially) coniferous upland and lowland forest. It also may use rocky alpine areas. Habitat elements important to marten include holes in dead or live trees or stumps, abandoned squirrel nests, conifer crowns, rock piles, burrows and snow cavities; young are born in a den, usually in a hollow tree but sometimes in a rock den.

Marten use mainly subnivean sites, often associated with coarse woody debris, in winter. Detailed information on the species' ecology and habitat requirements is provided in the Pacific marten species account (**Appendix D.3-8**).

Martens have been shown to be sensitive to fragmentation of mature forest at the landscape scale, with survival rates of adults and dispersing juveniles lower in intensively managed forests (Johnson et al., 2009). Population densities vary greatly across North America but are known to be within the range of 0.4 to 2.4 animals per 1 km^2, depending on prey abundance (Hatler et al., 2003).

Within the LSA, there is no habitat specifically mapped as important to marten. The Kalum LRMP does provide general resource direction objectives for trapping, including marten:

- Maintain trapping opportunities for the trapping industry;
- Maintain the viability of fur bearer populations through habitat management and, specifically for marten winter habitat, establish and implement guidelines for the presence and distribution of course woody debris piles; and
- Strive for the continuance of the social and cultural aspects of trapping and recognize the cultural history associated with the trapping industry, for both First Nations and non-First Nations peoples.

The most important negative influence on marten populations in many areas, including the Skeena region, is the removal and alteration of habitat during logging operations (Hatler et al., 2003) and fragmentation of habitat (Guppy, 2012). When subjected to both habitat degradation and intense trapping pressure, the species' resilience may decrease and populations may be compromised, especially in managed landscapes where expanding road networks increase trapper access (BC MFLNRO, 2014b).

6.5.2.6.1.1 Field Survey Results

No systematic surveys were completed for Pacific marten in 2015 (due to unsuitable snow conditions during the winter tracking survey). However, the species was part of a wildlife camera pilot study focused on medium-sized and small mammals within the CWHws1 BGC variant of the LSA. Of the ten wildlife cameras, three captured marten (cameras 1, 9 and 11; **Appendix D.4-11**). Eight detections of a least five separate individual martens occurred at three cameras near Wedeene River (**Appendix D.4-11**). The cameras that detected marten were located in wet and riparian coniferous forest within structural stage 4, 6, and 7; they were not detected on cameras in mesic forest or swamp within coniferous forest of structural stage 7. Martens are known to be nocturnal hunters (Hatler et al., 2003); all of the marten detections in 2015 were between the hours of 0300 and 1100.

Additional incidental sightings of marten occurred at Wedeene FSR between Wedeene and the Little Wedeene Rivers (structures 121 and 122); two marten detections occurred on the Lakelse FSR near the intersection with the Coldwater North FSRs (structures 39 to 36).

6.5.2.6.1.2 Species Information from Other Studies

No marten were detected during mammal baseline surveys in 2012 and 2013 for the LNG Canada Export Terminal Project (Stantec, 2014) and 2014 baseline surveys for the Rio Tinto Alcan terminal expansion (WorleyParsons Resources and Energy, 2015). No furbearer surveys were undertaken for baseline surveys for the Pacific Trails Pipeline Project (Westland Resource Group Inc., 2007). That project however, did identify the following habitat types as potentially containing suitable habitat features for marten: coastal riparian forest, coastal floodplain forest, coastal closed forest, mountain riparian forest and mountain closed forest.

6.5.2.6.1.3 Habitat Information

6.5.2.6.1.3.1 Habitat Features

The field rating of wildlife habitat revealed that dry mesic forest of structural stage 4–5 had large, decomposing root wads suitable for the marten; however, other sources of required coarse woody debris such as networks of large fallen logs were not always present.

Habitat Suitability Mapping

Habitat suitability mapping for marten (criteria provided in **Appendix D.3-8**) shows that 2,325 ha (22.1%) of the LSA can currently be considered moderate and high suitability habitat (**Table 6.5-13**; **Appendix D.4-11**). The habitat analysis identified moderate and high-value winter habitat along the length of the LSA, with two larger concentrations of contiguous habitat (**Appendix D.4-11**). The first is south and west of the Little Wedeene River to the south end of the LSA around Mount Clague (structures 128 to 180). The second is near Iron Mountain on the east and west side of the LSA. The habitat in this area is rated as nil due to regenerating clear-cuts and clearing for the Pacific Trails Pipeline. Another concentration of suitable habitat is between structures 31 and 52, which is also contiguous habitat; however, it is intertwined with nil and low value habitat due to logging in the area.

Table 6.5-13: Potential Living-Winter Habitat for Pacific Marten within the Local Study Area, Terrace to Kitimat Transmission Project, 2015

Habitat Suitability	Area (ha)	Proportion of Total LSA[1] (%)
Nil	1,852	17.6
Low	6,343	60.3
Moderate	529	5.0
High	1,796	17.1

Notes: ha = hectares; LSA = Local Study Area; % = percent.
[1]Total LSA = 10,520 ha.

A total of nine wildlife cameras were established in habitat that was subsequently modelled as low (n=1), moderate (n=3) and high (n=5) habitat suitability. One marten was camera trapped in low suitability habitat and two martens were detected in moderate suitability habitat.

6.5.2.7 Bats

Nine bat species are assumed or confirmed to occur in the Skeena region (MFLNRO, 2014) and may occur in the habitats of the LSA, including big brown bat, silver-haired bat, California myotis, long-eared myotis, Keen’s myotis, little brown myotis, northern myotis, long-legged myotis and Yuma myotis. Bat Species of Conservation Concern include little brown myotis and northern myotis, both of which are listed by *SARA* and COSEWIC as Endangered, and Keen’s myotis, which is provincially Blue-listed, and a Species at Risk under the IWMS (BC MOE, 2006). Northern myotis is also provincially Blue-listed. Threats to bats in northern areas include habitat alteration, disturbance during winter hibernation and use of pesticides. Bats are also highly susceptible to the fungal disease white-nose syndrome, a threat that is moving westward from eastern Canada and the United States. Summer maternity roosts and winter hibernation sites are critical habitat features for bats.

Bat surveys during summer of 2015 generated a total of 10,756 bat sonar calls from five acoustic detectors at 19 stations. Based on these surveys, six species (little brown myotis, California myotis, Yuma myotis, long-legged myotis, silver-haired myotis and big brown bat) and one species group (Keen’s myotis/long-eared myotis) were confirmed within the LSA. The confirmed species potentially includes two Species of Conservation Concern (**Table 6.5-14**). While the little brown myotis was confirmed, presence of Keen’s myotis is only a possibility as it cannot be separated from long-eared myotis using acoustic recordings; all identifications are therefore left at the level of this species group. Both of the listed species had been identified during wildlife issue scoping (**Table 6.3-1**).

Table 6.5-14: Federally and Provincially Listed Bat Species Potentially Confirmed in the Local Study Area, Terrace to Kitimat Transmission Project, 2015

Common Name	Federal Designation		Provincial Designation
	***SARA* Schedule 1**	**COSEWIC**	**BC CDC List**
Little brown myotis	Endangered	Endangered	Yellow
Keen’s myotis[1]	-	Data Deficient	Blue

Notes: [1]Possible presence based on acoustic detections; *SARA = Species at Risk Act*; COSEWIC = Committee on the Status of Endangered Wildlife in Canada; BC CDC = British Columbia Conservation Data Centre; BC CDC Blue-listed = species of Special Concern; BC CDC Yellow-listed = species apparently secure and not at risk.

6.5.2.7.1 Keen’s myotis

Keen’s myotis is a Blue-listed species in BC and has been designated as a species at risk under the IWMS. The main threat to the habitat of this species is cutting of mature and old forest and mineral extraction. Disturbance during hibernation and while raising young and loss of summer tree roosts due to forest clearing are major concerns. Disturbance may result from recreational activities (e.g. caving) or industrial activities (e.g. blasting for road construction) (BC CDC, 2015).

The species is sparsely distributed over a fairly wide range and may be vulnerable to large-scale logging practices (BC CDC, 2015). Without detailed morphological or mitochondrial DNA analysis, Keen’s myotis is difficult to distinguish from long-eared myotis and Northern myotis in areas where their ranges overlap.

Keen's myotis are associated with cool, wet coastal montane forests and karst features (Nagorsen and Brigham, 1993; Chatwin, 2004). Tree cavities and loose bark are important natural roost sites and may be limiting in some parts of their range (Laki and Baker, 2007). Low elevation coastal forest and riparian areas are important foraging areas (Chatwin, 2004).

6.5.2.7.1.1 Field Survey Results

The species group Keen's myotis/long-eared myotis was detected at six locations out of the 19 sampling stations within the LSA (**Appendix D.4-12**). The detections of Keen's myotis/long-eared myotis occurred in proximity to structures 2, 12, 27, 31, 34 and 77. No detections were obtained on the five acoustic detector stations south of structure 77.

6.5.2.7.1.2 Species Information from Other Studies

There are no known sites for Keen's myotis in the BC Timber Sales Skeena Business Area (Guppy, 2012). The Kitimat Naturalists Club is working with the Wildlife Conservation Society of Canada and initiating a winter bat-monitoring project near Kitimat (BC Nature, 2014) and the Northern Amphibians Naturalists Society (NANS) are involved in this bat project in the Terrace area (BC Nature, 2015). Solar bat monitoring devices were set out for the winter of 2014/2015; however, low winter light levels caused issues with data collection. The project is the first of a multiyear study. Lausen's work in Alberta and BC (Lausen and Barclay, 2006) has shown that some bats naturally awake in winter and leave their hibernacula at temperatures as low as -8°C.

During 2014, baseline bat surveys for the Rio Tinto Alcan terminal expansion Project, WorleyParsons Resources and Energy (2015) undertook mist netting and an acoustic sampling survey within an area that overlaps the southern end of the LSA. One of the bats escaped genetic testing for final identification; however, its morphological characteristics identified it as Keen's myotis (WorleyParsons Resources and Energy, 2015).

6.5.2.7.1.3 Habitat Information

Keen's/long-eared myotis were detected at six locations within the LSA (**Appendix D.4-12**). Three detections were within 50 m of optimal-rated habitat, and the other three were within 340 m of optimal-rated habitat. Five of the six detections were within wetlands, and one took place along the edge of an existing transmission line ROW northeast of structure 2. No detections were obtained south of structure 77.

During the TEM/WHR survey, it was noted that some mature and old growth forests contained trees with cavities and loose bark and this information was incorporated into the wildlife habitat ratings. A rock outcrop was located at structure 157 within an area modelled as high suitability habitat.

Habitat Suitability Modelling

Habitat suitability mapping for the Keen's myotis shows that 2,257 ha (21%) of the total LSA can be considered optimal habitat (modelling criteria are provided in **Appendix D.3-9**). While areas of optimal habitat are generally found throughout the LSA, larger areas of more or less contiguous habitat are located at the north end of the ROW from SKA substation structures 1 to 16 and between and around structures 38 to 49, south of Wedeene River between structures 117 and 123, and from structure 171 to 177 at MIN substation (**Appendix D.4-13**).

6.5.2.7.2 Little Brown Myotis

Little brown myotis has been designated as an Endangered species by *SARA* and COSEWIC. The main threat to the habitat of this species is disturbance at hibernation sites, maternal colonies, and summer roosting sites. Disturbance may result from physical colony eradication and chemical contamination (COSEWIC, 2013b).

The species is distributed over a fairly wide range of habitat types and altitudes across BC. Little brown myotis have adapted to primarily using man-made structures (i.e., buildings) as well as caves as roosting sites and wetlands and other cleared areas as foraging sites (Nagorsen and Brigham, 1993). Tree cavities and loose bark are natural roost sites used infrequently. Unlike Keen's myotis, the little brown myotis can be identified to species by its acoustic signature.

6.5.2.7.2.1 Field Survey Results

Little brown myotis were detected at eight locations within the LSA, all of which were located north of structure 77 (**Appendix D.4-12**). Three detections were in open grassy areas near the SKA substation, two of which were along an existing transmission line ROW. Three other detections were within wetland complexes, and two were located along the edges of small lakes.

6.5.2.7.2.2 Species Information from Other Studies

Lakelse Lake has been identified as an important foraging site for bats (Government of BC, 2002b). Large numbers of bats are known to forage at Lakelse Lake in summer and a maternity colony of little brown myotis is known from the area. Mist-netting at Lakelse River in summer 2014 confirmed large numbers of little brown myotis and Yuma bats (Kerby, 2014).

During 2014, baseline bat surveys for the Rio Tinto Alcan terminal expansion Project, WorleyParsons Resources and Energy (2015) undertook mist netting and an acoustic sampling survey within an area that overlaps the southern end of the LSA. The little brown myotis was one of the species detected during these surveys (WorleyParsons Resources and Energy, 2015).

6.5.2.7.2.3 Habitat Information

Wildlife habitat suitability modelling was not done for the little brown myotis as it was not selected as a VC subcomponent species for the Project effects assessment (see **Section 6.6.1**).

6.5.2.8 Amphibians

Based on the 2015 amphibian surveys and incidental observations in the LSA, a total of five amphibian species (**Appendix D.1**), including two listed species (western toad and coastal tailed frog), were confirmed. Columbia spotted frog was incidentally detected as adults (n = 27) at seven sites, two at the SKA substation and five around structure 38. Northwestern salamanders were detected as egg masses (n = 5) in early- to mid-June and as an adult (n = 1) in mid-July. The egg masses were detected between Iron Mountain and the Wedeene River (between structures 87 and 97). The adult detected was found near structure 136 between Bowbyes Lake and the Little Wedeene River. Dozens of roughskin newts were detected in a small breeding pond beside the road between structure 137 and 138 in early May.

6.5.2.8.1 Pond-breeding amphibians – Western Toad

The western toad is listed by COSEWIC and *SARA* as Special Concern and is provincially Blue-listed. This species has experienced population declines and population extirpations in the southern part of its range in BC. The toads are particularly sensitive to emerging skin disease caused by the amphibian chytrid fungus. It is relatively intolerant of urban expansion, conversion of habitat for agricultural use and habitat fragmentation resulting from resource extraction and road networks (COSEWIC, 2012d).

The western toad has three primary habitat requirements: aquatic habitat for mating, egg laying and tadpole development; aquatic and terrestrial habitat for foraging; and forest hibernacula for overwintering. Hibernating and breeding habitats are often in close proximity (BC MOE, 2014). Detailed information on the species' ecology and habitat requirements is provided in the western toad species account (**Appendix D.3-10**).

6.5.2.8.1.1 Field Survey Results

No toads were detected during systematic visual encounter surveys. A total of 37 western toad detection events occurred incidentally in the LSA during the 2015 wildlife surveys (**Appendix D.4-13**). All incidental detections occurred between the SKA substation and structure 156. Toads and juveniles were detected moving to and from breeding ponds created and modified by beavers between structures 33 and 34. Toads were detected as adults (n = 20) or subadults (n = 18) in or near breeding ponds in early May, as tadpoles (n = 1) in the middle of June and as emerging toadlets (n = 2) in early- to mid-July.

6.5.2.8.1.2 Species Information from Other Studies

The western toad is known to occur in the Kitimat Valley and there are mapped locations provided by the CDC (BC CDC, 2015). The species was detected in baseline surveys around Kitimat (Stantec, 2014) and various locations in the Kitimat Valley (Westland Resource Group Inc., 2007).

6.5.2.8.1.3 Habitat Information

Toads were detected in the following habitat types: pond, river, riparian forest, wet forest, mesic forest and dry forest within the CWHvm1 and CWHws1 BGC variants. Because just under half of the toads were detected incidentally during the nocturnal Western Screech-owl surveys, many of the detections were on or beside a road.

Habitat Suitability Mapping

Habitat suitability mapping for the western toad shows that 4,651 ha (44%) of the total LSA can be considered suitable habitat (modelling criteria are provided in **Appendix D.3-10**). While suitable habitat is generally found throughout the LSA, two larger areas of contiguous habitat are located north of Wedeene River by Iron Mountain (structures 82 to 117) and between Wedeene River and MIN substation (structures 129 to 177) (**Appendix D.4-13**).

Thirty-seven percent of the 30 detection sites of western toads overlapped with locations modelled as suitable habitat (**Appendix D.4-13**). Thirty-five percent of those detections were noted during June when toads migrate back to their breeding ponds. Western toads can perform large migrations (in northwest BC, up to 30 km from known breeding sites (COSEWIC, 2012d)) and may pass through areas that do not necessarily equate with suitable habitat.

6.5.2.8.2 Coastal Tailed Frog

The coastal tailed frog is listed by COSEWIC and *SARA* as Special Concern and is provincially Blue-listed (BC CDC, 2015). It is also listed as a Species at Risk under the IWMS (MWLAP, 2004). Population declines are primarily attributed to habitat loss/degradation resulting from forest harvesting and urbanization.

The species is a unique amphibian, specially adapted to breed in cool, clear, fast-flowing mountain streams. The coastal tailed frog frequently use grassland/shrub meadows and are obligate users of riparian forest and stream/river habitat types (BC CDC, 2015). Their specialized habitat requirements of step pool or riffle pool stream morphology, required stream gradient range and temperature and presence of old forest with significant understory limit their distribution (MWLAP, 2004). Forested riparian buffers benefit adults and larvae by regulating the stream temperatures and preventing sediment from infilling the stream bed interstitial spaces. Detailed information on the species' ecology and habitat requirements is provided in the coastal tailed frog species account (**Appendix D.3-11**).

6.5.2.8.2.1 Field Survey Results

During systematic transect surveys, coastal tailed frog tadpoles were detected on five of 12 transects (**Appendix D.4-14**), two of which had two detections for a total of seven detection sites. At the seven detection sites, 25 individual tadpoles were detected (**Table 6.5-14**). No adults were observed during the systematic surveys.

The data presented in **Table 6.5-15** indicate where coastal tailed frogs were detected and the respective site and stream characteristics. The streams for which no detections were reported may or may not have been inhabited by frogs; limited survey intensity and detectability of frogs were such that false negatives (i.e. frogs not detected but present) cannot be ruled out.

Table 6.5-15: Site and Stream Characteristics at Survey Sites of Coastal Tailed Frogs, Terrace to Kitimat Transmission Project, 2015

Transect No.	Detection UTM N / E	No. of tadpoles detected	Site Characteristics				Stream Characteristics				
			Elevation (m)	Aspect	BGC Unit	Structural Stage	Channel Gradient (%)	Wetted / Channel Width (m)	Dominant Substrate[1]	Subdominant Substrate[1]	Organic Material Cover[2]
Transects with coastal tailed frog detections											
1	522897 / 6022372	3	135	60	CWHws1	5	7	n/a	n/a	n/a	n/a
1	522874 / 6022333	3	135	60	CWHws1	5	7	n/a	Cobbles	Gravels	n/a
2	522460 / 6022430	2	152	n/a	CWHws1	5	≤1	5 / 10	Cobbles	Gravels	n/a
2	522459 / 6022426	13	152	n/a	CWHws1	5	≤1	5 / 10	Cobbles	Gravels	n/a
4	522776 / 6014881	1	192	270	CWHws1	7	4	6 / 6	Cobbles	Gravels	Abundant SWD and LWD
7	519818 / 5994517	2	67	45	CWHvm1	5	18	2 / 4	Cobbles	Gravels	Abundant LWD
12	519205 / 5991612	1	118	90	CWHvm1	7	10	3 / 5	Boulders	Cobbles	Abundant LWD, instream vascular plants, mosses and algae
Transects without coastal tailed frog detections											
3	523661 / 6014225	0	175	45	CWHws1	5	6	7 / 7	Cobbles	Gravels	Moderate instream vascular plants
5	519569 / 5993000	0	82	132	CWHvm1	5	28	0.5 / 5	Cobbles	Gravels	Abundant SWD, LWD and instream vascular plants
6	519516 / 5993977	0	78	87	CWHvm1	4	10	2 / 5	Gravels	Cobbles	Abundant SWD, LWD and instream vascular plants, mosses and algae
8	519167 / 5992533	0	129	55	CWHvm1	5	<1	7 / 10	Boulders	Cobbles	Abundant LWD
9	519091 / 5992574	0	122	167	CWHvm1	7	20	6 / 7	Boulders	Cobbles	Moderate LWD
10	519013 / 5992179	0	127	99	CWHvm1	7	29	1.5 / 2	Boulders	Cobbles	Trace LWD, mosses and algae
11	519290 / 5991688	0	106	96	CWHvm1	7	10	2 / 7	Cobbles	Boulders	Moderate LWD, instream vascular plants, mosses algae

Notes: [1]Gravels = <6.4 cm; Cobbles = 6.4 cm–25.6 cm; Boulders = >25.6 cm; [2]Abundant = cover exists over >20% of the site; Moderate = cover exists over 5%--20% of the site.
CWHws1 = Coastal Western Hemlock Wet Submaritime Submontane variant; CWHvm1 = Coastal Western Hemlock Very Wet Maritime Submontane variant; BGC = biogeoclimatic; E = east; LWD = large woody debris; m = metre; N = north; No. = number; n/a = not available; SWD = small woody debris; UTM = Universal Transverse Mercator; % = percent.

6.5.2.8.2.2 Species Information from Other Studies

Studies conducted in the 1990s found that the CWHws BGC subzone within the Kitimat drainage was among the areas with the greatest frequencies of occurrence and abundance of coastal tailed frogs in the North Coast and Kalum districts at the time (Dupuis and Steventon, 1999). Further investigations in the area concluded that despite large natural variation in population size, densities of tailed frog tadpoles decreased with increasing levels of fine sediment (<64 mm diameter), rubble, detritus and wood and increased with bank width. Tadpole densities were also lower in logged streams compared with buffered and old growth creeks (Dupuis and Steventon, 1999).

Rare element occurrence reports show that the closest detections of coastal tailed frogs to the LSA were along the mid-reaches of Bowbyes Creek and an unnamed tributary creek near the Little Wedeene River (**Appendix D.4-14**) (BC CDC, 2014).

Coastal tailed frogs were detected in baseline surveys conducted for the Pacific Trails Pipeline Project (Westland Resource Group Inc., 2007), LNG Canada Export Terminal Project (Stantec, 2014) and the Rio Tinto Alcan expansion (WorleyParsons Resources and Energy, 2015), although their study areas do not overlap with the LSA.

6.5.2.8.2.3 Habitat Information

There are no current or proposed WHAs within the Project LSA; the closest current approved and proposed WHAs are 3.3 km and 3.5 km to the west, respectively.

Coastal tailed frogs were detected in the following habitat types: wet forest, riparian forest and mature forest within the CWHvm1 and CWHws1 BGC variants. Detections ranged in elevation from 65 m to 195 m.

Habitat Suitability Mapping

Habitat suitability mapping for the coastal tailed frog shows that only four out of 45 watercourse crossings within the LSA (8.9%) can currently be considered optimal habitat (**Appendix D.4-14;** modelling criteria are provided in **Appendix D.3-11**). This result is in part, influenced by the model criterion for optimal suitability of a 100 m area of mature or old forest adjacent to suitable streams and the general scarcity of such forest stands in the Kitimat Valley. Additionally, it is thought that only the CWHws, and not the CWHvm BGC subzone, provides optimal habitat for the species (Dupuis and Friele, 2003), which excludes approximately the southern third of the LSA as optimal habitat (**Figure 2.6-1**). Based on the TEM habitat model of this assessment, the LSA of the provisional transmission corridor crosses through only four small and isolated suitable habitat patches and one larger almost contiguous area between structures 78 and 86 (**Appendix D.4-14**).

The 2015 field survey detections did not overlap with any of the areas modelled as optimal habitat (**Appendix D.4-14**). The likely reason for this inconsistency is there appears to be a difference between the range of site-specific conditions to which the frogs may be tolerant and the relatively high-level landscape and stream criteria used for the habitat model. Evidence from this study of the tailed frogs' wider distribution within the Kitimat Valley and specific streams beyond what is thought to be optimal habitats (**Appendix D.3-11** and references therein) includes occurrence in the CWHvm1 BGC variant, streams with adjacent forest of structural stage 5, stream sections with gradient <1% and streams up to 10 m in width (**Table 6.5-15**). Dupuis and Steventon (1999) reported that tadpole densities vary greatly under natural conditions and decrease with increasing amounts of instream sediments and organic materials. Qualitatively, this study did not show a clear trend in substrate and organic material cover between streams where coastal tailed frogs were detected and were not detected (**Table 6.5-15**). In conclusion, potential coastal tailed frog distribution within the LSA may include most perennial streams up to 10 m in channel width that intersect with the LSA.

6.6 Wildlife Effects Assessment

6.6.1 Valued Components Selection

The proposed Project is anticipated to affect wildlife and wildlife habitat, both directly and indirectly. Through issues scoping and evaluation of candidate VCs, a final list of VCs was selected for the assessment of potential Project effects.

A total of 39 separate wildlife, habitat and ecological issues were identified, including designated species at risk; Species of Conservation Concern (AMEC, 2014); species important to First Nations, the public, and local stakeholders; and important ecological relationships (**Table 6.3-1**). Only wildlife species with a reasonably high probability of occurring in the LSA and interacting with the Project's works and activities were considered as candidate VCs. For example, listed landbird species detected in the LSA during field surveys (**Table 6.5-4**) included Band-tailed Pigeon, Barn Swallow, Black Swift and Short-billed Dowitcher, all species either not expected to be affected by the Project due to low number of detections (six Band-tailed Pigeons and one Short-billed Dowitcher) or site-specific habitat requirements (e.g. human-made structure and cliff habitat) with no or negligible anticipated Project interactions.

Based on the results of issues scoping and subsequent evaluation, nine candidate wildlife VCs and 17 subcomponent species were identified and further evaluated for consideration in the Project's effects assessment. Any species, wildlife group or significant habitat for supporting wildlife life requisites known to occur in the study area was considered if there was a reasonable likelihood that it would be affected by or have an influence on the Project.

The results of the baseline field studies (**Section 6.5.2**) were used, in part, to accept or reject candidate VCs or subcomponents for the detailed assessment of potential Project effects (**Table 6.6-1**). Some VCs were selected or rejected because they can function as umbrella species (individual species with habitat requirements that overlap with a number of other species) or can be covered by selected umbrella species, respectively. This process resulted in a total of eight wildlife VCs and 12 subcomponents that were selected as focus for the effects assessment (**Table 6.6-1**).

Table 6.6-1: Summary of Selected Valued Components and Subcomponents for Wildlife Effects Assessment

Candidate Valued Component	Candidate Subcomponent	Rationale for Consideration	Subcomponent Selected for Effects Assessment	Rationale for Inclusion or Exclusion
Landbirds	Olive-sided Flycatcher	Olive-sided Flycatcher is listed on *SARA* Schedule 1 as Threatened and is on the BC Blue list. It has been confirmed in the LSA.	Yes	• Additional sightings during field surveys • Functions as umbrella species for other species requiring old/mature conifer forest edge habitat
	Sooty Grouse	Sooty Grouse used to be on the BC Blue list. It has been confirmed in the LSA.	No	• Species' provincial status changed to Yellow (apparently secure and not at risk of extinction) • Species very common throughout LSA; 46% of survey stations had detections • Species' habitat requirements covered by other species (e.g. Olive-sided Flycatcher, Northern Goshawk) used for effects assessment
	Common Nighthawk	Common Nighthawk is listed on *SARA* Schedule 1 as Threatened. It has been confirmed in the LSA.	No	• Species rare in LSA; three of 19 survey stations (16%) had detections • Species' habitat requirements covered by other species (e.g. Olive-sided Flycatcher, Rusty Blackbird) used for effects assessment
	Rusty Blackbird	Rusty Blackbird is listed on *SARA* Schedule 1 as Special Concern and is on the BC Blue list. It has been confirmed in the LSA.	Yes	• Additional sightings in LSA during field surveys • Functions as umbrella species for other species requiring old/mature conifer forest habitat adjacent to wetlands
Waterbirds	Marbled Murrelet	Marbled Murrelet is listed on *SARA* Schedule 1 as Threatened and as a species at risk under the IWMS and is on the BC Blue list. It has been confirmed in the LSA.	Yes	• A total of 436 Marbled Murrelets detections were recorded during field surveys
	Trumpeter Swan	Trumpeter Swans overwinter and nest on Lakelse Lake and are known to use the Lakelse River corridor as flyways. The species is an objective under the Kalum LRMP and is important to local stakeholders.	Yes	• Species important to local stakeholders and specific objective of Kalum LRMP
Raptors	Northern Goshawk, *laingi* subspecies	The *laingi* subspecies of Northern Goshawk is listed on *SARA* Schedule 1 as Threatened, as a species at risk under the IWMS, and on the BC Red List. It has been confirmed in the LSA.	Yes	• Functions as umbrella species for other species requiring relatively large contiguous patches of old/mature conifer forests that provide forest interior habitat conditions

Candidate Valued Component	Candidate Subcomponent	Rationale for Consideration	Subcomponent Selected for Effects Assessment	Rationale for Inclusion or Exclusion
	Western Screech-owl, *kennicottii* subspecies	The *kennicottii* subspecies of Western Screech-owl is listed on *SARA* Schedule 1 as Special Concern and is on the BC Blue list. It has been confirmed in the LSA.	No	• Species only detected once incidentally during surveys and no detections during systematic surveys • Species' habitat requirements covered by other species (e.g. Northern Goshawk) used for effects assessment
Bears	Kermode American black bear	Kermode bear is a rare subspecies of American black bear with high cultural and spiritual value. It is the provincial mammal and potentially occurs in the LSA.	Yes	• Sensitive to destruction or disturbance of their denning habitat
	Grizzly bear	Grizzly bear is listed by COSEWIC as Special Concern and as a species at risk under the IWMS, and is on the BC Blue list. It is a species of concern to local First Nations and a management objective under the Kalum LRMP. It has been confirmed in the LSA.	Yes	• Additional sightings during field surveys • Sensitive to destruction or disturbance of their denning habitat
Ungulates	Moose	Moose is a species of management concern to local First Nations and a management objective under the Kalum LRMP. It has been confirmed in the LSA.	Yes	• Numerous sightings of individuals and/or their sign (i.e. scats and tracks) during field surveys
Furbearers	Pacific marten	Pacific marten is one of the most valuable furbearer species for local trappers. The species is a management objective under the Kalum LRMP. It has been confirmed in the LSA.	Yes	• Additional sightings during field surveys
Bats	Keen's myotis	Keen's myotis is on the BC Blue list and listed as a species at risk under the IWMS. Of all the potential bat species of the region, Keen's myotis is the species most affected by clearing of old coastal forest. It may occur in the LSA.	Yes	• Previous studies detected the species in the Kitimat Valley • Based on 2015 field sampling, the species possibly occurs in the LSA.
	Little brown myotis	Little brown myotis is listed on *SARA* Schedule 1 and by COSEWIC as Endangered. It has been confirmed in the LSA.	No	• *SARA* and COSEWIC listing due to white nose syndrome in Eastern Canada, which does not currently occur in BC • Listed in BC as Yellow (apparently secure and not at risk of extinction) • Appears to be common in the Kitimat Valley • Species' foraging habitat requirements covered by other species (e.g. Rusty Blackbird) used for effects assessment

Candidate Valued Component	Candidate Subcomponent	Rationale for Consideration	Subcomponent Selected for Effects Assessment	Rationale for Inclusion or Exclusion
				• Species' roosting requirements largely restricted to man-made structures and caves which have no or negligible Project interactions
Amphibians	Western toad	Western toad is listed on *SARA* Schedule 1 as Special Concern and is on the BC Blue list. It has been confirmed in the LSA.	Yes	• Additional sightings during field surveys
	Coastal tailed frog	Coastal tailed frog is listed on *SARA* Schedule 1 as Special Concern, as a species at risk under the IWMS, and on the BC Blue list. It has been confirmed in the LSA.	Yes	• Additional sightings during field surveys
Reptiles	Common Garter snake	Common gartersnake is a species of concern to local stakeholders (i.e. LRMP Committee). Of particular concern is the integrity of hibernacula, which are often used by large numbers of snakes. The species potentially occurs in the LSA.	No	• Not a Species of Conservation Concern • Only one dead specimen found incidentally during field survey • Potential effects on hibernacula will be mitigated through standard CEMP provisions and use of BMPs
	Terrestrial Garter snake	Terrestrial gartersnake is a species of concern to local stakeholders (i.e. LRMP Committee). Of particular concern is the integrity of hibernacula, which are often used by large numbers of snakes. The species potentially occurs in the LSA.	No	• Not a Species of Conservation Concern • None found during field survey • Potential effects on hibernacula will be mitigated through standard CEMP provisions and use of BMPs

Notes: BMP= best management practice; COSEWIC = Committee on the Status of Endangered Wildlife in Canada; EMP = Environmental Management Plan; IWMS = Identified Wildlife Management Strategy; LRMP = Land and Resource Management Plan; LSA = Local Study Area; MBCA = *Migratory Bird Convention Act*; *SARA = Species at Risk Act*.

6.6.2 Potential Effects and Proposed Mitigation

This section describes the nature and extent of the Project's potential effects on wildlife VCs. The general approach and methodology to the effects assessment is described in **Section 3.3**; the Project components and activities that potentially interact with wildlife VCs are listed in **Table 3.3-1**. Potential effects are evaluated before mitigation with the exception of the mitigation measures that have already been implemented and/or incorporated into Project design. For example, access requirements will use existing roads wherever possible and the initial crossing location of the Lakelse River has been relocated to for the most part avoid old growth forest habitat. Furthermore, Project engineers have taken environmentally sensitive features into account during the initial design of the provisional transmission line route and structures to avoid OGMAs and wetland habitat wherever practicable.

The mechanisms of potential Project effects and results of those effects are VC- and site-specific and differ in magnitude among Project phases. During all Project phases, the general types of Project effects on wildlife, described in detail in the following sections, are (1) alteration of habitat, (2) direct and/or indirect mortality, (3) sensory disturbance and (4) alteration of movement pattern.

Two types of mitigation measures to avoid or minimize potential adverse Project effects are included in the effects assessment: (1) general mitigation measures that apply to all or many VCs, potential effects and/or Project phases (WM1-WM9 in **Table 6.6-2**) and (2) VC-specific mitigation measures (**Sections 6.6.2.2.1** to **0**), numbered WM10 to WM35, that address threats to special life history or habitat requirements or specific locations along the provisional ROW and access roads. General mitigation measures include preparation of specific plans and protocols and implementation of provincial BMPs, specifically:

- Ministry of Environment program Develop With Care (BC MOE, 2015);
- Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area, British Columbia (BC MFLNRO, 2014a); and
- BC Hydro management plans and approved work practices, including:
    - Integrated Vegetation Management Plan for Control of Vegetation within Transmission Rights-of-way (BC Hydro, 2016); and
    - Approved Work Practices for Managing Riparian Vegetation: A Guide to Incorporating Riparian Environmental Concerns into the Management of Vegetation in BC Hydro's Transmission and Distribution Corridors (BC Hydro-BCTC, 2003).

Table 6.6-2: Description of General Mitigation Measures for Potential Project Effects on Wildlife

Mitigation Number	Mitigation Description
WM1	Where feasible, implement site-specific mitigation measures during all Project phases to reduce habitat disruptions associated with vegetation clearing. Site-specific opportunities during construction will be determined during development and implementation of the Project's CEMP. During operations/maintenance, use the guidance for wildlife and wildlife habitat as per BC Hydro's integrated vegetation management plan (BC Hydro, 2016).
WM2	Subject to safety and constructability requirements, minimize footprint on moderate, high suitability, or optimal habitats and reduce the risk of accidental encroachment on such habitats by clearly marking retention areas.
WM3	Develop species-specific wildlife management plans that includes mitigation for species at risk with methodologies for avoiding or mitigating effects on wildlife and for monitoring procedures, where applicable. These will be contained within an At-Risk Bird Management Plan and Pre-Clearing Nest Search Protocol, Bird Collision Mitigation Plan, Myotis Management Plan and an Amphibian Management Plan.
WM4	To the extent feasible, implement applicable procedures and mitigations from the Wildlife Guidelines for Industrial Development Projects in the North Area, British Columbia (BC MFLNRO, 2014a) and provincial BMPs (Develop with Care (BC MOE, 2015))
WM5	As part of the Project's Restoration and Closure Plan (see mitigation measure VM7 in Section 5.7.1), include measures for the conservation of wildlife habitat features (e.g. wildlife tree/ log creation) to facilitate wildlife-specific habitat restoration. Where appropriate during construction, target the revegetation of disturbed areas with mitigation measures in the CEMP or EPPs that conserve native plant materials and, seed, plant or utilize species similar to those identified during the TEM and WHR survey, where available.
WM6A	For Project-related construction activities, avoid vegetation clearing and site preparation activities during the migratory bird-breeding season; if this is not feasible, pre-clearing nest surveys will be conducted under the direction of a qualified professional and following a Pre-clearing Nesting Survey Protocol. The At-Risk Bird Management plan and pre-clearing nest survey protocol will cover species-specific mitigation measures for bird species at risk, including but not limited to SARA-listed bird species known to occur in the project area (e.g. Northern Goshawk, Common Nighthawk and Western Screech Owl). For each relevant species, the At-Risk Bird Management Plan and pre-clearing nest survey protocol will include identification of suitable habitats where pre-clearing nesting surveys should be conducted, and any other appropriate mitigation measures.
WM6B	For operations/maintenance activities, avoid vegetation clearing during the migratory bird-breeding season; if this is not feasible, pre-clearing nesting surveys will be conducted following an established protocol with additional mitigation measures as required for at-risk bird species.
WM7	Following guidance in the pre-clearing nesting survey protocol a QEP will establish species-specific buffer zones and setbacks for nesting migratory bird species, with specific provisions for species at risk and no activity zones, as appropriate.
WM8	Develop a bird collision mitigation plan to identify sections of the transmission line with high bird collision risk, including provisions for installation of line markers and bird flight diverters on high-risk sections, where feasible.
WM9A	For the construction phase, prepare and implement an access management plan detailing road closures, seasonal restrictions, allowed vehicle use, schedules/protocols for temporary road deactivations, speed restrictions and other measures to reduce effects on wildlife. On radio-controlled roads, require contractors and construction personnel to report the location of medium- and large-sized mammals to other drivers.

Mitigation Number	Mitigation Description
WM9B	For the operations/maintenance phase, work with MFLNRO as appropriate to observe or implement access management measures that MFLNRO deems necessary in its role managing public access to roads on Crown lands, in order to minimize effects on wildlife.

Notes: BC MOE = British Columbia Ministry of Environment; BC MFLNRO = British Columbia Ministry of Forests, Lands and Natural Resource Operations; BMP = Best Management Practice; CEMP = Construction Environmental Management Plan; LSA = Local Study Area; OGMA = Old Growth Management Area; TEM = Terrestrial Ecosystem Mapping; VC = Valued Component; WHR = Wildlife Habitat Rating.

6.6.2.1 Potential Project Effects on Wildlife

6.6.2.1.1 Alteration of Habitat

Project Footprint – Alteration of habitat involves loss or disruption of habitat. Either one is expected to occur through vegetation clearing and soil disturbance within the proposed ROW and associated infrastructure components (i.e. access roads, laydown areas, crane and helicopter pads, waste deposit areas and work crew facilities). In addition to the areas where vegetation cover is disturbed, there will be effects on habitat related to wildlife/danger tree removal within prescribed zones adjacent to Project components and work areas.

Local Study Area – At this larger spatial scale, habitat of VC species that require large-sized, contiguous habitat patches with forest interior conditions (e.g. Northern Goshawk) or are sensitive to unnatural edge effects (e.g. Marbled Murrelet) may also be lost or degraded.

Most habitat alteration will occur as a result of forest clearing during site preparation for ROW and access road construction. Continued vegetation management activities will maintain the early seral conditions until Project closure. Following decommissioning of the transmission line and access roads, natural forest succession will resume.

Thresholds for habitat alteration after which species significantly decline or become extirpated have generally not been well established (Dykstra, 2004). However, evidence suggests that, below certain thresholds of habitat cover, species may decline more rapidly than would be expected from the rate of habitat loss alone (Andrén, 1994). When remaining functional habitat is greater than 10%–30% in a region, species are still affected by habitat loss (Andrén, 1994; Fahrig, 1997; Swift and Hannon, 2010) but are not necessarily at risk of regional extirpation. Higher thresholds have been reported for woodland amphibians (Gibbs, 1998) and pond-breeding amphibians (Homan et al., 2004), which may reflect sensitivity to fragmentation after only moderate habitat loss. Depending on taxa and landscape, residual habitat thresholds ranging from 10% to as high as 60% may be required to avoid rapid population declines (Bennett and Ford, 1997; Villard et al., 1999; Swift and Hannon, 2010). However, most threshold evidence supports a minimum 30% residual habitat threshold at a landscape level to avoid rapid declines that may lead to regional extirpation (Swift and Hannon, 2010). For this assessment, precautionary thresholds have been identified for species for which specific thresholds do not exist. A precautionary approach for Species of Conservation Concern is 20% habitat loss within the Project LSA.

6.6.2.1.2 Direct and/or Indirect Mortality

Direct Mortality – Relatively small species with little or slow mobility (e.g. western toad) may experience direct mortality related to clearing/construction equipment. All mammals, amphibians and low-flying birds may experience direct mortality from wildlife-vehicle collisions related to clearing/construction-related road traffic. Avian mortality may also occur during operation/maintenance as a result of collisions with the Project's transmission line cables and towers, as well as electrocution risks.

Indirect Mortality – Species with relatively small territories or home ranges that require vegetation cover (e.g. amphibians) but overlap largely or entirely with the newly cleared ROW and/or access roads may experience mortality due to lack of food or thermal and/or security cover. In general, wildlife may experience indirect mortality from increased human access and associated hunting, trapping, poaching, recreational activities or general human presence that affect species-specific life requisites such as predator avoidance behaviour. Prey species may experience increased mortality due to the ROW and roads facilitating predator travel and hunting efficiency (Leblond et al., 2013).

6.6.2.1.3 Sensory Disturbance

Sensory disturbance to wildlife could occur from a variety of disturbance sources (e.g. noise, visual (Clinton and Barber, 2013; Taylor and Knight, 2003)). Potential sources of disturbance during the clearing/construction phase include noise and vibration from ground traffic, helicopters and construction equipment; general human activity; and odours of foods and food wastes from construction crews. Depending on the type and intensity of sensory disturbance, potential effects may spread throughout the entire wildlife LSAs and disturb wildlife breeding or other life requisites far from the Project footprint.

Sensory disturbance effects can include disruption of breeding activities, displacement from foraging or hunting areas, distractions of predators during hunting or, conversely, distraction of prey from anti-predator vigilance behavior. Similar to the anticipated frequency of wildlife mortality effects, the severity of sensory disturbance during the different Project phases from highest to lowest is expected to be clearing/construction, closure, operation/maintenance, and post closure.

6.6.2.1.4 Alteration of Movement Patterns

Major linear developments such as roads, railroads, transmission lines and pipelines can interfere with the movement and migration patterns of large mammals (e.g. bears, ungulates and large furbearers) (Jalkotzy et al., 1997). This effect is caused by large-scale habitat fragmentation and sensory disturbance generated from road traffic and other human activities.

6.6.2.2 Project Effects on Valued Subcomponent Species and Mitigation

The following subsections describe the anticipated Project effects on species selected to represent the wildlife VCs for the effects assessment. The four types of Project effects described in **Section 6.6.2.1** may or may not all apply to each species and Project phase (**Table 6.6-3**). If potential effects are anticipated, mitigation measures are provided. The mitigation measures are selected to conform to the effect mitigation hierarchy of the BC Environmental Mitigation Policy

(BC MOE, 2014), which is, in order of priority: avoid, minimize, restore on-site and offset. If Project effects on wildlife VCs are anticipated to be adverse effects that remain after implementation of mitigation measures (i.e. anticipated effectiveness of mitigation is not high), they will be carried forward as residual effects and characterized in accordance with the methodology outlined in section 3 (**Section 6.6.4**).

Table 6.6-3: Summary of Potential Project Effects by Phase on Valued Component Wildlife Species, Terrace to Kitimat Transmission Project

Valued Component	Landbirds		Waterbirds		Raptors	Bears		Ungulates	Furbearers	Bats	Amphibians	
Subcomponent / Potential Project Effect	**Olive-sided Flycatcher**	**Rusty Blackbird**	**Marbled Murrelet**	**Trumpeter Swan**	**Northern Goshawk**	**Grizzly bear**	**Kermode bear**	**Moose**	**Pacific marten**	**Keen's myotis**	**Western toad**	**Coastal tailed frog**
Clearing / Construction Phase												
Alteration of Habitat	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Direct and/or Indirect Mortality	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sensory Disturbance	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Alteration of Movement Patterns	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Operation / Maintenance Phase												
Alteration of Habitat	No	No	No	No	No	Yes	Yes	Yes	No	No	Yes	No
Direct and/or Indirect Mortality	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Sensory Disturbance	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	No	No
Alteration of Movement Patterns	No	No	No	No	No	Yes	Yes	Yes	Yes	No	No	Yes
Closure Phase												
Alteration of Habitat	No	No	No	No	No	Yes	Yes	Yes	No	No	Yes	No
Direct and/or Indirect Mortality	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes
Sensory Disturbance	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	No	No
Alteration of Movement Patterns	No	No	No	No	No	Yes	Yes	Yes	No	No	No	No
Post Closure Phase												
Alteration of Habitat	No	No	No	No	No	No	No	No	No	No	No	No
Direct and/or Indirect Mortality	No	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No
Sensory Disturbance	No	No	No	No	No	No	No	No	No	No	No	No
Alteration of Movement Patterns	No	No	No	No	No	No	No	No	No	No	No	No

6.6.2.2.1 Landbirds (breeding) – Olive-sided Flycatcher

6.6.2.2.1.1 Alteration of Habitat

Optimal habitat for Olive-sided Flycatcher and overlap with the provisional transmission line route are shown in **Appendix D.4-1**. The calculated values of anticipated habitat alteration (**Table 6.6-4**) indicate that approximately 103 ha (7.7%) of optimal habitat within the LSA will be affected by the clearing/construction of the ROW and new access roads. Since, based on data from Alaska, average territory size for this species may range from 10 ha to 26 ha (**Appendix D.3-1**) and assuming all optimal habitat is included in individual territories, the potential loss of 108 ha of suitable habitat is predicted to affect 4–10 Olive-sided Flycatcher territories. Due to vegetation management on ROW and access roads, it is not anticipated that optimal habitat will be restored during the operation/maintenance Project phase.

Table 6.6-4: Potential Suitable Olive-sided Flycatcher Habitat Affected during the Growing Season within the Local Study Area

Project Component	Amount (ha) / Proportion[1] (%) of Optimal Habitat Affected Within the LSA
Transmission line ROW	102 / 7.7
New Access Roads – Permanent	1 / 10.1
New Access Roads – Temporary	<1 / <0.1
Total	**103 / 7.7**

Notes: ha = hectare; LSA = Local Study Area; ROW = right-of-way; % = percent.
[1]Total in LSA = 1,336 ha.

6.6.2.2.1.2 Direct and/or Indirect Mortality

Direct mortality may be experienced by eggs or nestlings if forest clearing is conducted during the Olive-sided Flycatcher breeding season and nests are not discovered prior to tree felling during clearing/construction. Direct mortality may also be caused by inadvertent nest destruction during tree felling or trimming at the edge of the ROW and access roads during ROW maintenance and by bird collisions with the transmission line. Indirect mortality may be experienced by nesting adults, eggs or nestlings through increased predation at the artificial forest edge adjacent to the cleared ROW and access roads.

6.6.2.2.1.3 Sensory Disturbance

Insufficient information is available in the literature to define the magnitude, frequency and duration of sensory disturbance that would result in Olive-sided Flycatchers experiencing reduced nesting success or abandonment of active nests. Other comparable passerine species, however, show a medium ‘alert distance’ or ‘static’ disturbance distance of 75 m and a ‘flight initiation distance’ or ‘active’ disturbance distance of 5 m during incubation and 30 m during chick-rearing (Ruddock and Whitfield, 2007). These disturbance distances may also be conservatively assumed to apply to Olive-sided Flycatchers.

6.6.2.2.1.4 Specific Mitigation Measures

WM10: If clearing/construction activities fall within the Olive-sided Flycatcher nesting period (March 25 – August 31), conduct surveys and nest searches in optimal habitat patches that intersect or are adjacent (≤100 m) to the ROW and new access roads near the following structure locations: 2–3, 9–12, 14–16, 31–39, 41–45, 76–80, 84–99, 101–117, 128–129, and 168–170 (**Appendix D.4-1**). The structure numbers identified are preliminary; final identification will be completed by a QEP once clearing limits have been finalized. Follow pre-clearing nest survey protocol (W**M6A/B**). If active nests are located, establish appropriate buffers (50 to 300 m) as determined by a QEP or delay work activities until the observed nesting activity has completed (WM7). The At-risk Bird Management plan and pre-clearing nest survey will incorporate species-specific provisions for Olive-sided Flycatcher.

Based on the effects assessment summarized in **Table 6.6-5**, mitigation measures to avoid or minimize habitat alterations during clearing/construction and direct mortality to Olive-sided Flycatchers from potentially colliding with the transmission line during the operation/maintenance phase are not anticipated to be highly effective. These two potential effects are therefore considered adverse residual effects (**Section 6.6.3**).

Table 6.6-5: Summary of Potential Effects, Mitigation Measures and Anticipated Effectiveness of Mitigation for Olive-sided Flycatcher

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
Clearing / Construction	Alteration of Habitat	• Avoid removal of forest cover to the extent practicable (**WM1**) • Minimize clearing/construction footprint (**WM2**) • Implement Wildlife Management Plans and BMPs (**WM3, WM4)**	WM1, WM2, WM3, WM4 = Low	Yes
	Direct and/or Indirect Mortality	• Avoid nesting season (**WM6A**) • Conduct pre-clearing surveys (**WM10**) • Establish setback buffers at active nest sites (**WM7, WM10**) • Implement Wildlife Management Plans and BMPs (**WM3, WM4)**	WM3, WM4, WM6A/B, WM7, WM10 = High	No
	Sensory Disturbance	• Avoid nesting season (**WM6A**) • Conduct pre-clearing surveys (**WM10**) • Establish setback buffers at active nest sites (**WM7, WM10**) • Implement Wildlife Management Plans and MBPs **(WM3, WM4)**	WM3, WM4, WM6A, WM7, WM10 = High	No
Operation / Maintenance	Direct and/or Indirect Mortality	• Install line markers and bird flight diverters (**WM8**) • Avoid nesting season (**WM6B**) • Conduct pre-clearing surveys (**WM10**) • Establish setback buffers at active nest sites (**WM7, WM10**) • Implement Wildlife Management Plans and BMPs (**WM3, WM4)**	WM3, WM4, WM6B, WM7, WM10 = High WM8 = Moderate	Yes

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
	Sensory Disturbance	• Avoid nesting season (**WM6B**) • Conduct pre-clearing surveys (**WM10**) • Establish setback buffers at active nest sites (**WM7, WM10**) • Implement Wildlife Management Plans and BMPs (**WM3, WM4)**	WM3, WM4, WM6B, WM7, WM10 = High	No
Closure and Post-closure	Direct and/or Indirect Mortality	• Avoid nesting season (**WM6A/B**) • Conduct pre-clearing surveys (**WM10**) • Establish setback buffers at active nest sites (**WM7, WM10**) • Implement Wildlife Management Plans and BMPs (**WM3, M4)**	WM3, WM4, WM6A/B, WM7, WM10 = High	No
	Sensory Disturbance	• Avoid nesting season (**WM6A/B**) • Conduct pre-clearing surveys (**WM10**) • Establish setback buffers at active nest sites (**WM7, WM10**) • Implement Wildlife Management Plans and BMPs (**WM3, WM4)**	WM3, WM4, WM6A/B, WM7, WM10 = High	No

Note: BMP = best management practice.

6.6.2.2.2 Landbirds (breeding) - Rusty Blackbird

6.6.2.2.2.1 Alteration of Habitat

Optimal habitat for Rusty Blackbird and overlap with the provisional transmission line route are shown in **Appendix D.4-2**. The calculated values of anticipated habitat alteration (**Table 6.6-6**) indicate that approximately 136 ha (7.2%) of optimal habitat will be affected by the clearing/construction of the ROW and new access roads. This habitat occurs around streams and wetlands that intersect with the ROW and roads approximately 46 times. It is difficult to estimate the effect this level of habitat loss may have on the population, especially because Rusty Blackbirds can also nest colonially. Due to vegetation management on ROW and access roads, it is not anticipated that optimal habitat will be restored during the operation/maintenance Project phase.

Table 6.6-6: Potential Suitable Rusty Blackbird Habitat Affected during the Growing Season within the Local Study Area

Project Component	Amount (ha) / Proportion[1] (%) of Optimal Habitat Affected Within the LSA
Transmission line ROW	134 / 7.0
New Access Roads – Permanent	3 / 0.1
New Access Roads – Temporary	<1 / <0.1
Total	**136 / 7.2**

Notes: ha = hectare; LSA = Local Study Area; ROW = right-of-way; % = percent.
[1]Total in LSA = 1,898 ha.

6.6.2.2.2.2 Direct and/or Indirect Mortality

During clearing/construction, direct mortality may be experienced by eggs or nestlings if forest clearing is conducted during the Rusty Blackbird breeding season and nests are not discovered prior to tree felling, vegetation clearing, or ground works. Direct mortality may also be caused by inadvertent nest destruction during tree felling or trimming at the edge of the ROW and access roads during ROW maintenance work, and bird collisions with the transmission line.

For wetlands and streams that intersect with the roads and ROW, the riparian setback of 15 m may not be adequate for retaining hydrological and other wetland functions associated with this species' habitat needs. Potentially reduced habitat suitability resulting in increased demand on blackbirds to fly around their territories and closer proximity of roads to nest sites may result in higher Rusty Blackbird mortality due to vehicle collisions. Indirect mortality may be experienced by nesting adults, eggs, or nestlings through reduced foraging success, reduced thermal/security cover and increased predation at the artificial forest edge adjacent to the cleared ROW and roads.

Riparian buffers as wide as 75 m are conservatively recommended to discourage Rusty Blackbirds from nesting in or near artificially created openings such as regenerating clear-cuts where the birds are susceptible to higher predation, and to reduce the edge effects of predation (Powell et al., 2010). Within the ROW, BC Hydro will remove all trees and establish 15 m RVMAs around classified wetlands and streams. It is therefore anticipated that without riparian buffer of forest around wetlands and streams, Rusty Blackbirds will either avoid those habitats or potentially experience higher than normal mortality.

6.6.2.2.2.3 Sensory Disturbance

Limited information is available in the literature regarding the magnitude, frequency and duration of sensory disturbance that would result in Rusty Blackbirds experiencing reduced nesting success or abandonment of active nests. Since studies have shown that buffers of 75 m help protect Rusty Blackbird nesting habitat (Powell, 2010), it is assumed that this buffer would also act as an appropriate sensory buffer.

6.6.2.2.2.4 Specific Mitigation Measures

WM11: If clearing/construction activities fall within the Rusty Blackbird nesting period (May 10 to July 20), conduct surveys and nest searches for Rusty Blackbird around suitable wetlands that intersect or are adjacent (≤100 m) to the ROW and new access roads near the following structure locations: 2–4, 7–10, 21–22, 24–25, 32–42, 45–47, 49–50, 55–56, 58–62, 66–68, 71–72, 73–75, 76–79, 80–82, 83–85, 88–90, 92–93, 96–97, 100–101, 105–113, 116–118, 120–128, 129, 132–142, 147–148, 149–151, 155–159, 160–175, 173–175, and 180 (**Appendix D.4-2**). The structure numbers identified are preliminary; final identification will be completed by a QEP once clearing limits have been finalized and considered in development of the CEMP. Follow pre-clearing nest survey protocol (**WM6A/B**). If active nests are located, establish appropriate buffers (100 to 350 m) as determined by a QEP or delay work activities until the observed nesting activity has completed (WM7). The At-risk Bird Management plan and pre-clearing nest survey will incorporate species-specific provisions for Rusty Blackbird.

Table 6.6-7: Summary of Potential Effects, Mitigation Measures and Anticipated Mitigation Success for Rusty Blackbird

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
Clearing / Construction	Alteration of Habitat	• Avoid removal of forest cover near wetlands to the extent practicable (**WM1**) • Minimize clearing/construction footprint (**WM2**) • Implement Wildlife Management Plans and BMPs (**WM3, WM4)**	WM1, WM2, WM3, WM4 = Low	Yes
	Direct and/or Indirect Mortality	• Avoid nesting season whenever practicable (**WM6A**) • Conduct pre-clearing surveys (**WM11**) • Establish setback buffers at active nest sites (**WM7**) • Implement Wildlife Management Plans and BMPs (**WM3, WM4)**	WM3, WM4, WM6A, WM7, WM11= High	No
	Sensory Disturbance	• Avoid nesting season whenever practicable (**WM6A**) • Conduct pre-clearing surveys (**WM11**) • Establish setback buffers at active nest sites (**WM7**) • Implement Wildlife Management Plans and BMPs (**WM3, WM4)**	WM3, WM4, WM6A, WM7, WM11 = High	No
Operation / Maintenance	Direct and/or Indirect Mortality	• Install line makers and bird flight diverters (**WM8**) • Avoid nesting season whenever practicable (**WM6B**) • Conduct pre-clearing surveys (**WM11**) • Establish setback buffers at active nest sites (**WM7**) • Implement Wildlife Management Plans and BMPs (**WM3, WM4)**	WM3, WM4, WM6B, WM11 = High WM8 = Moderate WM7 = Low	Yes
	Sensory Disturbance	• Avoid nesting season whenever practicable (**WM6B**) • Conduct pre-clearing surveys (**WM11**) • Establish setback buffers at active nest sites (**WM7**) • Implement Wildlife Management Plans and BMPs (**WM3, WM4)**	WM3, WM4, WM6B, WM7, WM11 = High	No
Closure and Post-closure	Direct and/or Indirect Mortality	• Avoid nesting season whenever practicable (**WM6A/B**) • Conduct pre-clearing surveys (**WM11**) • Establish setback buffers at active nest sites (**WM7**) • Implement Wildlife Management Plans and BMPs (**WM3, WM4)**	WM3, WM4, WM6A/B, WM7, WM11 = High	No
	Sensory Disturbance	• Avoid nesting season whenever practicable (**WM6A/B**) • Conduct pre-clearing surveys (**WM11**) • Establish setback buffers at active nest sites (**WM7**) • Implement Wildlife Management Plans and BMPs (**WM3, WM4)**	WM3, WM4, WM6A/B, WM7, WM11 = High	No

Note: BMP = best management practice.

Based on the effects assessment summarized in **Table 6.6-7**, mitigation measures to avoid or minimize habitat loss for Rusty Blackbirds during the clearing/construction phase and direct and/or indirect mortality during the operation/maintenance phase are not anticipated to be highly effective. These two potential effects are therefore considered adverse residual effects (**Section 6.6.3**).

6.6.2.2.3 Waterbirds – Marbled Murrelet

6.6.2.2.3.1 Alteration of Habitat

Habitat suitability classes for Marbled Murrelet and overlap with the provisional transmission line route are shown in **Appendix D.4-3**. The calculated values of anticipated habitat alteration (**Table 6.6-8**) indicate that approximately 14 ha (3.0%) of moderate and high suitability habitat will be affected by the clearing/construction of the ROW and new access roads. The patches that will be affected by ROW and access road clearing are generally small and isolated with two exceptions: (1) east/southeast of Bowbyes Lake from structure 146 to 148; this area consists of moderate and high suitability habitat and is connected to a large area of suitable habitat to the west of the ROW and (2) east of Clague Mountain from structures 162 to 165; this area also consists of moderate and high suitability habitat and is connected to a large area of suitable habitat to the west and east of the ROW that will be fragmented (**Appendix D.4-3)**.

Since information on territoriality in Marbled Murrelets is lacking (**Appendix D.3-3**), it is not possible to infer population effects from the calculated habitat loss. Due to vegetation management on ROW and access roads, it is not anticipated that suitable habitat will be restored during the operation/maintenance Project phase.

Table 6.6-8: Potential Marbled Murrelet Reproducing Habitat Affected during the Growing Season within the Local Study Area

Project Component	Amount (ha) / Proportion (%) of Rated Habitat Affected Within the LSA			
	Nil Suitability[1]	**Low Suitability[2]**	**Moderate Suitability[3]**	**High Suitability[4]**
Transmission line ROW	377 / 6.4	243 / 6.6	8 / 1.3	5 / 1.5
New Access Roads – Permanent	6 / 0.1	4 / 0.1	1 / 0.1	<1 / 0.1
New Access Roads – Temporary	<1 / <0.1	<1 / <0.1	0 / 0	0 / 0
Total	**383 / 6.5**	**247 / 6.7**	**8 / 1.4**	**6 / 1.6**

Notes: ROW = right-of-way; ha = hectare; LSA = Local Study Area; % = percent.
[1]Total in LSA = 5,937 ha; [2]Total in LSA = 3,662 ha; [3]Total in LSA = 568 ha; [4]Total in LSA = 353 ha.

6.6.2.2.3.2 Direct and/or Indirect Mortality

Direct mortality may be experienced by eggs or nestlings if forest clearing is conducted during the Marbled Murrelet breeding season and nests are not discovered prior to tree felling during clearing/construction. Direct mortality may also be caused by (1) inadvertent nest destruction during tree felling or trimming at the edge of the ROW and access roads during ROW maintenance and (2) bird collisions with the transmission line. Indirect mortality may be experienced by nesting adults, eggs or nestlings through increased predation at the hard, artificial forest edge adjacent to the cleared ROW and throughout the LSA.

6.6.2.2.3.3 Sensory Disturbance

No information is available in the literature regarding the magnitude, frequency and duration of sensory disturbance that would result in Marbled Murrelets experiencing reduced nesting success or abandonment of active nests. Noisy construction activities (e.g. blasting, use of heavy machinery) in areas of moderate and high habitat suitability may affect Marbled Murrelet nesting activities throughout the LSA.

6.6.2.2.3.4 Specific Mitigation Measures

WM12: Consult the 2014 Marbled Murrelet Recovery Strategy (Environment Canada, 2014) in developing the At-risk Bird Management Plan to avoid or minimize effects on critical habitat. Consider all moderate and high suitability habitat patches within the LSA (**Appendix D.4-3**) as critical habitat. It is assumed that the polygons delineating moderate and high suitability habitat are a refinement of the BC Model used to identify critical habitat for the 2014 recovery strategy.

WM13: If clearing/construction activities fall within the critical risk timing window for Marbled Murrelets (April 1 to September 14), conduct standard forest surveys (RISC, 2001b) and nest searches in patches of moderate and high suitability habitat that intersect or are adjacent (≤500 m) to the ROW and new access roads near the following structure locations: 6–12, 14–16, 21–23, 31–34, 36–42, 43–46, 47–48, 49–50, 71–72, 76–78, 83–85, 96–97, 103–109, 128–129, 132–141, 142 (**Appendix D.4-3**). The structure numbers identified are preliminary; final identification will be completed by a QEP with expertise in marbled murrelets once clearing limits have been finalized and will be considered in developing the CEMP and associated wildlife management plans (WM3). Follow pre-clearing nest survey protocol (**WM6A/B**). If active nests are located, establish appropriate buffers (~500 m) as determined by a QEP or delay work activities until the nesting activity has been completed (WM7). The At-risk Bird Management plan and pre-clearing nest survey will incorporate species-specific provisions for Marbled Murrelet.

Based on the effects assessment summarized in **Table 6.6-9**, mitigation measures to avoid or minimize habitat alterations during clearing/construction and direct mortality to Marbled Murrelets from potentially colliding with the transmission line during the operation/maintenance phase are not anticipated to be highly effective. These two potential effects are therefore considered adverse residual effects (**Section 6.6.3**).

Table 6.6-9: Summary of Potential Effects, Mitigation Measures and Anticipated Effectiveness of Mitigation for Marbled Murrelet

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
Clearing / Construction	Alteration of Habitat	• Avoid removal of forest cover to the extent practicable (**WM1, WM12**) • Minimize clearing/construction footprint (**WM2**) • Implement wildlife management plans and BMPs (**WM3, WM4)**	WM1, WM2, WM3, WM4, WM12 = Low	Yes
	Direct and/or Indirect Mortality	• Avoid nesting season whenever practicable (**WM6A**) • Conduct pre-clearing surveys (**WM13**) • Establish setback buffers at active nest sites (**WM7**) • Implement wildlife management plans and BMPs (**WM3, WM4)**	WM3, WM4, WM6A, WM7, WM13= High	No
	Sensory Disturbance	• Avoid nesting season whenever practicable (**WM6A**) • Conduct pre-clearing surveys (**WM13**) • Establish setback buffers at active nest sites (**WM7**) • Implement wildlife management plans and BMPs (**WM3, WM4)**	WM3, WM4, WM6A, WM7, WM13 = High	No
Operation / Maintenance	Direct and/or Indirect Mortality	• Install line markers and bird flight diverters, where feasible (**WM8**) • Avoid nesting season whenever practicable (**WM6B**) • Conduct pre-clearing surveys (**WM13**) • Establish setback buffers at active nest sites (**WM7**) • Implement wildlife management plans and BMPs (**WM3, WM4)**	WM3, WM4, WM6B, WM7, WM13 = High WM8 = Moderate	Yes
Closure and Post-closure	Direct and/or Indirect Mortality	• Avoid nesting season whenever practicable (**WM6A/B**) • Conduct pre-clearing surveys (**WM13**) • Establish setback buffers at active nest sites (**WM7**) • Implement wildlife management plans and BMPs (**WM3, WM4)**	WM3, WM4, WM6A/B, WM7, WM13 = High	No
	Sensory Disturbance	• Avoid nesting season whenever practicable (**WM6A/B**) • Conduct pre-clearing surveys (**WM13**) • Establish setback buffers at active nest sites (**WM7**) • Implement wildlife management plans and BMPs (**WM3, WM4)**	WM3, WM4, WM6A/B, WM7, WM13 = High	No

Note: BMP = best management practice.

6.6.2.2.4 Waterbirds – Trumpeter Swan

6.6.2.2.4.1 Alteration of Habitat

Because the Project's footprint is located outside of the Trumpeter Swans' habitat, no potential Project effects causing alteration of habitat, sensory disturbance or alteration of movement patterns are anticipated.

6.6.2.2.4.2 Direct and/or Indirect Mortality

Direct mortality may be experienced by Trumpeter Swans as a result of collisions with the transmission line over watercourses used as flyways. Trumpeter Swans aggregate in the area during the overwintering period between late October and March (Horwood, 1992). The main site of collision risk for the provisional transmission line is the Lakelse River crossing. Lakelse Lake and River are important overwintering areas. Lakelse Lake is the warmest lake in northern BC due to hot springs in and around the lake. During very cold winters, swans leave the primary overwintering site of Lakelse Lake and fly to Kitsumkalum Lake northwest of Terrace or along the Skeena River (Horwood, 1992), possibly using the Lakelse River as a flyway.

The high wing loading of swans causes a lack of maneuverability and, in combination with their poor frontal vision, increases their susceptibility to collisions (Beer and Ogilvie, 1977; Avian Power Line Interaction Committee (APLIC), 2012). They also fly in flocks, which, because of relatively tight inter-bird spacing, also reduce their maneuverability and increases collision risk (Brown, 1993; Drewit and Langston, 2008). During the overwintering period, any flying would be considered non-migratory. Migrating birds tend to fly higher than transmission lines whereas non-migratory birds tend to fly within the height range of transmission lines (APLIC, 2012).

A limited literature review on the effectiveness of line markers and diverters for reducing transmission line collision risk for swans and other waterfowl species shows a wide range of results, ranging from a 37% reduction (Crowder, 2000) to a complete removal of risk (Hunting, 2002).

6.6.2.2.4.3 Specific Mitigation Measures

WM14: In the bird collision mitigation plan, include provisions for installation of line markers and bird flight diverters (**WM8**) tailored to the Lakelse River crossing. This section will describe installation of line markers (i.e. aerial markers) to improve visibility of the line, as recommended by a QEP considering APLIC (2012) guidelines.

Based on the effects assessment summarized in **Table 6.6-10**, mitigation measures (i.e. line markers and diverters) to avoid direct mortality of Trumpeter Swans from potentially colliding with the transmission line during the operation/maintenance phase are not anticipated to be highly effective because of the large range in reported effectiveness of the devices, relatively narrow flyway along Lakelse River and lack of maneuverability of the swans. This potential effect is therefore considered an adverse residual effect (**Section 6.6.3**).

Table 6.6-10: Summary of Potential Effects, Mitigation Measures and Anticipated Effectiveness of Mitigation for the Trumpeter Swan

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
Operation / Maintenance	Direct and/or Indirect Mortality	• Install line markers and flight diverters (**WM8**, **WM14**)	WM8, WM14 = Moderate	Yes

6.6.2.2.5 Raptors – Northern Goshawk

6.6.2.2.5.1 Alteration of Habitat

Habitat suitability classes for Northern Goshawk and overlap with the provisional transmission line route are shown in **Appendix D.4-4**. The calculated values of anticipated habitat alteration (**Table 6.6-11**) indicate that approximately 61 ha (7.0%) of moderate and high suitability habitat will be affected by the clearing/construction of the ROW and new access roads. Given 61 ha of habitat loss, a potential loss of 0.6–1.5 goshawk territories is predicted, based on a minimum patch size of 100 ha for highly suitable habitat or 40 ha of moderately suitable habitat (Northern Goshawk *Accipiter gentilis laingi* Recovery Team, 2008). Due to vegetation management on ROW and access roads, it is not anticipated that suitable habitat will be restored during post-construction Project phases.

Table 6.6-11: Potential Northern Goshawk Reproducing Habitat Affected during the Growing Season within the Local Study Area

Project Component	Amount (ha) / Proportion (%) of Rated Habitat Affected Within the LSA			
	Nil Suitability[1]	Low Suitability[2]	Moderate Suitability[3]	High Suitability[4]
Transmission line ROW	332 / 6.2	242 / 6.9	16 / 2.5	43 / 4.2
New Access Roads – Permanent	5 / 0.1	3 / 0.1	<1 / 0.1	1 / 0.1
New Access Roads – Temporary	<1 / <0.1	<1 / <0.1	0 / 0	<1 / <0.1
Total	**337 / 6.3**	**246 / 7.0**	**16 / 2.6**	**45 / 4.4**

Notes: ROW = right-of-way; ha = hectare; LSA = Local Study Area; % = percent
[1]Total in LSA = 5,373 ha; [2]Total in LSA = 3,496 ha; [3]Total in LSA = 628 ha; [4]Total in LSA = 1,024 ha.

6.6.2.2.5.2 Direct and/or Indirect Mortality

Direct mortality may be experienced by goshawks at any age and may be caused by (1) inadvertent nest destruction during forest clearing, if conducted during the breeding season; (2) birds colliding with the transmission line; and (3) electrocution when a bird simultaneously contacts electrical equipment, either phase-to-phase or phase-to-ground. Indirect mortality may be experienced by adults, eggs or nestlings through increased predation at the artificial forest edge adjacent to the cleared ROW and throughout the LSA.

6.6.2.2.5.3 *Sensory Disturbance*

No data exist that quantify the magnitude, frequency or duration of sensory disturbance that would result in Northern Goshawk experiencing reduced nesting success or abandonment of active nests (COSEWIC, 2013; Northern Goshawk *Accipiter gentilis laingi* Recovery Team, 2008). Evidence suggests that Northern Goshawks may be sensitive to disturbance by humans; however, the amount of tolerance that is acceptable is variable (McLaughlin, 2002). Effects of sensory disturbance may vary based on the timing, intensity and proximity of the disturbance (Toyne, 1997).

6.6.2.2.5.4 *Specific Mitigation Measures*

WM15: If clearing/construction activities fall within the Northern Goshawk nesting period (March 7 – August 15), conduct repeated call playback surveys and nest searches in optimal habitat patches that intersect or are adjacent (≤800 m) to the ROW and new access roads near the following structure locations: 2–4, 5–24, 28–56, 56–66, 70–73, 75–93, and 95–179 (**Appendix D.4-4**). The structure numbers identified are preliminary; final identification will be completed by a QEP once clearing limits have been finalized, and considered in development of the CEMP and associated wildlife management plans. Follow pre-clearing nest survey protocol (**WM6A/B**). If nests (active or inactive) are located, establish appropriate buffers (500 to 800 m) as determined by a QEP, in consultation with FLNRO, or delay work activities until the observed nesting activity has completed. Report all nest locations to FLNRO Ecosystem Section. If inactive nests must be removed, FLNRO will be notified in advance. The At-risk Bird Management plan and pre-clearing nest survey will incorporate species-specific provisions for Northern Goshawk. Based on the effects assessment summarized in **Table 6.6-12**, mitigation measures to avoid or minimize habitat alterations during clearing/construction and direct mortality to Northern Goshawks from potentially colliding with the transmission line during the operation/maintenance phase are not anticipated to be highly effective. These two potential effects are therefore considered adverse residual effects (**Section 6.6.3**).

Table 6.6-12: Summary of Potential Effects, Mitigation Measures and Anticipated Effectiveness of Mitigation for Northern Goshawk

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
Clearing / Construction	Alteration of Habitat	• Avoid removal of forest cover to the extent practicable (**WM1**) • Minimize clearing/construction footprint (**WM2**) • Implement wildlife management plans and BMPs (**WM3, WM4**)	WM1, WM2, WM3, WM4 = Low	Yes
	Direct and/or Indirect Mortality	• Avoid nesting season whenever practicable (**WM6A**) • Conduct pre-clearing surveys (**WM15**) • Establish setback buffers at nest sites (**WM7**) • Implement wildlife management plans and BMPs (**WM3, WM4)**	WM3, WM4, WM6A, WM7, WM15 = High	No
	Sensory Disturbance	• Avoid nesting season whenever practicable (**WM6A**)	WM3, WM4, WM6A, WM7, WM15 = High	No

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
		• Conduct pre-clearing surveys (**WM15**) • Establish setback buffers at nest sites (**WM7**) • Implement wildlife management plans and BMPs (**WM3, WM4)**		
Operation / Maintenance	Direct and/or Indirect Mortality	• Install line markers and flight diverters (**WM8**) • Avoid nesting season whenever practicable (**WM6B**) • Conduct pre-clearing surveys (**WM15**) • Establish setback buffers at nest sites (**WM7**) • Implement wildlife management plans and BMPs (**WM3, WM4)**	WM3, WM4, WM6B, WM7, WM15 = High WM8 = Moderate	Yes
	Sensory Disturbance	• Avoid nesting season whenever practicable (**WM6B**) • Conduct pre-clearing surveys (**WM15**) • Establish setback buffers at nest sites (**WM7**) • Implement wildlife management plans and BMPs (**WM3, WM4)**	WM3, WM4, WM6B, WM7, WM15 = High	No
Closure	Direct and/or Indirect Mortality	• Avoid nesting season whenever practicable (**WM6A/B**) • Conduct pre-clearing surveys (**WM15**) • Establish setback buffers at nest sites (**WM7**) • Implement wildlife management plans and BMPs (**WM3, WM4)**	WM3, WM4, WM6A/B, WM7, WM15 = High	No
	Sensory Disturbance	• Avoid nesting season whenever practicable (**WM6A/B**) Conduct pre-clearing surveys (**WM15**) • Establish setback buffers at nest sites (**WM7**) • Implement wildlife management plans and BMPs (**WM3, WM4)**	WM3, WM4, WM6A/B, WM7, WM15 = High	No

Note: BMP = best management practice.

6.6.2.2.6 Grizzly Bear

6.6.2.2.6.1 Alteration of Habitat

Habitat suitability classes for grizzly bear and overlap with the provisional transmission line route are shown in **Appendix D.4-5** and **D.4-6**. The calculated values of anticipated habitat alteration (**Table 6.6-13**) indicate that approximately 254 ha (7.8%) of moderate and high suitability spring habitat and 570 ha (11.8%) of moderate and high suitability fall habitat, will be affected by the clearing/construction of the ROW and new access roads. Area affected by the Project within

Grizzly Bear Identified Watersheds will include 263 ha in the Lakelse–Cecil, 66 ha in the Little Wedeene and 153 ha in the Wedeene watersheds. For each of these watersheds, the area affected represents <1% of the total watershed area.

Table 6.6-13: Potential Grizzly Bear Feeding Habitat Affected during spring, and Fall Season within the Local Study Area

Season	Project Component	Amount (ha) / Proportion (%) of Rated Habitat Affected Within the LSA			
		Nil Suitability[1]	Low Suitability[2]	Moderate Suitability[3]	High Suitability[4]
Spring	Transmission line ROW	23 / 5.4	359 / 7.3	16 / 2.4	235 / 5.2
	New Access Roads – Permanent	<1 / <0.1	6 / 0.1	1 / 0.1	3 / 0.1
	New Access Roads – Temporary	0 / 0.0	<1 / <0.1	<1 / <0.1	<1 / <0.1
	Total	**23 / 5.4**	**366 / 7.4**	**16 / 2.5**	**238 / 5.3**
Fall	Transmission line ROW	23 / 5.5	50 / 10.5	153 / 5.7	406 / 5.9
	New Access Roads – Permanent	<1 / <0.1	<1 / <0.1	4 / 0.1	7 / 0.1
	New Access Roads – Temporary	0 / 0.0	0 / 0.0	<1 / <0.1	<1 / <0.1
	Total	**23 / 5.6**	**51 / 10.5**	**157 / 5.8**	**413 / 6.0**

Notes: ha = hectare; LSA = Local Study Area; ROW = right-of-way; % = percent.
[1]Total in LSA Spring/Fall = 433/408 ha; [2]Total in LSA Spring/Fall = 4,931/482 ha;
[3]Total in LSA Spring/Fall = 654/2,693 ha; [4]Total in LSA Spring/Fall = 4,502/6,937 ha.

Given 281 ha of spring feeding habitat loss, a potential loss of 0.02 male grizzly bear territories or 0.05 female grizzly bear territories is predicted, based on an average male territory size of 137 km² and average female territory size of 52 km² (MacHutchon et al., 1993). Fall feeding habitat loss is predicted to be 571 ha, which is a potential loss of 0.04 male grizzly bear territories or 0.11 female grizzly bear territories. Due to vegetation management on ROW and access roads, it is not anticipated that suitable habitat will be restored during the operation/maintenance Project phase.

6.6.2.2.6.2 Direct and Indirect Mortality

Direct mortality may be experienced by grizzly bears and may be caused by (1) vehicle collisions; (2) vegetation clearing occurring when bears are in their dens; and (3) control killing of problem bears within the LSA. Much evidence exists of human-caused bear mortality, including large-scale, systematic studies (e.g. Benn and Herrero, 2002; McLellan, 1989; and McLellan et al., 1999). For example, human-related mortality was the source of the majority of known mortalities in Banff and Yoho National Parks. Control killing of problem bears accounted for 71% of known mortalities, followed by road and rail collisions (19%); most mortalities occurred during fall when bears used food resources at low elevations (Benn and Herrero, 2002). Road construction for resource extraction industries was found to increase access for hunters and poachers in southeastern BC (McLellan, 1989). Legal harvest was found to account for 39%–44% of known mortalities in the Rocky and Columbia Mountains, and management agencies were unaware of half the mortalities (McLellan et al., 1999).

Indirect mortality resulting from accidental collisions, by either road vehicles or trains, accounted for up to 6% of known human-related grizzly mortality in Alberta, and additional mortalities may result from reduced cub survival (COSEWIC, 2012c).

New Project-related roads will result in an increase in total road density and direct and indirect mortality risks for all management units (**Table 6.6-14**). Road density with new roads will stay below the threshold density of 0.75 km/km² (Boulanger and Stenhouse, 2014; see **Section 6.5.2.4.1.3**) at the population unit level. Existing road densities for all other management units already exceed the 0.75 km/km² threshold density and will further increase (**Table 6.6-14**). Grizzly bears are known to occur in areas where road densities exceed threshold values; however, survival rates tend to decrease with increasing road density and these areas can become sink habitats (Boulanger and Stenhouse, 2014). The addition of new access roads will increase current road density within the LSA by 8.37%; this will likely increase grizzly bear mortality risk and likelihood of the LSA becoming a sink habitat for grizzly bears.

Table 6.6-14: Total Length and Density of Existing and New Roads in Grizzly Bear Management Units and the Local Study Area

Management Unit Name	Total Existing Roads (km)	New Roads (km)	Total Existing Roads with New Roads (km)	Management Unit Area (km²)	Existing Road Density (km/km²)	Road Density with New Roads (km/km²)	Proportion of Road Density Increase (%)[2]
Lakelse – Cecil Identified Watershed[1]	675.7	18.6	694.3	314.8	2.15	2.21	2.75
Little Wedeene Identified Watershed[1]	114.9	3.2	118.1	133.5	0.86	0.88	2.74
Wedeene Identified Watershed[1]	276.5	8.8	285.3	311.1	0.89	0.92	3.19
Grizzly Bear Population Unit – North Coast	2,565.2	41.2	2,606.4	7,162.3	0.36	0.36	1.61
LSA (with 2 x 1 km buffer around ROW)	492.1	41.2	533.3	162.0	3.04	3.29	8.37

Notes: [1]Kalum Land and Resource Management Plan (Government of BC, 2002b);
[2]calculated before rounding to 2 decimals;
km = kilometre; km² = square kilometre; LSA = Local Study Area; ROW = right-of-way.

6.6.2.2.6.3 Sensory Disturbance

Project activities during clearing/construction, maintenance and closure phases may result in sensory disturbance for grizzly bears. Increased levels of stress, energy expenditure, disruption of behaviour and indirect habitat loss or fragmentation can occur through the loss of habitat security caused by a negative response to sensory disturbances (Gibeau et al*.,* 1996). The large home range size of grizzly bears can place bears in contact with humans even when Project activities are at a considerable distance from the centre of the home range. The clearing required for the transmission line and Project-related roads may also cause indirect sensory disturbance, caused by an increase in human recreational activities in the ROW, roads and adjacent areas.

Grizzly bears frequently alter their behaviour (e.g. increase in nocturnal behaviour) in response to areas with human activity and when those activities are most frequent (e.g. high-use roads (Mueller, 2001)). Grizzly bears may avoid habitat up to 900 m away from high-use areas (e.g. construction sites), particularly when there are new disturbances or when crews are working (Kasworm and Manley, 1990; McLellan and Shackleton, 1988). Aircraft can cause sensory disturbance when flights are less than 200 m above ground, resulting in altered behavioural uses of the grizzly bear's home range (McLellan and Shackleton, 1988). Road traffic can cause sensory disturbance that causes avoidance of even high quality habitats (Mace et al., 1996; Kasworm and Manley, 1990). A study in southwestern Alberta found that grizzly bears avoided roads receiving moderate traffic (20–100 vehicles per day) and strongly avoided high-use roads (>100 vehicles per day) at all times; habitat avoidance can extend to 900 m from roads (Northrup et al*.,* 2012; Kasworm and Manley, 1990).

6.6.2.2.6.4 Alteration of Movement Patterns

The ROW and its access roads can cause alteration in movement patterns for grizzly bears that avoid busy roads. Conversely, roads may act as attractants for bears due to an increase in preferred foods (e.g. ants, *Equisetum* sp.) in the adjacent cleared areas (Roever et al., 2008). Roads may also provide females with cubs a relatively secure area away from potentially aggressive adult males (McLellan and Shackleton, 1988). Grizzly bears may also select roads for travel (Roever et al., 2010).

With respect to the location and north–south direction of the LSA, the provisional linear corridor may constitute an additional barrier for grizzly bears moving east from the western slopes to access the seasonal food resources of the Kitimat River and valley bottom wetlands (**Figure 6.4-1**).

6.6.2.2.6.5 Specific Mitigation Measures

WM16: If clearing/construction activities fall within the grizzly bear denning period, conduct pre-clearing den surveys in potential habitat. If an active or recently used bear den is discovered, establish an appropriate setback buffer, as determined by a QEP, around the den where no activities are to occur until the den is vacated (BC MFLNRO, 2014a). Consult a qualified wildlife biologist regarding potential den sites and behaviour of local bears, and appropriate site- and activity-specific buffers.

WM17: Require all company and construction personnel to receive mandatory training on working in bear country to reduce potential grizzly bear conflicts.

WM18: Include provisions in the CEMP to outline and implement a policy managing potential grizzly bear attractants (e.g. garbage, compost, petroleum products) that can alter the movement and behaviour of grizzly bears and increase risk of conflict or creation of problem bears. This policy should include, but not be limited to, using bear-proof garbage containers, locking away any food or petroleum products, no littering and no feeding of grizzly bears.

WM19: Report all direct and indirect grizzly mortalities to BC MOE.

WM20: Use adaptive mitigation measures based on the effectiveness of implemented mitigation measures and/or when new information on the status and behaviour of local/regional grizzly bears becomes available.

Based on the effects assessment summarized in **Table 6.6-15**, most mitigation measures to avoid or minimize Project effects on grizzly bear during the different Project phases are not anticipated to be highly effective and therefore adverse residual effects are possible. The only exception is alteration of habitat during Project closure when avoidance and minimization of Project footprint along with following BMPs are anticipated to be highly effective mitigation measures. All other potential effects are considered adverse residual effects (**Section 6.6.3**).

Table 6.6-15: Summary of Potential Effects, Mitigation Measures and Anticipated Effectiveness of Mitigation for Grizzly Bear

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
Clearing / Construction	Alteration of Habitat	• Minimize removal of forest cover to the extent practicable (**WM1**) • Minimize clearing/construction footprint (**WM2**) • Implement BMPs (**WM4**)	WM1, WM2, WM3, WM4 = Low	Yes
	Direct and/or Indirect Mortality	• Minimize activity during the denning season (**WM3, WM4**) • Conduct pre-clearing surveys for potential denning areas (**WM16**) • Establish appropriate setback buffers around dens where required (**WM16**) • Implement BMPs (**WM4**) • Implement Access Management Plan (**WM9A**) • Educate Project field staff regarding bear awareness (**WM17, WM18, WM19**)	WM3, WM4, WM9A, WM16 = Moderate WM17, WM18, WM19 = High	Yes
	Sensory Disturbance	• Minimize activity during the denning season (**WM3, WM4**) • Conduct pre-clearing surveys for potential denning areas (**WM16**) • Establish appropriate setback buffers around dens where required (**WM16**) • Implement BMPs (**WM4**) • Implement Access Management Plan (**WM9A**)	WM3, WM4, WM9A, WM16 = Moderate	Yes
	Alteration of Movement Patterns	• Monitor for new information on regional grizzly bears and implement adaptive mitigation measures (**WM20**)	WM20 = Moderate	Yes
Operation / Maintenance	Alteration of Habitat	• Avoid removal of berry shrubs to the extent practicable (**WM1**)	WM1, WM2 = Low	Yes
	Direct and/or Indirect Mortality	• Implement BMPs (**WM4**) • Implement Access Management Measures (**WM9B**) • Educate Project field staff regarding bear awareness (WM17, WM18, WM19)	**WM3, WM4, WM9B = Moderate** **WM17, WM18, WM19 = High**	Yes
	Sensory Disturbance	• Implement BMPs (**WM4**) • Implement Access Management Measures (**WM9B**)	WM3, WM4, WM9B = Moderate	Yes
	Alteration of Movement Patterns	• Monitor for new information on regional grizzly bears and implement adaptive mitigation measures (**WM20**)	WM20 = Moderate	Yes

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
Closure	Alteration of Habitat	• Minimize clearing/construction footprint (**WM2**) • Implement BMPs (**WM4**)	WM2, WM3, WM4 = High	No
	Direct and/or Indirect Mortality	• Minimize activity during the denning season (**WM3, WM4**) • Conduct pre-clearing surveys for potential denning areas (**WM16**) • Establish appropriate setback buffers around dens where required (**WM16**) • Implement BMPs (**WM4**) • Implement Access Management Measures (**WM9B**) • Educate Project field staff regarding bear awareness (**WM17, WM18, WM19**)	WM3, WM4, WM9B, WM16 = Moderate WM17, WM18, WM19 = High	Yes
	Sensory Disturbance	• Minimize activity during the denning season (**WM3, WM4**) • Conduct pre-clearing surveys for potential denning areas (**WM16**) • Establish appropriate setback buffers around dens where required (**WM16**) • Implement BMPs (**WM4**) • Implement Access Management Measures (**WM9B**)	WM3, WM4, WM9B, WM16 = Moderate	Yes
	Alteration of Movement Patterns	• Monitor for new information on regional grizzly bears and implement adaptive mitigation measures (**WM20**)	WM20 = Moderate	Yes
Post - closure	Direct and/or Indirect Mortality	• Implement Access Management Measures (**WM9B**) • Educate Project field staff regarding bear awareness (**WM17, WM18, WM19**)	WM9B = ModerateWM17, WM18, WM19 = High	Yes

Note: BMP = best management practice.

6.6.2.2.7 Kermode American Black Bear

6.6.2.2.7.1 Alteration of Habitat

Habitat suitability classes for the American black bear, including Kermode subspecies, and overlap with the provisional transmission line route are shown in **Appendix D.4-7** and **D.4-8**. The calculated values of anticipated habitat alteration (**Table 6.6-16**) indicate that 270 ha (10.2%) of moderate and high suitability spring habitat and 208 ha (7.3%) of moderate and high suitability fall habitat will be affected by the clearing/construction of the ROW and new access roads. Given 270 ha of spring feeding habitat loss, a potential loss of 0.06 male black bear territories or 0.35 female black bear territories is predicted, based on an average male territory size of 41.9 km² and average female territory size of 7.8 km² (Koehler and Pierce, 2003; Erickson, 1982). Fall feeding habitat loss is predicted to be 211 ha, a potential loss of 0.05 male black bear territories or 0.27 female black bear territories. Due to vegetation management on ROW and access roads, it is not anticipated that suitable habitat will be restored during the operation/maintenance Project phase.

Table 6.6-16: Potential Black Bear Feeding Habitat Affected during the Spring and Fall Seasons within the Local Study Area

Season	Project Component	Amount (ha) / Proportion (%) of Rated Habitat Affected Within the LSA			
		Nil Suitability[1]	Low Suitability[2]	Moderate Suitability[3]	High Suitability[4]
Spring	Transmission line ROW	23 / 5.4	343 / 7.2	68 / 5.0	198 / 5.0
	New Access Roads – Permanent	<1 / <0.1	6 / 0.1	1 / 0.1	3 / 0.1
	New Access Roads – Temporary	0 / 0.0	<1 / <0.1	<1 / <0.1	<1 / <0.1
	Total	**23 / 5.4**	**350 / 7.3**	**69 / 5.1**	**201 / 5.1**
Fall	Transmission line ROW	21 / 6.0	407 / 6.9	4 / 2.2	201 / 4.9
	New Access Roads – Permanent	<1 / <0.1	7 / 0.1	<1 / <0.1	3 / 0.1
	New Access Roads – Temporary	0 / 0.0	<1 / <0.1	0 / 0.0	<1 / <0.1
	Total	**21 / 6.0**	**415 / 7.0**	**4 / 2.3**	**204 / 5.0**

Notes: ha = hectare; LSA = Local Study Area; ROW = right-of-way; % = percent.
[1]Total in LSA Spring/Fall = 433/343 ha; [2]Total in LSA Spring/Fall = 4,783/5,925 ha;
[3]Total in LSA Spring/Fall = 1,359/181 ha; [4]Total in LSA Spring/Fall = 3,945/4,072 ha.

6.6.2.2.7.2 Direct and Indirect Mortality

Direct mortality may be experienced by black bears and may be caused by (1) vehicle collisions, (2) vegetation clearing occurring when bears are in dens, and (3) control killing of problem bears within the LSA.

Vehicle collisions can pose a substantial mortality risk for black bears. Road kill was the largest source of mortality in an unhunted black bear population in Florida, and road kill accounts for 25% of all bear-human conflicts in Colorado (Baruch-Mordo et al., 2008; Forman et al., 2003). Road kill black bears were found to be 1.5 times more likely to occur on smaller highways than interstates in the United States, suggesting that bears may avoid high traffic roads and are more likely to cross and be killed on smaller roadways (Baruch-Mordo et al., 2008).

Little data are available on mortality of denning bears; however, female den abandonment caused by human disturbance around the den site has been found to cause cub mortality (Linnel et al., 2000).

Management of problem bears can be a substantive source of mortality. In a study in Banff National Park, 27% of human-caused mortalities were control-killed bears, 18% of which died during relocation efforts (Hebblewhite et al*.,* 2003). Control kills of nuisance black bears in the Yukon accounted for 36% of known human-caused bear mortalities and unreported control kills were estimated to equal or exceed reported ones (MacHutchon and Smith, 1988).

Indirect mortality may result from increased vehicle collisions and hunting or poaching caused by increased access of non-Project-related traffic to previously unroaded areas (Reynolds-Hogland and Mitchell, 2007; Brody and Pelton, 1989). In North Carolina, 30% of black bears tagged were reported killed by human-related mortality, of which 93% were caused by hunting or poaching (Reynolds-Hogland and Mitchell, 2007).

Data on magnitude of human-related black bear mortality in the Kitimat Valley are not available. Note, however, that the Kermode subspecies accounts for an estimated 2.5% of the black bear population around the Terrace area; human-caused mortality may therefore be proportional to this estimate.

6.6.2.2.7.3 Sensory Disturbance

Project activities during clearing/construction, maintenance and closure phases may result in direct sensory disturbance for black bears, although this is dependent on the location and type of activity. Indirect sensory disturbance may be caused by increases in human activities within the ROW and associated road network. High traffic volumes can cause sensory disturbances that result in area avoidance both at the home range and population scale (Coady, 2001; Kasworm and Manley, 1990). Distances of avoidance are greater in fall (0 m–914 m) compared with spring (0 m–274 m) and are more pronounced around highways compared with rural roads; bear crossings are located primarily on low-traffic roads and at sites that minimize human detection (Jensen, 2009; Coady, 2001; Kasworm and Manley, 1990). However, in areas where road mortality is minimal relative to hunting or poaching mortality, black bears have been shown to avoid areas near gravel roads more than they avoided areas near paved roads (Reynolds-Hogland and Mitchell, 2007). Males may display more evidence of road avoidance than females, but females may cross roads more selectively than males (Jensen, 2009).

In rural areas, along an urban-forest interface, black bears are known to maintain their daily activity patterns despite human activity. However, bears have been shown to increase their activities during nocturnal periods and be active for fewer hours per day (Lewis and Rachlow, 2011; Beckmann and Berger, 2006). Increased human activity can displace bears from optimal feeding habitat along salmon-bearing streams and reduce time spent foraging for salmon (Chi and Gilbert, 1999). Sensory disturbance within 1 km, and especially within 200 m of a den during the winter denning period, can cause abandonment of a den location, especially early in the denning period (Linnel et al., 2000; Elowe and Dodge, 1989).

6.6.2.2.7.4 Alteration of Movement Patterns

The ROW and access road network can cause alteration in movement patterns for black bears through the sensory disturbances described above. Conversely, roads can act as attractants for bears due to an increase in preferred foods in the adjacent cleared areas and for use as travel corridors (Brody and Pelton, 1989; Manville, 1983).

6.6.2.2.7.5 Specific Mitigation Measures

WM21: If clearing/construction activities fall within the black bear denning period (mid- to late-winter), conduct pre-clearing den surveys in potential habitat. If an active or recently used bear den is discovered, establish an appropriate setback buffer, as determined by a QEP, around the den where no activities are to occur until the den is vacated (BC MFLNRO, 2014a). Consult a qualified wildlife biologist regarding potential den sites and behaviour of local bears, and advice on appropriate buffers depending on the site and Project activities.

WM22: Require all company and construction personnel to receive mandatory training on working in bear country to reduce potential black bear conflicts.

WM23: Include provisions in the CEMP to outline and implement a policy managing potential black bear attractants (e.g. garbage, compost, petroleum products) that can alter the movement and behaviour of black bears and increase risk of conflict or creation of problem bears. Policy should include, but not be limited to, using bear-proof garbage containers, locking away any food or petroleum products, no littering and no feeding of black bears.

WM24: Report all direct and indirect black bear mortalities to BC MOE.

Table 6.6-17: Summary of Potential Effects, Mitigation Measures and Anticipated Effectiveness of Mitigation for Kermode Black Bear

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
Clearing / Construction	Alteration of Habitat	• Minimize removal of forest cover to the extent practicable (**WM1**) • Minimize clearing/construction footprint (**WM2**) • Implement BMPs (**WM4**)	WM1, WM2, WM3, WM4 = Low	Yes
	Direct and/or Indirect Mortality	• Minimize activity during the denning season (**WM3, WM4**) • Conduct pre-clearing surveys for potential denning areas (**WM21**) • Establish appropriate setback buffers around dens where required (**WM21**) • Implement BMPs (**WM4**) • Implement Access Management Plan (**WM9A**) • Educate Project field staff regarding bear awareness (**WM22, WM23, WM24**)	WM3, WM4, WM9A, WM21 = Moderate WM22, WM23, WM24 = High	Yes
	Sensory Disturbance	• Minimize activity during the denning season (**WM3, WM4**) • Conduct pre-clearing surveys for potential denning areas (**WM21**) • Establish appropriate setback buffers around dens where required (**WM21**) • Implement BMPs (**WM4**) • Implement Access Management Plan (**WM9A**)	WM3, WM4, WM9A, WM21 = Moderate	Yes
	Alteration of Movement Patterns	• Implement BMPs (**WM4**) • Implement Access Management Plan (**WM9A**)	WM3, WM4, WM9A = Moderate	Yes
Operation / Maintenance	Alteration of Habitat	• Minimize clearing/construction footprint (**WM2**)	WM1, WM2 = Low	Yes
	Direct and/or Indirect Mortality	• Implement BMPs (**WM4**) • Implement Access Management Measures (**WM9B**) • Educate Project field staff regarding bear awareness (**WM22, WM23, WM24**)	WM3, WM4, WM9B = Moderate WM22, WM23, WM24 = High	Yes
	Sensory Disturbance	• Implement BMPs (**WM4**) • Implement Access Management Measures (**WM9B**)	WM3, WM4, WM9B = Moderate	Yes

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
	Alteration of Movement Patterns	• Implement BMPs (**WM4**) • Implement Access Management Measures (**WM9B**)	WM3, WM4, WM9B = Moderate	Yes
Closure	Alteration of Habitat	• Minimize clearing/construction footprint (**WM2**) • Implement BMPs (**WM4**)	WM2, WM3, WM4 = High	No
	Direct and/or Indirect Mortality	• Minimize activity during the denning season (**WM3, WM4**) • Conduct pre-clearing surveys for potential denning areas (**WM21**) • Establish appropriate setback buffers around dens where required (**WM21**) • Implement BMPs (**WM4**) • Implement Access Management Measures (**WM9B**) • Educate Project field staff regarding bear awareness (**WM22, WM23, WM24**)	WM3, WM4, WM9B, WM21 = Moderate WM22, WM23, WM24 = High	Yes
	Sensory Disturbance	• Minimize activity during the denning season (**WM3, WM4**) • Conduct pre-clearing surveys for potential denning areas (**WM21**) • Establish appropriate setback buffers around dens where required (**WM21**) • Implement BMPs (**WM4**) • Implement Access Management Measures (**WM9B**)	WM3, WM4, WM9B, WM21 = Moderate	Yes
	Alteration of Movement Patterns	• Implement BMPs (**WM4**) • Implement Access Management Measures (**WM9B**)	WM3, WM4, WM9B = Moderate	Yes
Post-closure	Direct and/or Indirect Mortality	• Implement Access Management Measures (**WM9B**) • Educate Project field staff regarding bear awareness (**WM22, WM23, WM24**)	WM9B = Moderate WM22, WM23, WM24 = High	Yes

Note: BMP = best management practice.

Based on the effects assessment summarized in **Table 6.6-17**, most mitigation measures to avoid or minimize Project effects on Kermode black bear during the different Project phases are not anticipated to be highly effective and adverse residual effects are possible. The only exception is alteration of habitat during Project closure when avoidance and minimization of Project footprint along with following BMPs are anticipated to be highly effective mitigation measures. All other potential effects are considered adverse residual effects (**Section 6.6.3**).

6.6.2.2.8 Moose

6.6.2.2.8.1 Alteration of Habitat

Habitat suitability classes for moose and overlap with the provisional transmission line route are shown in **Appendix D.4-9** and **Appendix D.4-10**. The calculated values of anticipated habitat alteration (**Table 6.6-18**) indicate that approximately 335 ha (9.6%) of moderate and high suitability winter habitat and 196 ha (8.0%) of growing habitat will be affected by the clearing/construction of the ROW and new access roads; the majority of suitable habitat was rated moderate suitability. Generally, suitable habitat for both seasons is found within the same areas of the LSA (**Appendix D.4-9** and **Appendix D.4-10)**. High suitability winter and growing season habitat accounts for the lowest amount of area of the three suitability ratings (low to high) available in the LSA. Forestry in the Kitimat Valley has converted riparian floodplains into earlier successional stages, reducing the amount of winter habitat available. The loss of mature conifer-dominated forests has reduced shelter during periods of heavy snow accumulation and for calving (Enns et al., 1993).

The moderate and high suitability habitat near Lakelse River will be preserved between structures 21 and 22 due to mitigation in design: the provisional route and high structures will not require removal of riparian forest. The ROW and new access roads overlap with 130.1 ha (0.7%) of the area identified in the Kalum LRMP as secondary winter range[3] for moose (**Figure 6.4-1**; **Table 6.6-19**). There are no approved or proposed primary ungulate winter ranges for moose within the LSA. Due to vegetation management on ROW and access roads, it is not anticipated that suitable habitat will be restored during post-construction Project phases, with the exception of temporary access roads.

Table 6.6-18: Potential Moose Living Habitat Affected during the Winter and Growing Seasons within the Local Study Area

Season	Project Component	Amount (ha) / Proportion (%) of Rated Habitat Affected Within the LSA			
		Nil Suitability[1]	Low Suitability[2]	Moderate Suitability[3]	High Suitability[4]
Winter	Transmission line ROW	25 / 4.1	278/ 6.2	316 / 6.3	14 / 3.2
	New Access Roads – Permanent	<1 / <0.1	5 / 0.1	6 /0.1	<1 / <0.1
	New Access Roads – Temporary	0 / 0.0	<1 / <0.1	<1 / <0.1	0 / 0
	Total	**25 / 4.1**	**283 / 6.4**	**321 / 6.4**	**14 / 3.2**
Growing	Transmission line ROW	25 / 4.2	416 / 7.3	175 / 4.8	17 / 3.1
	New Access Roads – Permanent	<1 / <0.1	6 / 0.1	4 / 0.1	<1 / <0.1
	New Access Roads – Temporary	0 / 0.0	<1 / <0.1	<1 / <0.1	0 / 0.0
	Total	**26 / 4.3**	**422 / 7.4**	**179 / 4.9**	**17 / 3.1**

Notes: ha = hectare; LSA = Local Study Area; ROW = right-of-way; % = percent.
[1]Total in LSA Winter/Growing = 623/600 ha; [2]Total in LSA Winter/Growing = 4,456/5,709 ha;
[3]Total in LSA Winter/Growing = 5,012/3,681 ha; [4]Total in LSA Winter/Growing = 428/530 ha

[3] *Primary moose winter habitat is the best available winter range based on the presence and availability of the tall shrub community. These shrub communities are present in the secondary moose winter range but are generally temporary in nature unless frequent disturbance events occur* (Kalum LRMP; Government of BC, 2002b).

Table 6.6-19: Secondary Moose Winter Range Affected

Project Component	Amount (ha) / Proportion (%) of Suitable Habitat Affected within Secondary Moose Winter Range	
	Polygon ID – 89364[1]	Polygon ID – 89367[2]
Transmission line ROW	53.4 / 0.9	75.4 / 0.6
New Access Roads – Permanent	0.9 / <0.1	0.1 / <0.1
New Access Roads – Temporary	0.3 / <0.1	0 / 0
Total	**54.6 / 0.9**	**75.5 / 0.6**

Notes: ha = hectare; ROW = right-of-way; % = percent; ID = non-legal feature ID.
[1]Total area in ID89364 = 5,940 ha; [2]Total area in ID89367 = 12,448 ha.

6.6.2.2.8.2 Direct and/or Indirect Mortality

Direct mortality may be experienced by moose and may be caused by moose-vehicle collisions and increased hunting mortality. Large mammal-vehicle collisions in BC differ in magnitude, times of year and time of day, depending on species and region (Rea and Klassen, 2006; O'Keefe and Rea, 2012). In the North Coast Region surrounding Terrace, moose-vehicle collisions peak in winter (December through February), especially around 1700 hours to 1900 hours (O'Keefe and Rea, 2012). The highest risk zones for moose-vehicle collisions are often located where roads bisect a valley (Dussault et al., 2007). In addition, for this Project, the highest risk zones will likely also be where the suitable (moderate and high value) habitats intersect with current and new roads. As explained in the sensory section below, moose will tend to avoid roads but are more likely to cross where suitable security habitat intersects with the road. Indirect mortality may be experienced by moose by increasing the access and line-of-sight of predator species and human hunters. Road access to winter ranges is a concern because of increased disturbance and poaching when ungulates are concentrated on winter range. Disturbances on the winter range often results in animal displacements to less suitable habitat, increased vulnerability to predators and reduced survival rates (MFLNRO, 2002). An increase in hunting mortality is anticipated for this Project, as increased human access points, especially in previously unroaded areas, may lead to higher moose mortality (Lynch-Stewart, 2004; Anderson, 2014). Moose are known to use transmission line ROWs (Amec Foster Wheeler, 2015) and the presence of access roads and increased line-of-sight on ROWs facilitates moose hunting.

6.6.2.2.8.3 Sensory Disturbance

There is an energetic cost for moose due to human-caused disturbance such as noise from construction and vegetation clearing, particularly in winter when thermoregulatory requirements are high and during the growing season when calves are vulnerable to predation (MFLNRO, 2002). Moose are reported to avoid areas within 500 m of forest roads during periods of increased traffic in the boreal forest (Laurian et al., 2008). The effect of roads on ungulate spatial distribution is greater within landscapes where suitable habitat patches are clumped and the road network is well developed (Rettie and Messier, 2000).

6.6.2.2.8.4 Alteration of Movement Patterns

ROWs may act as movement barriers for moose. Joyal et al. (1984) demonstrated that moose refrain from crossing ROWs that exceeded 140 m in width, with stronger avoidance as width increases. Studies in Alberta have shown that moose were deflected from crossing a road when snow banks of plowed roads were 65 cm or greater (Jalkotzy et al., 1997). Alteration of movement patterns can have an effect at a daily or seasonal scale. A daily avoidance of a ROW will likely reduce the home range of moose. Studies have shown that moose with home ranges near highways avoid crossing roads resulting in home ranges being located primarily on one side of the highway (Laurian et al., 2008).

Moose have elevational migration routes (see **Section 6.5.2.5.1.2**), but it is not currently known if moose in the Kitimat Valley are migratory. If there is an elevational migration, however, the transmission line may alter seasonal movement patterns. As mentioned in the habitat alteration section, much of the growing and winter season suitable habitat overlaps and an elevational migration may not be required by all moose. The highest elevations within the LSA are found near Iron Mountain and Mount Clague. The provisional transmission line route near Iron Mountain stays at the base of the slope and is not located within suitable habitat during the growing season but is during the winter season. Near Mount Clague, the route increases in elevation and crosses suitable growing and winter habitat on the north and south side of Mount Clague (structures 161–165 and 169–175). Alterations of movement patterns are possible in this area.

6.6.2.2.8.5 Specific Mitigation Measures

WM25: Monitor moose activity in winter habitat from Nov 16 to May 14 in patches that intersect or are adjacent (≤500 m) to the ROW and new access roads near the following structure locations: 1–54, 57–69 and 70–182 (**Appendix D.4-9**). Monitor moose activity during calving (May 15 to July 15) near structure locations: 1–53, 58–182, 14–15, 22, 24–25, 31–34, 37–42, 44–48, 49–50, 60, 71–72, 74, 76–79, 80–82, 83–85, 96–98, 101–109, 113, 116–117, 119–122, 124–125, 128–129, 133–142, 145–153, 155–156 and 158–175 (**Appendix D.4-10**). The structure numbers identified are preliminary; final identification will be completed by a QEP once clearing limits have been finalized and will be considered in development of the CEMP.

WM26: Retain tree and shrub cover in gullies whenever practicable, where the need for vegetation clearing is reduced. Maintain tall shrub cover as line-of-sight breaks and visual screens at access points to the ROW and adjacent to the secondary winter range to the extent practicable.

WM27 Environmental monitor will record observations of habitat features important for moose such as wallows and mineral licks. A QEP will confirm observations and provide direction to crews to avoid disturbance around such features when moose are present, where feasible.

WM28: Consider alternatives to road salts and dust control chemicals on roads where run-off could affect water quality and act as an attractant.

Based on the effects assessment summarized in **Table 6.6-20**, most mitigation measures to avoid or minimize Project effects on moose during the different Project phases are not anticipated to be highly effective and adverse residual effects are possible. The only exception is alteration of habitat during Project closure when avoidance and minimization of Project footprint along with following

BMPs are anticipated to be highly effective mitigation measures. All other potential effects are considered adverse residual effects (**Section 6.6.3**).

Table 6.6-20: Summary of Potential Effects, Mitigation Measures and Anticipated Effectiveness of Mitigation for Moose

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
Clearing / Construction	Alteration of Habitat	• Minimize removal of forest cover to the extent practicable (**WM1, WM26**) • Minimize clearing/construction footprint (**WM2, WM27**) • Implement BMPs **(WM4**)	WM1, WM2, WM26 = Low WM3, WM4, WM27 = Moderate	Yes
	Direct and/or Indirect Mortality	• Minimize activity to the extent practicable during the risk timing windows if moose are present (WM4 and **WM25**) • Create line-of-sight breaks to the extent practicable (**WM26**) • Avoid chemical attractants on roads to the extent practicable (**WM28**) • Implement BMPs **(WM4**) • Implement Access Management Plan (**WM9A**)	WM3, WM4, WM9A, WM25, WM26, WM28 = Moderate	Yes
	Sensory Disturbance	• Minimize activity to the extent practicable during the risk timing windows, if moose are present (WM4 and **WM25**) • Implement **(WM4**) • Implement Access Management Plan (**WM9A**)	WM3, WM4, WM9A, WM25 = Moderate	Yes
	Alteration of Movement Patterns	• Implement Access Management Plan (**WM9A**)	WM9A = Moderate	Yes
Operation / Maintenance	Alteration of Habitat	• Minimize removal of shrub cover to the extent practicable (**WM1, WM26**)	WM1, WM26 = Low	Yes
	Direct and/or Indirect Mortality	• Minimize activity to the extent practicable during the risk timing windows if moose are present (WM4 and **WM25**) • Minimize chemical attractants on roads to the extent practicable (**WM28**) • Implement BMPs **(WM4**) • Implement Access Management Measures (**WM9B**)	WM3, WM4, WM9B, WM25, WM28 = Moderate	Yes
	Sensory Disturbance	• Minimize activity to the extent practicable during the risk timing windows if moose are present (WM4 and **WM25**) • Implement BMPs **(WM4**) • Implement Access Management Measures (**WM9B**)	WM3, WM4, WM9B, WM25 = Moderate	Yes
	Alteration of Movement Patterns	• Implement Access Management Measures (**WM9B**)	WM9B = Moderate	Yes

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
Closure	Alteration of Habitat	• Minimize clearing/construction footprint (**WM2, WM27**) • Implement Restoration and closure plan (**WM5**)	WM2, WM5, WM27 = High	No
	Direct and/or Indirect Mortality	• Minimize activity to the extent practicable during the risk timing windows if moose are present (WM4 and **WM25**) • Minimize chemical attractants on roads (**WM28**) • Implement BMPs **(WM4**) • Follow Access Management Measures (**WM9B**)	WM25 = Low WM3, WM4, WM9B, WM28 = Moderate	Yes
	Sensory Disturbance	• Minimize activity to the extent practicable during the risk timing windows if moose are present (WM4 and **WM25**) • Implement BMPs **(WM4**) • Implement Access Management Measures (**WM9B**)	WM25 = Low WM3, WM4, WM9B = Moderate	Yes
	Alteration of Movement Patterns	• Implement Access Management Measures (**WM9B**)	WM9B = Moderate	Yes
Post-closure	Direct and/or Indirect Mortality	• Implement Access Management Measures (**WM9B**)	WM9B = Moderate	Yes

Note: BMP = best management practice.

6.6.2.2.9 Pacific Marten

6.6.2.2.9.1 Alteration of Habitat

Habitat suitability classes for Pacific marten and overlap with the provisional transmission line route are shown in **Appendix D.4-11**. The calculated values of anticipated habitat alteration (**Table 6.6-21**) indicate that approximately 77 ha (5.5%) of moderate and high suitability habitat within the LSA will be affected by the clearing/construction of the ROW and new access roads. There are approximately 29 intersections of the ROW and new roads with suitable habitat, indicating possible alteration of habitat for potentially that same number of martens. Some of the habitat areas intersecting the line are large enough to contain multiple martens as high habitat quality results in relatively small territories and home ranges. The moderate and high suitability habitat near the Lakelse River will be preserved between structures 21 and 22 due to the design mitigation of the provisional alignment not requiring removal of the forest. Martens are sensitive to habitat fragmentation of mature forest and most of the suitable habitat patches intersected by the ROW will be fragmented (**Appendix D.4-11**). Due to vegetation management on ROW and access roads, it is not anticipated that suitable habitat of mature or old forest will be restored until late in the post-closure Project phase. Once lost, structural elements required by Pacific martens during the winter for denning and resting require more than a century to develop (Slauson and Zielinski, 2009). The additional loss of dense, shade-tolerant shrub layer would take 10–20 years to regrow after removal or alteration (United States Fish and Wildlife Service, 2015).

Table 6.6-21: Potential Pacific Marten Living Habitat Affected during the Winter Season within the Local Study Area

Project Component	Amount (ha) / Proportion (%) of Rated Habitat Affected Within the LSA			
	Nil Suitability[1]	Low Suitability[2]	Moderate Suitability[3]	High Suitability[4]
Transmission line ROW	140 / 7.6	418 / 6.6	10 / 1.8	65 / 3.6
New Access Roads – Permanent	2 / 0.1	7 / 0.1	<1 / <0.1	2 / 0.1
New Access Roads – Temporary	0 / 0.0	<1 / <0.1	0 / 0.0	<1 / <0.1
Total	**142 / 7.7**	**425 / 6.7**	**10 / 1.8**	**67 / 3.7**

Notes: ha = hectare; LSA = Local Study Area; ROW = right-of-way; % = percent.
[1]Total in LSA = 1,852 ha; [2]Total in LSA = 6,343 ha; [3]Total in LSA = 529 ha; [4]Total in LSA = 1,796 ha.

6.6.2.2.9.2 Direct and/or Indirect Mortality

Martens may experience direct mortality caused by inadvertent den destruction during vegetation clearing, if conducted during the natal denning and early rearing period, and by martens colliding with vehicles. The highest risk of marten-vehicle collisions would likely occur when juvenile martens are dispersing. Indirect mortality may occur due to increased access for trappers and poachers (Claar et al., 1999) or to decreased prey availability.

6.6.2.2.9.3 Sensory Disturbance

Claar et al. (1999) speculated that there is an energetic cost to human-caused disturbance (e.g. noise from construction and vegetation-clearing activities) on martens, particularly in winter when thermoregulation requirements are high. Zielinski et al. (2008) found no effect of off-road vehicles on marten occupancy, suggesting that noise from recreationalists had little to no effect on populations. No data exist that quantify the magnitude, frequency or duration of sensory disturbance that would result in Pacific marten experiencing abandonment of natal dens.

6.6.2.2.9.4 Alteration of Movement Patterns

Martens have been shown to avoid cleared linear corridors (i.e. seismic lines) ≥3 m wide (Tigner, 2012), primarily to reduce risk of predation. As this value is substantially lower than the anticipated range of the width of the transmission line ROW (42 m to 130 m) and the cleared ROW width of access roads (20 m), it is anticipated that martens will change their movement patterns and territory/home range use in response to ROW clearing and subsequent vegetation management.

6.6.2.2.9.5 Specific Mitigation Measures

WM29: If vegetation clearing is scheduled between March 1 and September 30, the EMP will include provisions for denning surveys as appropriate in suitable habitat patches that intersect or are adjacent to the ROW and new access roads near the following structure locations: 1–18, 20–24, 26–48, 49–52, 59–66, 70–73, 76–80, 82–87, 88–90, 95–116, and 119–177. The structure numbers identified are preliminary; final identification will be completed by a QEP once clearing limits have been finalized.

WM30: Retain shrub cover on ROW to the extent practicable, especially adjacent to suitable marten habitat patches. Retain vegetation cover and coarse woody debris piles along the edges of the ROW, where feasible. Retain tree and shrub cover, coarse woody debris and wildlife trees in gullies and other low impact areas within the ROW, wherever practicable. To the extent practicable, retain visual cover and line-of-sight breaks at road access points to the ROW.

Based on the effects assessment summarized in **Table 6.6-22**, most mitigation measures to avoid or minimize alteration of habitat during clearing/construction and direct and/or indirect mortality and sensory disturbance during clearing/construction and operation/maintenance are not anticipated to be highly effective. These potential effects are therefore considered adverse residual effects (**Section 6.6.3**).

Table 6.6-22: Summary of Potential Effects, Mitigation Measures, and Anticipated Effectiveness of Mitigation for Pacific Marten

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
Clearing / Construction	Alteration of Habitat	• Minimize removal of forest cover to the extent practicable (**WM1, WM30**) • Minimize clearing/construction footprint (**WM2**) • Implement BMPs (**WM4**)	WM1, WM2, WM3, WM4 = Low WM30 = Moderate	Yes
	Direct and/or Indirect Mortality	• Minimize activity to the extent practicable during the denning season, if martens are present (**WM29**) • Conduct pre-clearing surveys for potential denning areas where warranted (**WM29**) • Implement BMPs (**WM4**) • Implement Access Management Plan (**WM9A**)	WM3, WM4, WM29 = Moderate WM9A = High	Yes
	Sensory Disturbance	• Minimize activity to the extent practicable during the denning season, if martens are present (**WM29**) • Implement BMPs (**WM4**) • Implement Access Management Plan (**WM9A**)	WM29 = Moderate WM3, WM4, WM9A = High	Yes
	Alteration of Movement Patterns	• Minimize removal of forest cover to the extent practicable (**WM1, WM30**) • Minimize clearing/construction footprint (**WM2**) • Implement BMPs (**WM4**)	WM1, WM2, WM3, WM4 = Low WM30 = Moderate	Yes
Operation / Maintenance	Direct and/or Indirect Mortality	• Implement BMPs (**WM4**) • Implement Access Management Measures (**WM9B**)	WM3, WM4, WM9B = High	No
	Sensory Disturbance	• Implement BMPs (**WM4**) • Implement Access Management Measures (**WM9B**)	WM3, WM4, WM9B = High	No

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
	Alteration of Movement Patterns	• Minimize removal of shrub cover to the extent practicable (**WM1, WM30**) • Minimize clearing/construction footprint (**WM2**) • Implement BMPs (**WM4**)	WM1, WM2, WM3, WM4 = Low WM30 = Moderate	Yes
Closure	Direct and/or Indirect Mortality	• Minimize activity to the extent practicable during the during the denning season, if martens are present (**WM29**) • Conduct pre-clearing surveys for potential denning areas where warranted (**WM29**) • Implement BMPs (**WM4**) • Implement Access Management Measures (**WM9**B	WM3, WM4, WM29 = Moderate WM9B = High	Yes
	Sensory Disturbance	• Minimize activity to the extent practicable during the during the denning season, if martens are present (**WM29**) • Implement BMPs (**WM4**) • Implement Access Management Measures (**WM9B**)	WM29 = Moderate WM3, WM4, WM9B = High	Yes
Post-closure	Direct and/or Indirect Mortality	• • Implement Restoration and Closure Plan (**WM5**) • Implement Access Management Measures (**WM9B**)	WM3, WM5, WM9B = High	No

Note: BMP = best management practice.

6.6.2.2.10 Keen's Myotis

6.6.2.2.10.1 Alteration of Habitat

Habitat suitability classes for Keen's myotis and overlap with the provisional transmission line route are shown in **Appendix D.4-12**. The calculated values of anticipated habitat alteration (**Table 6.6-23**) indicate that approximately 1,309 ha (5.6%) of optimal growing habitat will be affected by the clearing/construction of the ROW and new access roads. The optimal habitat near the Lakelse River will be preserved between structures 21 and 22 due to the provisional route not requiring removal of forest. The alteration of habitat includes the loss of foraging habitat and also the loss of potential roost sites. The day-roosts in trees within the optimal habitat are a critical resource for many forest-dwelling bat species (Boland et al., 2009). Removal of large-diameter trees during timber harvest can reduce the number of potential roosts available to bats, and harvesting forests under short rotations can inhibit the development of suitable roosts over time (Hayes and Loeb, 2007). Due to vegetation management on ROW and access roads, it is not anticipated that suitable habitat will be restored until late in the post-construction Project phase, with the exception of temporary access roads. Once lost, structural elements required in optimal Keen's myotis habitat require more than a century to develop, based on the age and size of roost trees.

Table 6.6-23: Potential Keen's Myotis Living Habitat Affected during the Growing Season within the Local Study Area

Project Component	Amount (ha) / Proportion[1] (%) of Optimal Habitat Affected Within the LSA
Transmission Line ROW	129 / 5.5
New Access Roads – Permanent	1 / <0.1
New Access Roads – Temporary	<1 / <0.1
Total	**130 / 5.6**

Notes: ha = hectare; LSA = Local Study Area; ROW = right-of-way; % = percent.
[1]Total in LSA = 2,340 ha.

6.6.2.2.10.2 Direct and/or Indirect Mortality

Direct mortality may be experienced by roosting Keen's myotis during forest clearing. Tree harvesting disturbances are reasonably certain to interact with tree roosting bats during the maternity roosting period and possibly during the winter hibernaculum window (BC MFLNRO, 2014a). Indirect mortality can be caused by use of chemicals for silvicultural/agricultural pest control. The white-nose syndrome has not yet been recorded within BC; however, the rate of spread indicates that it may affect bats in the province of BC within 20 years (COSEWIC, 2012b), which is during the life of this Project. If and when the syndrome occurs in the Kitimat Valley, the effects of the Project and the syndrome on the local Keen's myotis population may be additive. There are currently no known hibernacula in caves or mines within the LSA.

6.6.2.2.10.3 Sensory Disturbance

A change in ambient noise and artificial light may occur during the life of the Project, which could result in disturbance to roosting and foraging behaviour of bats. Noise, whether natural or anthropogenic, has been shown to reduce bat activity due to its interference with their echolocation calls. Siermers and Schuab (2010) found that vehicle noise reduced bat activity near highways. Ultrasonic deterrents have been used by wind power companies to try to decrease the number of bats killed by wind turbines. A background noise level of 65 dB was noted to interfere with bats with an ultrasonic frequency similar to that of Keen's myotis (Arnett et al., 2013). Noise associated with clearing/construction may be above this frequency and has the potential to cause sensory disturbance, especially during blasting events. Smaller forest bats like Keen's myotis do not typically forage at light sources, likely due to the threat of predation (Furlonger et al., 1987).

6.6.2.2.10.4 Alteration of Movement Patterns

Although daily and seasonal movements of bats in northwestern BC are not well understood, daily movements between foraging and roosting sites can be up to 20 km (Nagorsen et al., 2013; Cryan, 2003). Keen's myotis only uses forest interior and edge habitat; therefore, there could be an alteration of movement patterns in areas where the ROW or roads bisect optimal habitat. A number of studies have demonstrated that, while some forest specialist bat species may forage along the edges created by clearings such as cutblocks (Grindal, 1996), few bats forage in the clear cuts themselves (Humes et al., 1999; Ericksen and West, 2003). There is no literature available on the width of a corridor or opening that reduces its habitat function for Keen's myotis.

6.6.2.2.10.5 Specific Mitigation Measures

WM31: Since the critical maternal roosting period (May 15 to September 30) and critical winter hibernation period (October 1 to May 31) for Keen's myotis span the entire year, the CEMP and associated Myotis management plans will include provisions for when and how surveys for maternity roost or hibernaculum sites should be carried out in optimal habitat. This may include optimal habitat patches that intersect or are adjacent to the ROW and new access roads near the following structure locations: 1–25, 27–29, 30–80, 82–87, 89–90, 95–99, 101–111, 113, 116–165, and 168–182 (**Appendix D.4-12**). The structure numbers identified are preliminary; final identification will be determined by a QEP once clearing limits have been finalized. If hibernacula or active maternity roosts are located, and in habitat with a high likelihood of supporting roosts or hibernacula, appropriate buffers, as determined by a QEP, will be established. A wildlife management plan will be developed for Myotis species following the North Area bat guidelines and relevant Species At Risk Act species recovery plans (see WM3 and **WM4**).

Based on the effects assessment summarized in **Table 6.6-24**, mitigation measures to avoid or minimize habitat loss, direct or indirect mortality, sensory disturbance and alteration of movement patterns during clearing/construction are not predicted to be highly effective. The four potential effects are therefore considered adverse residual effects (**Section 6.6.3**).

Table 6.6-24: Summary of Potential Effects, Mitigation Measures and Anticipated Effectiveness of Mitigation for Keen's Myotis

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
Clearing / Construction	Alteration of Habitat	• Minimize removal of old forest cover to the extent practicable (**WM1**) • Minimize clearing/construction footprint (**WM2**) • Implement Myotis Management Plan and BMPs (**WM3, WM4**)	WM1, WM2, WM3, WM4 = Low	Yes
	Direct and/or Indirect Mortality	• In consultation with a QEP minimize activity to the extent practicable near known active roosts or hibernacula (**WM31**) • Conduct appropriate pre-clearing/construction surveys and create buffers where required (**WM31, WM4**) • Implement Myotis Management Plan and BMPs (**WM3, WM4**)	WM31 = Low WM3, WM4 = Moderate	Yes
	Sensory Disturbance	• In consultation with a QEP minimize activity to the extent practicable near known active roosts or hibernacula (**WM31**) • Conduct appropriate pre-clearing/construction surveys and create buffers where required (**WM31, WM4**) • Implement Myotis Management Plan and BMPs (**WM3, WM4**) • Implement Access Management Plan (**WM9**)	WM31 = Low WM3, WM4, WM9 = Moderate	Yes

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
	Alteration of Movement Patterns	• Minimize fragmentation of old forest patches (**WM1**) • Implement Myotis Management Plan and BMPs (**WM3, WM4**)	WM1 = Low WM3, WM4 = Moderate	Yes

Note: BMP = best management practice.

6.6.2.2.11 Western Toad

6.6.2.2.11.1 Alteration of Habitat

Optimal habitat for western toads and overlap with the provisional transmission line route are shown in **Appendix D.4-13**. The calculated values of anticipated habitat alteration (**Table 6.6-25**) indicate that approximately 229 ha (5.2%) of optimal habitat will be affected by the clearing/construction of the ROW and new access roads. This habitat occurs at numerous locations along the ROW but most importantly in wetlands at the following 11 structure locations: 24–25, 33–34, 37–38, 58–59, 61, 74, 76–77, 80–81, 121–122, 128–129 and 132–134 (**Appendix D.4-13**). Of the total 10,609 ha LSA, 4,386 ha (44%) are considered optimal western toad habitat, much of which will be fragmented by the ROW and access roads.

Table 6.6-25: Potential Optimal Western Toad Living Habitat Affected during the Growing Season within the Local Study Area

Project Component	Amount (ha) / Proportion[1] (%) of Optimal Habitat Affected Within the LSA
Transmission Line ROW	226 / 5.2
New Access Roads – Permanent	3 / 0.1
New Access Roads – Temporary	<1 / <0.1
Total	**229 / 5.2**

Notes: ha = hectare; LSA = Local Study Area; ROW = right-of-way; % = percent.
[1]Total in LSA = 4,386 ha.

6.6.2.2.11.2 Direct and/or Indirect Mortality

During clearing/construction, direct mortality may be experienced by adult and juvenile western toads if riparian forest clearing is conducted while frogs are using the forest habitat. Construction-related road traffic will increase risk of road mortality. Indirect mortality may occur due to the effects of forest clearing at or near the edge of natal wetlands and ponds; effects include significant reduction in moist or wet habitat conditions and altered availability of preferred prey, requiring the toads to increase their movements. The latter will further increase risk of road mortality.

6.6.2.2.11.3 Specific Mitigation Measures

WM32: Subject to safety and constructability requirements, minimize clearing adjacent (≥100 m) to the ROW within the optimal habitat patches that surround wetlands and intersect or are adjacent to the ROW and new access roads at the following structure locations: 1–5, 6–12, 13–19, 20–26, 30–55, 58–62, 66–67, 71–72, 73–82, 83–118, 119–126, 127–138, 140–141, 145–153, 158–159, 161–165, 167–175, and 181–182 (**Appendix D.4-14**). The structure numbers identified are preliminary; final identification will be completed by a QEP once clearing limits have been finalized and considered in development of the CEMP and Amphibian management plan.

WM33A: Subject to safety and constructability requirements during the clearing/construction phase, minimize use of heavy machinery near wetlands and ponds.

WM33B: To the extent practicable during the operation/maintenance phase, minimize use of heavy machinery and avoid the use of herbicides near wetlands and ponds for vegetation management purposes, as described in the IVMP (BC Hydro, 2016) and AWPRV (BC Hydro, 2003a).

Based on the effects assessment summarized in **Table 6.6-26**, mitigation measures to avoid or minimize habitat loss, direct and/or indirect mortality and alteration of movement patterns during clearing/construction, operation/maintenance and closure are not anticipated to be highly effective. These potential effects are therefore considered adverse residual effects (**Section 3.0**).

Table 6.6-26: Summary of Potential Effects, Mitigation Measures and Anticipated Mitigation Success for Western Toad

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
Clearing / Construction	Alteration of Habitat	• Minimize removal of forest cover near wetlands and ponds to the extent practicable (**WM1**) • Minimize clearing/construction footprint (**WM2**) • Minimize clearing to the extent practicable in optimal habitat (**WM32**) • Implement Amphibian Management Plan and BMPs (**WM3, WM4**)	WM1, WM2, WM3, WM4, WM32 = Low	Yes
	Direct and/or Indirect Mortality	• Minimize clearing to the extent practicable in optimal habitat (**WM32**) • Minimize using heavy machinery in riparian zones (**WM33A**) • Implement Amphibian Management Plan and BMPs (**WM3, WM4**)	WM32 = Low WM3, WM4 = Moderate WM33A = High	Yes
Operation / Maintenance	Alteration of Habitat	• Minimize removal of shrub cover near wetlands and ponds (**WM1**) • Minimize clearing/construction footprint (**WM2**) • Minimize clearing to the extent practicable in optimal habitat (**WM32**) • Implement Amphibian Management Plan and BMPs (**WM3, WM4**)	WM1, WM32 = Low WM2, WM3, WM4 = Moderate	Yes
	Direct and/or Indirect Mortality	• Minimize clearing to the extent practicable in optimal habitat (**WM32**) • Minimize use of heavy machinery and herbicides in riparian zones (**WM33B**) • Implement Amphibian Management Plan and BMPs (**WM3, WM4**)	WM32 = Low WM3, WM4 = Moderate WM33B = High	Yes

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
Closure	Alteration of Habitat	• Minimize removal of shrub cover near wetlands and ponds (**WM1**) • Minimize clearing/construction footprint (**WM2**) • Minimize clearing to the extent practicable in optimal habitat (**WM32**) • Implement Amphibian Management Plan and BMPs (**WM3, WM4**) • Restore forest habitat around wetlands and ponds **(WM5)**	WM1, WM32 = Low WM2, WM3, WM4 = Moderate WM5 = High	Yes
	Direct and/or Indirect Mortality	• Minimize clearing to the extent practicable in optimal habitat (**WM32**) • Minimize use of heavy machinery in riparian zones (**WM33A**) • Implement Amphibian Management Plan and BMPs (**WM3, WM4**)	WM32 = Low WM3, WM4 = Moderate WM33A = High	Yes

Note: BMP = best management practice.

6.6.2.2.12 Coastal Tailed Frog

6.6.2.2.12.1 Alteration of Habitat

Optimal habitat for coastal tailed frog and overlap with the provisional transmission line route are shown in **Appendix D.4-14**. The calculated values of anticipated habitat alteration (**Table 6.6-27**) indicate that approximately 15 ha (4.9%) of optimal habitat within the LSA will be affected by the clearing/construction of the ROW and new access roads. This habitat occurs around streams that intersect with the ROW and roads at nine locations between the following structures: 7–8, 40–42, 45–46, 83–84, 84–85, 96–97, 121–122, 171–172 and 172–173. As discussed in **Section 6.5.2.8.2.3**, potential coastal tailed frog distribution within the LSA may include most perennial streams of stream order 1–3 that intersect with the LSA. Therefore, it is difficult to estimate the effect this level of habitat loss may have on the population.

Table 6.6-27: Potential Optimal Coastal Tailed Frog Living Habitat Affected during the Growing Season within the Local Study Area

Project Component	Amount (ha) / Proportion[1] (%) of Optimal Habitat Affected Within the LSA
Transmission Line ROW	14 / 4.7
New Access Roads – Permanent	1 / 0.2
New Access Roads – Temporary	0 / 0.0
Total	**15 / 4.9**

Notes: ha = hectare; LSA = Local Study Area; ROW = right-of-way; % = percent.
[1]Total in LSA = 301 ha.

6.6.2.2.12.2 Direct and/or Indirect Mortality

During clearing/construction, direct mortality may be experienced by adult and juvenile tailed frogs if riparian forest clearing is conducted while frogs are using the forest habitat. Indirect mortality may occur due to the effects of forest clearing at or near the edge of streams; effects may include increased siltation of stream beds, organic material, and stream temperature, all of which may reduce the viability of eggs and tadpoles. Any clearing around streams will likely leave a maximum of 15 m riparian buffer, less than the recommended 100 m forested habitat needed for optimal habitat conditions around suitable streams.

6.6.2.2.12.3 Alteration of Movement Patterns

Adult and juvenile tailed frogs forage on the forest floor and move away from streams in search of food or to find suitable ovopositioning sites (Hayes et al., 2006); movement can be as far as several hundred metres from the streams' edge (BC MOE, 2004). Since tailed frogs are dependent on the moist and wet forest floor conditions and structural diversity of mature or old riparian forests, any forest clearing in tailed frog habitat will potentially limit or change their movement patterns.

6.6.2.2.12.4 Specific Mitigation Measures

WM34: Subject to safety and constructability requirements, minimize clearing adjacent to the ROW, especially within the optimal habitat patches that intersect or are adjacent to the ROW and new access roads near the following structure locations: 6–9, 40–42, 43–46, 83–85, 84–85, 95–98, 107–109, 121, 170–173, and 174–175 (**Appendix D.4-14**). The structure numbers identified are preliminary; final identification will be completed by a QEP once clearing limits have been finalized and considered in development of the CEMP and Amphibian management plan.

WM35: Adjacent to any stream of order 1–3, avoid using heavy machinery in RVMAs to minimize ground disturbance, erosion and stream siltation. If machinery encroachment into RVMAs is required, site-specific environmental protection plans will be developed to minimize ground disturbance, erosion and stream siltation. Use hand tools and/or other clearing techniques that minimize ground disturbance, erosion and stream siltation during clearing/construction and vegetation management.

Based on the effects assessment summarized in **Table 6.6-28**, mitigation measures to avoid or minimize habitat loss, direct and/or indirect mortality and alteration of movement patterns during clearing/construction are not anticipated to be highly effective. These potential effects are therefore considered adverse residual effects (**Section 6.6.3**).

Table 6.6-28: Summary of Potential Effects, Mitigation Measures and Anticipated Mitigation Success for Coastal Tailed Frog

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
Clearing / Construction	Alteration of Habitat	• Minimize removal of forest cover near streams to the extent practicable (**WM1**) • Minimize clearing/construction footprint (**WM2**)	WM1, WM34 = Low WM2, WM3, WM4 = Moderate	Yes

Phase	Potential Effect	Proposed Mitigation	Anticipated Effectiveness Rating	Residual Effect (Yes or No)
		• Minimize clearing to the extent practicable in optimal habitat (**WM34)** • Implement Amphibian Management Plan and BMPs (**WM3, WM4**)		
	Direct and/or Indirect Mortality	• Minimize clearing to the extent practicable in optimal habitat (**WM34**) • Avoid using heavy machinery in RVMAs (**WM35**) • Implement Amphibian Management Plan and BMPs (**WM3, WM4**)	WM34 = Low WM3, WM4 = Moderate WM35 = High	Yes
	Alteration of Movement Patterns	• Minimize removal of forest cover near streams to the extent practicable (**WM1**) • Minimize clearing/construction footprint (**WM2**) • Minimize clearing to the extent practicable in optimal habitat (**WM34**) • Implement Amphibian Management Plan and BMPs (**WM3, WM4**)	WM1, WM34 = Low WM2, WM3, WM4 = Moderate	Yes
Operation / Maintenance	Direct and/or Indirect Mortality	• Minimize using heavy machinery and herbicides in RVMAs (**WM35)**	WM35 = High	No
	Alteration of Movement Patterns	• Avoid removal of shrub cover near streams (**WM1**) • Minimize clearing/construction footprint (**WM2**) • Minimize clearing to the extent practicable in optimal habitat (**WM34**) • Implement Amphibian Management Plan and BMPs (**WM3, WM4**)	WM1, WM34 = Low WM2, WM3, WM4 = Moderate	Yes
Closure	Direct and/or Indirect Mortality	• Minimize using heavy machinery in RVMAs (**WM35)**	WM35 = High	No

Note: BMP = best management practice.

6.6.3 Residual Effects

All wildlife mitigation measures must be compliant with the North American Electric Reliability Council standards and/or with BC Hydro's vegetation management plan. If potential effects of the Project on wildlife VCs cannot be avoided through design or through mitigation during clearing/construction or operation/maintenance, then residual effects can be expected. Residual effects are described below by VC, incorporating the information from the subcomponent species provided in the previous section.

6.6.3.1 Landbirds

Landbirds could experience residual effects due to the alteration of habitat during clearing/construction and direct and/or indirect mortality during operation/maintenance. The recommended mitigation measures for avoidance of adverse effects on suitable habitat and minimization of the Project's footprint are not expected to be highly effective. Once habitat, in particular mature and old forest habitat, has been lost during the clearing/construction phase, it will not be restored until long after decommissioning of the transmission line. While protection of nesting migratory birds is mandatory and mitigation measures to prevent mortality are considered highly effective, mitigation measures aimed at reducing direct mortality from collisions with the transmission lines are expected to have only limited effectiveness. Alteration of habitat and direct and/or indirect mortality during operation/maintenance are considered residual adverse effects.

6.6.3.2 Waterbirds

Waterbirds could experience residual effects due to the alteration of habitat during clearing/construction and direct and/or indirect mortality during operation/maintenance. The recommended mitigation measures for avoidance of adverse effects on suitable habitat and minimization of the Project's footprint are not expected to be highly effective. Once habitat, in particular mature and old forest habitat, has been lost during the clearing/construction phase, it will not be restored until long after decommissioning of the transmission line. While protection of nesting migratory waterbirds is mandatory and mitigation measures to prevent mortality are considered highly effective, mitigation measures aimed at reducing direct mortality from collisions with the transmission lines are expected to have moderate effectiveness. Alteration of habitat and direct and/or indirect mortality during operation/maintenance are considered residual adverse effects.

6.6.3.3 Raptors

Raptors could experience residual effects due to the alteration of habitat during clearing/construction and direct and/or indirect mortality during operation/maintenance. The recommended mitigation measures for avoidance of adverse effects on suitable habitat and minimization of the Project's footprint are not expected to be highly effective. Once habitat, in particular mature and old forest habitat, has been lost during the clearing/construction phase, it will not be restored until long after decommissioning of the transmission line. While protection of nesting raptors is mandatory and mitigation measures to prevent mortality are considered highly effective, mitigation measures aimed at reducing direct mortality from collisions with the transmission lines are expected to have limited effectiveness. Alteration of habitat and direct and/or indirect mortality during operation/maintenance are considered residual adverse effects.

6.6.3.4 Bears

Bears could experience residual effects due to the alteration of habitat, direct and/or indirect mortality, sensory disturbance and alteration in movement patterns from clearing/construction through to the closure phase, with the exception of alteration of habitat during closure. Direct or indirect mortality in the post-closure phase is also expected to be a residual effect. The recommended mitigation measures for avoidance of adverse effects on suitable habitat and minimization of the Project's footprint are not expected to be highly effective. Once habitat, in particular mature and old forest habitat, has been lost during the clearing/construction phase, it will not be restored until long after decommissioning of the transmission line. Direct and/or indirect mortality, sensory disturbance and alteration of movement patterns are primarily related to the adverse effects of new and reconstruction access roads (particularly continued use by the public) and mitigation is not expected to be highly effective. All potential effects during all Project phases, except for alteration of habitat during closure, are considered residual adverse effects.

6.6.3.5 Ungulates

Ungulates could experience residual effects due to the alteration of habitat, direct and/or indirect mortality, sensory disturbance and alteration in movement patterns from clearing/construction through to the closure phase, with the exception of alteration of habitat during closure. Direct or indirect mortality in the post-closure phase is also expected to be a residual effect. The recommended mitigation measures for avoidance of adverse effects on suitable habitat and minimization of the Project's footprint are not expected to be highly effective. Once habitat, in particular mature and old forest habitat, has been lost during the clearing/construction phase, it will not be restored until long after decommissioning of the transmission line. Direct and/or indirect mortality, sensory disturbance and alteration of movement patterns are primarily related to the adverse effects of new and upgraded access roads, and mitigation is not expected to be highly effective. All potential effects during all Project phases, except for alteration of habitat during closure, are considered residual adverse effects.

6.6.3.6 Furbearers

Furbearers could experience residual effects due to the alteration of habitat, direct or indirect mortality and sensory disturbance during clearing/construction and direct and/or indirect mortality and sensory disturbance during closure. The recommended mitigation measures for avoidance of adverse effects on suitable habitat and minimization of the Project's footprint are not expected to be highly effective. Once habitat, in particular mature and old forest habitat, has been lost during the clearing/construction phase, it will not be restored until long after decommissioning of the transmission line. Direct and/or indirect mortality, sensory disturbance and alteration of movement patterns are primarily related to the adverse effects of new and upgraded access roads, and mitigation is not expected to be highly effective. All potential effects during all Project phases, except for alteration of habitat during closure, are considered residual adverse effects.

6.6.3.7 Bats

Bats could experience residual effects due to the alteration of habitat, direct and/or indirect mortality, sensory disturbance and the alteration of movement patterns during clearing/construction. The recommended mitigation measures for avoidance of adverse effects on suitable habitat and minimization of the Project's footprint are not expected to be highly effective. Once habitat, in particular mature and old forest habitat, has been lost during the clearing/construction phase, it will not be restored until long after decommissioning of the transmission line. Mitigation measures aimed at reducing direct and/or indirect mortality, sensory disturbance and alteration of movement patterns are also not expected to be highly effective during clearing/construction as the timing and location of clearing/construction activities cannot be adjusted to avoid effects. All potential effects during clearing/construction are considered adverse residual effects.

6.6.3.8 Amphibians

Amphibians could experience residual effects due to the alteration of habitat, direct and/or indirect mortality and alteration of movement patterns from clearing/construction through to closure. Effects will no longer be present during the post-closure phase. The recommended mitigation measures for avoidance of adverse effects on suitable habitat and minimization of the Project's footprint are not expected to be highly effective. Once habitat, in particular mature and old forest habitat, has been lost during the clearing/construction phase, it will not be restored until long after decommissioning of the transmission line. Mitigation to avoid/minimize direct and/or indirect mortality during clearing/construction and alteration of movement patterns during clearing/construction and operation/maintenance are not expected to be highly effective due to vegetation clearing and subsequent management requirements. Alteration of movement patterns will no longer be an effect starting at the closure phase when the affected areas are reclaimed and vegetation starts to provide cover again. All potential effects except sensory disturbance are considered adverse residual effects.

6.6.4 Characterization of Residual Effects

This section characterizes the Project's anticipated residual adverse effects with respect to context, magnitude, geographic extent, duration, reversibility and frequency (defined in **Section 3.3.8**). A summary of the residual effects for all VCs is provided at the end of this subsection in **Table 6.6-29**. The direction of all residual effects for wildlife VCs are considered to be adverse due to the alteration of habitat, direct and/or indirect mortality, sensory disturbance and alteration in movement patterns.

6.6.4.1 Landbirds

Context is rated as high due to the confirmed presence of species listed under *SARA* Schedule 1 within the LSA. In addition, previous logging of mature and old growth forest throughout the Kitimat River Valley may have removed large amounts of optimal habitat. The magnitude of the residual effect is low due to the loss of less than the threshold value of 20% of optimal habitat. The residual effect of direct or indirect mortality will occur intermittently from clearing/construction through operation/maintenance, and it is expected to be local in geographic extent and restricted to the LSA. It is reversible, but will be long term due to the length of time required for cut forest to return to a mature state.

The full characterization of residual effects for the landbirds VC is described in **Table 6.6-29**. These effects are not anticipated to require further planning, due to the low magnitude, local extent, intermittent occurrence and reversibility.

6.6.4.2 Waterbirds

Context is rated as high due to the confirmed presence of species listed under *SARA* Schedule 1 within the LSA. In addition, previous logging of mature and old growth forest throughout the Kitimat River Valley may have removed large amounts of optimal habitat. The magnitude of the residual effect is low due to the loss of less than the threshold value of 20% of optimal habitat. The residual effect of mortality will occur intermittently during the clearing/construction and operation/maintenance phases and will be local in geographic extent and restricted to the LSA. Its duration will be long term and considered irreversible, due to the length of time required for a cut forest to return to an old growth state.

The full characterization of residual effects for the waterbirds VC is described in **Table 6.6-29**. These effects are not anticipated to require further planning, due to the low magnitude, local extent and intermittent occurrence.

6.6.4.3 Raptors

Context is rated as high due to the confirmed presence of species listed under *SARA* Schedule 1 within the LSA. In addition, previous logging of mature and old growth forest throughout the Kitimat River Valley may have removed large amounts of suitable habitat. The magnitude of the residual effect is negligible due to anticipated mortality losses which would be within the range of natural variation and not measurable. The residual effect of habitat loss will occur once during clearing/construction and will be local in geographic extent and restricted to the LSA. Its duration will be long term and considered irreversible, due to the length of time required for cut forest to return to an old growth state.

The full characterization of residual effects for the raptors VC is described in **Table 6.6-29**. These effects are not anticipated to require further planning, due to the negligible magnitude, local extent and one-time occurrence.

6.6.4.4 Bears

For black bears, the residual effects are not anticipated to require further planning. The primary concern of residual effects is for grizzly bears, which is addressed in the following paragraphs.

Context is rated as high due to the confirmed presence of a species listed under *SARA* Schedule 1 within the LSA, the existing effects from other projects in the surrounding Kitimat River Valley on grizzly bears and the fact that the existing and projected road density is above habitat thresholds for grizzly bear in the Grizzly Bear Identified Watersheds and LSA. The magnitude of the residual effect is high due to road densities of existing conditions being above threshold values coupled with increases due to the Project, and anticipated increase in mortality (direct and indirect) and sensory disturbance that would be well above the natural range of variation. An increase in mortality will affect bears on a regional geographic extent due to their large home ranges and potential for bears from outside the LSA to be affected when travelling to or taking advantage of seasonal food resources in the LSA. The residual effect will be continuous, irreversible and considered permanent as the ROW and new roads will likely be used by local community members and increased mortality and sensory disturbance will be possible during all Project phases.

Due to the 'high' rating for context and magnitude; the larger, regional extent of anticipated effects; the long-term duration; the continuous frequency and the irreversibility of the anticipated effects (**Table 6.6-29**), the residual effects anticipated for grizzly bear may require further consideration. BC Hydro also acknowledges that grizzly bear is of value and concern to First Nations and stakeholder groups. Additional considerations and/or mitigations for grizzly bear will be incorporated as appropriate into the CEMP and environmental monitoring plan for the Project, which will include consultation with First Nations and direction, as appropriate, from regulators (Janet Mackenzie, BC Hydro, pers. comm.).

6.6.4.5 Ungulates

Context is rated as medium due to the moderate resilience of ungulates and likely effects of other resource developments such as logging and linear corridor creation. The magnitude of the residual effect is low due to the loss of less than the threshold value of 20% of suitable habitat. The residual effect will occur intermittently from clearing/construction through post-closure due to continued sensory disturbance from road traffic and vegetation management. It is considered local in geographic extent and restricted to the LSA. Mortality will likely continue through post-closure and is therefore considered irreversible and long term.

The full characterization of residual effects for the ungulates VC is described in **Table 6.6-29**. These effects are not anticipated to require further planning, due to the low magnitude, local extent and intermittent occurrence.

6.6.4.6 Furbearers

Context is rated as low due to the lack of listed species within the LSA and the strong resilience of furbearers to stress. The magnitude of the residual effect is rated medium due to the loss of less than the threshold value of 20% of optimal habitat. The residual effect of habitat loss will occur intermittently—first during clearing/construction followed by periodic vegetation management—and will be local in geographic extent and restricted to the LSA. It is considered reversible but will be long term, due to the length of time required for cut forest to return to a mature state.

The full characterization of residual effects for the furbearers VC is described in **Table 6.6-29**. These effects are not anticipated to require further planning, due to the low context, medium magnitude, local extent, intermittent occurrence and reversibility.

6.6.4.7 Bats

Context is rated as high due to the confirmed presence of species listed under *SARA* Schedule 1 within the LSA. In addition, previous logging of mature and old growth forest throughout the Kitimat River Valley may have removed large amounts of optimal habitat. The magnitude of the residual effect is low due to the loss of less than the threshold value of 20% of optimal habitat. The residual effect of habitat loss will occur once during clearing/construction and will be local in geographic extent and restricted to the LSA. Its duration will be long term and irreversible, due to the length of time required for cut forest to return to an old growth state.

The full characterization of residual effects for the bats VC is described in **Table 6.6-29**. These effects are not anticipated to require further planning, due to the low magnitude, local extent and one-time occurrence.

6.6.4.8 Amphibians

Context is rated as high due to the confirmed presence of species listed under *SARA* Schedule 1 within the LSA. In addition, previous logging of mature and old growth forest throughout the Kitimat River Valley may have removed large amounts of optimal forest habitat. The magnitude of the residual effect is medium due to the potential number of stream crossings involved with the Project. The residual effects of habitat loss will occur intermittently from clearing/construction through to closure and will be local in geographic extent and restricted to the LSA. Its duration will be long term, due to the length of time required for cut forest to return to a mature state and it will be reversible.

The full characterization of residual effects for the amphibians VC is described in **Table 6.6-29**. These effects are not anticipated to require further planning, due to the medium magnitude, local extent, long-term duration, intermittent occurrence and reversibility.

Table 6.6-29: Characterization of Residual Effects on Wildlife Valued Components, Terrace to Kitimat Transmission Project, 2015

Valued Component	Direction	Context	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
Landbirds	Adverse	High	Low	Local	Long-term	Intermittent	Reversible
Waterbirds	Adverse	High	Low	Local	Long-term	Intermittent	Irreversible
Raptors	Adverse	High	Negligible	Local	Long-term	Once	Irreversible
Bears (grizzly bear only)	Adverse	High	High	Regional	Long-term	Continuous	Irreversible
Ungulates	Adverse	Medium	Low	Local	Long-term	Intermittent	Irreversible
Furbearers	Adverse	Low	Medium	Local	Long-term	Intermittent	Reversible
Bats	Adverse	High	Low	Local	Long-term	Once	Irreversible
Amphibians	Adverse	High	Medium	Local	Long-term	Intermittent	Reversible

Notes: Context = ability of the VC to accept change; Magnitude = severity of the effect; Geographic Extent = area over which the predicted effect is expected to occur; Duration = length of time the effect lasts; Reversibility = ability of the VC to return to its original state once the stressor is removed; and Frequency = how often an effect is expected to occur.

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7 NON-TRADITIONAL LAND USE

7.1 Introduction

This section presents the environmental and socio-economic assessment of potential Project effects on Non-Traditional Land Use. A discussion of traditional land uses by First Nations is provided in the archaeology assessment (**Section 11**). Additional information on First Nations botanical resources is provided in **Section 5.6.1.3.1**.

The Project has the potential to affect existing Non-Traditional Land Use as a result of:

- The Project footprint displacing existing land uses and/or access to existing land uses or resources; and/or
- Other effects from Project activities, e.g. traffic, noise and dust disturbances that could disrupt and disturb various land and resource uses and users.

The assessment considers the potential interactions of the Project footprint and activities with Non-Traditional Land Use including:

- Land use planning and management;
- Land ownership;
- Access and transportation;
- Forestry;
- Hunting, trapping and guide outfitting;
- Tourism, parks and recreation;
- Water use and fishing;
- Agriculture; and
- Mining and exploration.

7.2 Regulatory Setting

Relevant legislation, regulations, plans, bylaws and guidelines considered for this assessment include:

- Land Use Plans
  - o Kalum LRMP (Government of BC, 2002);
  - o Kalum SRMP (Government of BC 2006);
  - o City of Terrace Official Community Plan (OCP) (City of Terrace, 2011); and
  - o District of Kitimat OCP (District of Kitimat, 2008).
- Provincial Acts
  - o *Agricultural Land Commission Act*
    The *Agricultural Land Commission Act* is the legislative framework for the

establishment, administration and procedures of BC's agricultural land preservation program.

- *Wildlife Act*
  Section 4 of the *Wildlife Act* addressed the designation of wildlife management area lands for the purpose of native wildlife species conservation. A person may not use land or resources in a wildlife management area without the written permission of the regional manager.
- *Forest and Range Practices Act*
  The regulations described in the *Forest and Range Practices Act* govern the activities of forest and range licensees in BC. The requirements are laid out for planning, road building, logging, reforestation and grazing. Goals of the *Forest and Range Practices Act* aim to protect forest values including watersheds and wildlife habitat, and creating efficiencies for both government and industry through streamlined planning processes.
- *Land Act*
  The *Land Act* legislates the government to convey Crown land to the public for community, industrial and business use. The Act allows the granting of land, and the issuance of Crown land tenure in the form of leases, licences, permits and rights-of-way.
- *Mineral Tenure Act*
  The administration of government-owned mineral and placer mineral rights in BC is today under the *Mineral Tenure Act*. The Act provides for mineral claims and mining leases for lode minerals, and placer claims and leases for placer minerals; all are termed “mineral titles” in the Act. A mineral title may be registered over mineral lands, defined as land in which minerals or placer minerals or the right to explore for, develop and produce minerals, or placer minerals is held by the government. In addition to mineral or placer mineral rights, a mineral title conveys the right to use, enter and occupy the surface of the claim or lease for the exploration and development or production of minerals or placer minerals, including the treatment of ore and concentrates, and all operations related to the business of mining.
- *Range Act*
  The *Range Act* provides the authority to grant range agreements, including permits and licences. These agreements include things like the tenure area and the amount of forage that can be consumed by livestock on Crown land.
- *Water Sustainability Act*
  The *Water Sustainability Act* is the primary provincial statute regulating water resources in BC. The Act provides for the allocation and management of surface water by authorizing issuance of water licences and approvals, creation of reserves, development of water management plans and establishment of water user communities. In a planning area, ground water development may be regulated by requiring drilling authorizations. The Act also sets out protective measures for wells and groundwater, and identifies offences and penalties.
- *Water Protection Act*
  The *Water Protection Act* re-confirms the ownership of surface water and

groundwater in the Province. The Act prohibits bulk export of water and large-scale water transfers between watersheds.

- Provincial Regulations and Guidelines:
  - Freshwater Fishing Regulation Synopsis (BC MFLNRO, 2015a);
  - Freshwater Salmon Supplement (DFO, 2013c);
  - Furbearer Management Guidelines (BC MFLNRO, 2014a; 2014b); and
  - Hunting and Trapping Regulations Synopsis (BC MFLNRO, 2014b).

7.3 Issues Scoping

The purpose of issues scoping is to focus the assessment on key issues that have the potential to affect non-traditional land users in the vicinity of the Project and to help identify potential VCs. The process for issues scoping included consideration of the regulatory environment; consultation with First Nations, the public and other stakeholders; a review of scientific factors; and professional judgement. Information provided in meetings and conference calls with First Nations, community members and stakeholders, which took place between February 2014 and October 2015, were considered during the issues scoping process.

Table 7.3-1 summarizes the issues and concerns identified with respect to potential Project effects on Non-Traditional Land Uses in the vicinity of the Project.

Table 7.3-1: Summary of Concerns with Respect to Non-Traditional Land Use

Non-Traditional Land Use	Issues and Concerns
Fishing	Potential effects on fishing (Williams Creek, Lakelse Lake, Lakelse River, Kitimat River, Wedeene River, Humphrys Creek and Nalbeelah Creek)
Hunting	Potential effects on hunting (moose and waterfowl/migratory birds) in the area, especially Lakelse River
	Potential increased pressure on the moose population due to increased access (for predator-prey relationships)
Recreational Uses	Potential effects on recreational users along Lakelse River, Lakelse Lake and Lower Kitimat River
	Potential effects on canoeing and other boating activity on the Lakelse River
	Potential effects on swimming activity on the Lakelse River
	Potential effects on wildlife viewing as a result of increased mortality of bears
Residential and Commercial Uses	Potential effects on commercial and residential development on the east side of Lakelse Lake
	The expansion will require acquisition of private property
Forestry	Loss of merchantable timber
Access	Potential increased access to the area, which could result in increased traffic, wildlife collisions and effects on terrain stability
Access and Transportation	Project development may affect access causing inconveniences and potential disruption of land and resource use
Agricultural Uses	Potential for the Project clearing/construction activities to disrupt agricultural land use
Acoustic Environment	Potential for Project clearing/construction activities to affect the experience of land use due to increased noise

Non-Traditional Land Use	Issues and Concerns
Air Quality	Potential for Project clearing/construction activities to affect air quality in the areas where Non-Traditional Land Use is practiced
Land Use Planning and Management	Consideration of the compatibility of the Project with existing land uses, municipal land use plans and zoning designations

Note: Non-Traditional Land Use = non-traditional land use.

7.4 Spatial Boundaries

The LSA is defined as the area where most potential effects are expected to occur. The LSA for Non-Traditional Land Use is based on the terrestrial and aquatic disciplines (**Sections 4**, **5** and **6**) and is defined by a 500 m buffer from the engineering boundary and around new and reconstructed roads. A detailed map of Non-Traditional Land Use tenures is provided in **Appendix E.1**. The assessment incorporates inputs from multiple disciplines, including fish and aquatic resources, vegetation and wildlife, which consider unique ecosystems and natural landform barriers and present relevant information on resources to be considered in the assessment of Non-Traditional Land Use.

7.5 Valued Component Selection

The approach of selecting VCs for Non-Traditional Land Use is consistent with the methodology outlined in **Section 3**.

The identification of candidate VCs for the assessment considers the issues scoping process presented in **Section 7.3**. **Table 7.5-1** presents the rationale for choosing each candidate VC, which considers interactions with Project components and activities and the issues and concerns raised.

During the evaluation process, if all attributes and questions were confirmed and answered with “Yes,” the candidate VC became a selected VC. If “No” was answered to one or more of the attributes or evaluation questions, the candidate VC was not considered as a selected VC, unless it was identified to be a component of concern.

The outcome of the iterative process is a list of selected VCs that appropriately reflects the concerns raised and the aspects of Non-Traditional Land Use that are of most value to society.

Table 7.5-1: Evaluation of Candidate Valued Components for Non-Traditional Land Use

	IDENTIFICATION OF CANDIDATE VCs			EVALUATION OF CANDIDATE VCs TO DETERMINE SELECTED VCs									
				Attributes					Evaluation Key Questions				
#	Candidate VC	Interaction with Project Components and Activities	Issues and Concerns	Relevant(1)	Comprehensive(2)	Representative(3)	Responsive(4)	Concise(5)	Measurable(6)	Grouping(7)	Ultimate Receptor(8)	Component of Concern (9)	Selected VC (Included or Excluded)
1	Land Use Planning and Management	Interaction with Project activities and/or Project components because of overlaps with the transmission line ROW and/or access roads.	Y – as presented in **Table 7.3-1.**	Y – Applicable to Non-Traditional Land Use	Y – VC needed to have full understanding of the Non-Traditional Land Use subject area.	Y – VC is illustrative of the natural and human environments to be possibly affected by the proposed Project.	Y – VC is responsive to the potential Project effects.	Y – Clear interaction with Project activities and/or Project components because of overlaps with the transmission line ROW and/or access roads .	Y – VC is measureable by using appropriate indicator such as land use loss or disruption.	Y – The potential effects of the candidate VC cannot be effectively represented by another VC.	Y – VC is an ultimate receptor, because the land is used by humans.	Y – VC is raised as a concern through the issues scoping process.	Y – Land Use Management and Planning is included as Selected VC
2	Land Ownership	Interaction with Project activities and/or Project components because of overlaps with the transmission line ROW and/or access roads.	Y – as presented in **Table 7.3-1.**	Y – Applicable to Non-Traditional Land Use	Y – VC needed to have full understanding of the Non-Traditional Land Use subject area.	Y – VC is illustrative of the natural and human environments to be possibly affected by the proposed Project.	Y – VC is responsive to the potential Project effects.	Y – Clear interaction with Project activities and/or Project components because of overlaps with the transmission line ROW and/or access roads .	Y – VC is measureable by using appropriate indicator such as land use loss or disruption.	Y – The potential effects of the candidate VC cannot be effectively represented by another VC.	Y – VC is an ultimate receptor, because the land is used by humans.	Y – VC is raised as a concern through the issues scoping process.	Y – Land Ownership is included as Selected VC
3	Access and Transportation	Interaction with Project activities and/or Project components because of overlaps with the transmission line ROW and/or access roads.	Y – as presented in **Table 7.3-1.**	Y – Applicable to Non-Traditional Land Use	Y – VC needed to have full understanding of the Non-Traditional Land Use subject area.	Y – VC is illustrative of the natural and human environments to be possibly affected by the proposed Project.	Y – VC is responsive to the potential Project effects.	Y – Clear interaction with Project activities and/or Project components because of overlaps with the transmission line ROW and/or access roads .	Y – VC is measureable by using appropriate indicator such as land use loss or disruption.	Y – The potential effects of the candidate VC cannot be effectively represented by another VC.	Y – VC is an ultimate receptor, because the land is used by humans.	Y – VC is raised as a concern through the issues scoping process.	Y – Access and Transportation is included as Selected VC
4	Forestry	Interaction with Project activities and/or Project components because of overlaps with the transmission line ROW and/or access roads.	Y – as presented in **Table 7.3-1.**	Y – Applicable to Non-Traditional Land Use	Y – VC needed to have full understanding of the Non-Traditional Land Use subject area.	Y – VC is illustrative of the natural and human environments to be possibly affected by the proposed Project.	Y – VC is responsive to the potential Project effects.	Y – Clear interaction with Project activities and/or Project components because of overlaps with the transmission line ROW and/or access roads .	Y – VC is measureable by using appropriate indicator such as land use loss or disruption.	Y – The potential effects of the candidate VC cannot be effectively represented by another VC.	Y – VC is an ultimate receptor, because the land is used by humans.	Y – VC is raised as a concern through the issues scoping process.	Y – Forestry is included as Selected VC
5	Hunting, Trapping and Guide Outfitting	Interaction with Project activities and/or Project components because of overlaps with the transmission line ROW and/or access roads.	Y – as presented in **Table 7.3-1.**	Y – Applicable to Non-Traditional Land Use	Y – VC needed to have full understanding of the Non-Traditional Land Use subject area.	Y – VC is illustrative of the natural and human environments to be possibly affected by the proposed Project.	Y – VC is responsive to the potential Project effects.	Y – Clear interaction with Project activities and/or Project components because of overlaps with the transmission line ROW and/or access roads .	Y – VC is measureable by using appropriate indicator such as land use loss or disruption.	Y – The potential effects of the candidate VC cannot be effectively represented by another VC.	Y – VC is an ultimate receptor, because the land is used by humans.	Y – VC is raised as a concern through the issues scoping process.	Y – Hunting, Trapping and Guide Outfitting is included as Selected VC
6	Tourism, Parks and Recreation	Interaction with Project activities and/or Project components because of overlaps with the transmission line ROW and/or access roads.	Y – as presented in **Table 7.3-1.**	Y – Applicable to Non-Traditional Land Use	Y – VC needed to have full understanding of the Non-Traditional Land Use subject area.	Y – VC is illustrative of the natural and human environments to be possibly affected by the proposed Project.	Y – VC is responsive to the potential Project effects.	Y – Clear interaction with Project activities and/or Project components because of overlaps with the transmission line ROW and/or access roads .	Y – VC is measureable by using appropriate indicator such as land use loss or disruption.	Y – The potential effects of the candidate VC cannot be effectively represented by another VC.	Y – VC is an ultimate receptor, because the land is used by humans.	Y – VC is raised as a concern through the issues scoping process.	Y – Tourism, Parks and Recreation is included as Selected VC
7	Water Use	Interaction with Project activities and/or Project components because of overlaps with the transmission line ROW and/or access roads.	N – as presented in **Table 7.3-1.**	Y – Applicable to Non-Traditional Land Use	Y – VC needed to have full understanding of the Non-Traditional Land Use subject area.	Y – VC is illustrative of the natural and human environments to be possibly affected by the proposed Project.	Y – VC is responsive to the potential Project effects.	Y – Clear interaction with Project activities and/or Project components because of overlaps with the transmission line ROW and/or access roads .	Y – VC is measureable by using appropriate indicator such as land use loss or disruption.	Y – The potential effects of the candidate VC cannot be effectively represented by another VC.	Y – VC is an ultimate receptor, because the land is used by humans.	N – VC was not raised as a concern through the issues scoping process.	N – Water use is not included as selected VC
8	Fishing	Interaction with Project activities and/or Project components because of overlaps with the transmission line ROW and/or access roads.	Y – as presented in **Table 7.3-1.**	Y – Applicable to Non-Traditional Land Use	Y – VC needed to have full understanding of the Non-Traditional Land Use subject area.	Y – VC is illustrative of the natural and human environments to be possibly affected by the proposed Project.	Y – VC is responsive to the potential Project effects.	Y – Clear interaction with Project activities and/or Project components because of overlaps with the transmission line ROW and/or access roads .	Y – VC is measureable by using appropriate indicator such as land use loss or disruption.	Y – The potential effects of the candidate VC cannot be effectively represented by another VC.	Y – VC is an ultimate receptor, because the land is used by humans.	Y – VC is raised as a concern through the issues scoping process.	Y – Fishing is included as Selected VC
9	Agriculture	Interaction with Project activities and/or Project components because of overlaps with the transmission line ROW and/or access roads.	Y – as presented in **Table 7.3-1.**	Y – Applicable to Non-Traditional Land Use	Y – VC needed to have full understanding of the Non-Traditional Land Use subject area.	Y – VC is illustrative of the natural and human environments to be possibly affected by the proposed Project.	Y – VC is responsive to the potential Project effects.	Y – Clear interaction with Project activities and/or Project components because of overlaps with the transmission line ROW and/or access roads .	Y – VC is measureable by using appropriate indicator such as land use loss or disruption.	Y – The potential effects of the candidate VC cannot be effectively represented by another VC.	Y – VC is an ultimate receptor, because the land is used by humans.	Y – VC is raised as a concern through the issues scoping process.	Y – Agriculture is included as Selected VC
10	Mining and Exploration	Interaction with Project activities and/or Project components because of overlaps with the transmission line ROW and/or access roads.	N – as presented in **Table 7.3-1.**	Y – Applicable to Non-Traditional Land Use	Y – VC needed to have full understanding of the Non-Traditional Land Use subject area.	Y – VC is illustrative of the natural and human environments to be possibly affected by the proposed Project.	Y – VC is responsive to the potential Project effects.	Y – Clear interaction with Project activities and/or Project components because of overlaps with the transmission line ROW and/or access roads .	Y – VC is measureable by using appropriate indicator such as land use loss or disruption.	Y – The potential effects of the candidate VC cannot be effectively represented by another VC.	Y – VC is an ultimate receptor, because the land is used by humans.	N – VC was not raised as a concern through the issues scoping process.	N – Mining and exploration is not included as selected VC

Notes:
(1) Relevant to Non-Traditional Land Use and clearly linked to the values reflected in the issues raised in respect to the Project.
(2) Comprehensive: taken together, the VCs selected for an assessment should enable a full understanding of the important potential effects of the Project.
(3) Representative of the important features of the natural and human environment likely to be affected by the Project.
(4) Responsive to the potential effects of the Project.
(5) Concise, so the nature of the Project-VC interaction and the resulting effect pathway can be clearly articulated and understood and overlapping or redundant analysis is avoided.
(6) Measurable, the potential effects of the Project on the VC can be measured and monitored.
(7) The potential effects of the candidate VC cannot be effectively represented by another VC.
(8) Ultimate Receptor: the ultimate receptors are humans.
(9) Component of Concern: includes issues and/or legislation raised by FNs, federal or provincial governments.
Y = Yes; N = No; FN = First Nations; Non-Traditional Land Use = non-traditional land use; ROW = right-of-way; VC = valued component

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7.6 Non-Traditional Land Use Studies

This section describes the existing conditions in the LSA. In doing so, it identifies the land use tenures, licences, land use activities and management designations near the proposed route. This information is used to inform the assessment of potential effects on Non-Traditional Land Use.

7.6.1 Methods

Data on existing conditions were collected through a desktop review of publicly available information and a variety of methods, including document reviews, desktop research and database searches and mapping.

Existing information was assembled from a number of sources, including, but not limited to:

- Government policies and LRMPs;
- Published reports and studies relevant to Non-Traditional Land Use;
- Publicly available cultural, ecological or community knowledge relevant to Non-Traditional Land Use, including data presented in previous environmental assessments of projects in the area; and
- Information relevant to Non-Traditional Land Use gathered during consultation and engagement with First Nations, the public and other stakeholders.

Environmental Systems Research Institute's ArcGIS 10.2 software was used to create all maps. Data used to generate the maps were from a variety of sources, including pre-existing shape files and geodatabases within the AMEC GIS department and additional shapefiles downloaded from the Geographic Data Discovery Service and Integrated Land and Resource Registry (ILRR) (Government of BC, 2015). Data layers were grouped and mapped at 1:155,000 to illustrate land uses near the Project in the context of the Skeena and Kitimat River Valleys.

Percentage calculations were based on the LSA described in **Section 7.6.2.1** and the ROW as follows:

- ROW = the specific area of each feature within the transmission line ROW;
- New Permanent Roads = the specific area of each feature within the clearing area for new permanent roads;
- New Temporary Roads = the specific area of each feature within the clearing area for new temporary roads;
- Reconstruction Roads = the specific area of each feature within the clearing / upgraded area for existing roads designated for reconstruction;
- Total area of feature potentially affected ***(a)*** = the total area of each feature (e.g. parcel of simple fee land, forestry tenure, resource management area, protected area) affected by all Project components (i.e. ROW, New Permanent and Temporary Roads and Reconstruction Roads);
- Area of feature located within the LSA ***(b)*** = the specific area of each feature within the LSA;

- Percentage of Project within portion of feature in LSA ***(a divided by b)*** = the total area of feature potentially affected area divided by the area of feature located within the LSA;
- Total feature size ***(c)*** = the total area of each feature; and
- Percentage of feature affected by Project ***(a divided by c)*** = the Project Total Area divided by the Total Parcel Size.

A field visit was not conducted nor required for the ESER, as relevant Non-Traditional Land Use secondary data were publicly available to complete a detailed analysis. This was done in conjunction with consultation activities to obtain additional information.

7.6.2 Existing Condition

7.6.2.1 Land Use Planning and Management

The LSA is located within the Kitimat-Stikine Regional District, an area that is managed by a variety of land use policies, plans and regulations. The regulatory framework is managed by the Kalum LRMP (Government of BC, 2002), the City of Terrace OCP (City of Terrace, 2011) and the Kitimat OCP (District of Kitimat, 2008).

7.6.2.1.1 Kalum Land and Resource Management Plan

The Kalum LRMP was developed in 2002 and covers 2.2 Mha in northwest BC. The LRMP represents the consensus reached by the participants of the Kalum LRMP—public stakeholders, First Nations and provincial and local government representatives. The LRMP directs the management of lands and resources through resource management zones (Government of BC, 2002).

The LRMP identifies three categories of management direction for the LRMP area: General Resource Management (GRM), Resource Management Zone (RMZ) and Protected Area. The LRMP also identifies land under Legal and Non-Legal status, meaning that the direction proposed for a specific portion of land under Legal status is legally enforceable while the direction under Non-Legal status is policy only and not legally enforceable.

The GRM direction represents a baseline for resource activities on Crown land outside Protected Areas. RMZ direction applies to geographically specific areas with distinct biophysical characteristics and resource issues. The GRM direction applies to all RMZs. RMZ direction provides additional management emphasis to those areas. Protected areas are identified for their natural, cultural heritage or recreational value in accordance with the Protected Areas Strategy for British Columbia (Government of BC, 1993).

GRM direction applies to all values and resources on provincial Crown land and provides a baseline for management. Objectives and strategies in GRM apply throughout the LRMP area, outside of the Protected Areas. The following resources and resource values are addressed in GRM direction:

- Access Management;
- Fish and Fish Habitat;

- Agriculture;
- Freshwater;
- Aquaculture and Marine Plants;
- Harvesting;
- Outdoor Recreation;
- Biodiversity;
- Timber Harvesting and Silviculture;
- Botanical Forest Products;
- Tourism;
- Coastal Resources;
- Trapping;
- Cultural Heritage;
- Ungulate Winter Ranges;
- Geological and Energy Resources;
- Visual Resources;
- Grizzly Bear; and
- Wildlife and Wildlife Habitats.

The LRMP describes three distinct RMZ categories: Proposed Protected Area, Settlement Zone and SRMZ. The Project components for the most part avoid Current or Proposed Protected Areas. The SRMZ emphasizes conservation-oriented land uses and yet allows for some resource development. This land use designation incorporates areas with high concentrations of provincially, regionally and locally significant special resource values, such as critical wildlife or fish habitat, community watersheds and locally important scenic and recreation resources (e.g. backcountry and marine recreation). Due to the unique nature and differing management requirements of the identified conservation values, the SRMZ is divided into ten categories (**Table 7.6-1**).

Table 7.6-1: Special Resource Management Zones

Category	Description
Non-Motorized Backcountry Recreation	An area for which the conservation of a non-motorized backcountry recreation experience is emphasized. Management direction provides for a variety of non-motorized recreational experiences.
Marine Backcountry Recreation	The conservation of a semi-primitive recreation experience is the management emphasis. The main values of concern include scenic landscapes, opportunities for solitude and rustic recreational opportunities.
Community Watersheds	Areas that require additional conservation measures to maintain a high level of water quality and quantity for purposes of human consumption.
Grizzly Bear Benchmark and Linkages	Areas with emphasis on the management of grizzly bear populations. Grizzly bear hunting is prohibited in these areas.
Lakelse River	An area designated as SRMZ as part of the integration of the Thunderbird Integrated Resource Management Plan. Multiple conservation values such

Category	Description
	as biodiversity, fish habitat, recreation and wildlife are addressed through the management direction of this zone.
Upper Kitsumkalum	An area designated for the conservation of its important biological attributes and ecosystem representation.
Kowesas	An area of high significance to the Haisla First Nation. This area was designated for the conservation and further detailed planning of oolichan, Marbled Murrelets and other Haisla cultural values.
Ascaphus Creek	An area established as a SRMZ specifically to conserve its well-known coastal tailed frog habitat.
Upper Copper River	The Class 1 water of the Copper watershed is known for its high quality steelhead angling opportunities. An area established to conserve its high value fish and fish habitat and a quality angling experience.
Miligit Valley	An area established as a distinct SRMZ within the Upper Copper SRMZ. The area includes significant conservation and recreation values, which will be primarily managed through visual quality management and Sensitive Area designation.

Note: SRMZ = Special Resource Management Zone

The LSA falls within the area covered by the GRM and intersects the Lakelse River SRMZ, which is designated as part of the Thunderbird Integrated Resource Management Plan (TIRMP). The TIRMP is a landscape-level forest management plan approved in 1992 and incorporated into the Kalum LRMP. The Lakelse River SRMZ addresses multiple conservation values such as biodiversity, fish habitat, recreation and wildlife and is divided into two subzones: Subzone 1 outlines the riparian zone of the Lakelse River; Subzone 2 is defined as a buffer to Subzone 1 based on existing land use patterns, topography and fish and wildlife habitat and use patterns.

The LSA does not intersect any other SRMZ, including existing or proposed Community Watersheds, Grizzly Bear Benchmark or Linkages or Non-Motorized Backcountry Recreation SRMZs (**Figure 7.6-1**).

Table 7.6-2 provides a summary of the area and percent coverage for each management zone overlapped by the LSA.

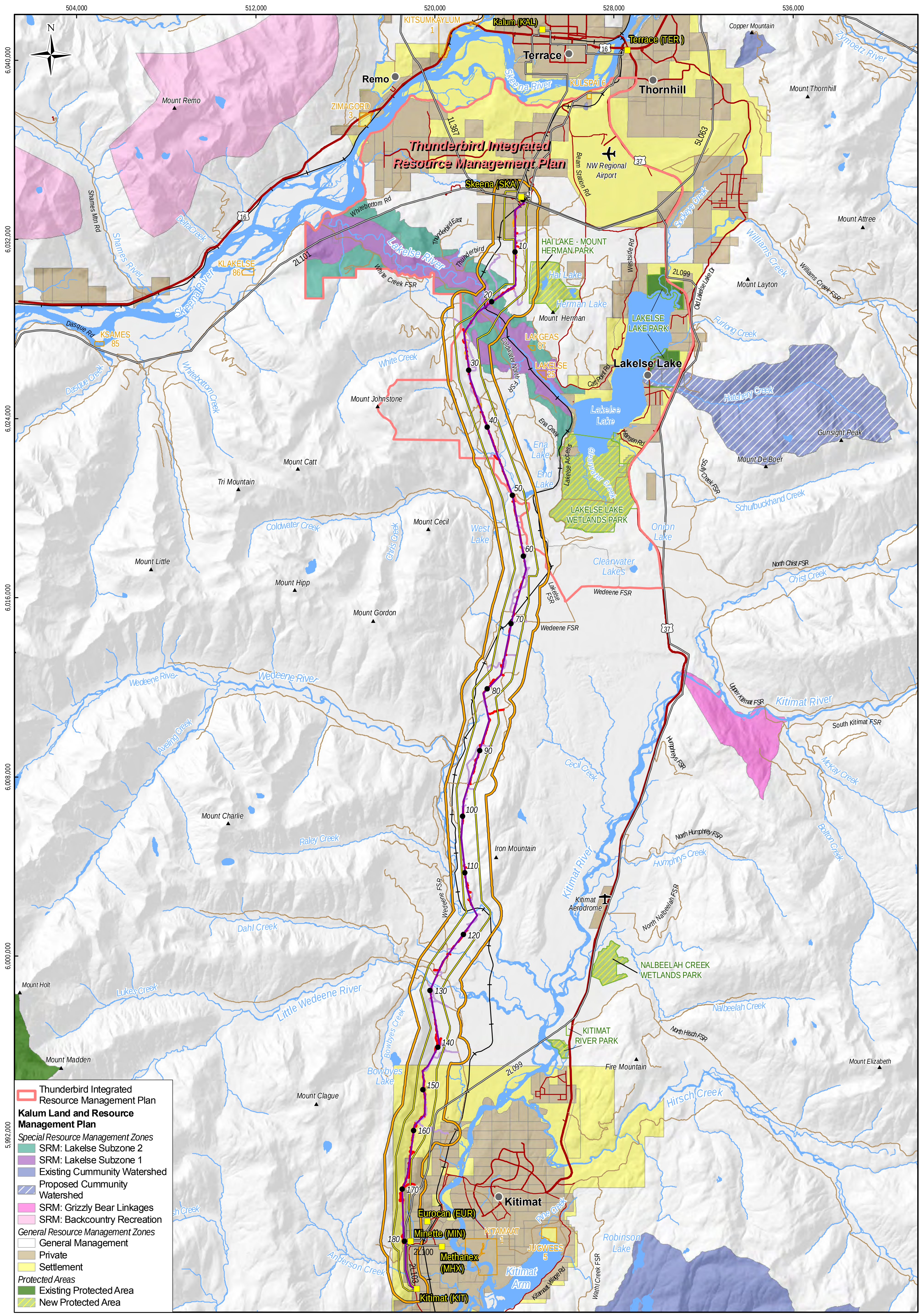
Table 7.6-2: Kalum LRMP – Management Zones within the Local Study Area

Non-legal Zones		Area Overlapped by Project Components					Area of Non-Legal Zones Located within LSA (ha) (b)	% of Project within Portion of Non-legal Zones in LSA (%) (a/b)	Total Size of Non-legal Zones (ha) (c)	% of Non-legal Zones Affected by Project (%) (a/c)
		TL ROW (ha)	New Permanent Roads (ha)	New Temporary Roads (ha)	Reconstruction Roads (ha)	Total Area of Non-legal Zones Potentially Affected (ha) (a)				
General Resource Management		458	6.59	0.13	41.88	506	7,726	6.55	1,084,114	0.05
Special Resource Management	Lakelse Subzone 1	9	0.09	0	0.08	9.58	235	4.08	1,822	0.53
	Lakelse Subzone 2	19	0.05	0	7.46	26.25	365	7.19	1,596	1.65
Private		59	1.73	0.26	2.17	62.83	986	6.37	26,247	0.24
Settlement zones[1]		88	1.95	0	4.10	94.25	1,154	8.16	18,374	0.51
Current or Proposed Protected Areas		0	0	0	0	0	54	0	309	0

Notes: [1]Areas reflecting existing community boundaries and anticipated growth areas. These areas are primarily planned and managed by local governments under the *Municipal Act*
ha = hectare; % = percent; ROW = right-of-way; LSA = Local Study Area; TL = transmission line;
Total area of feature potentially affected ***(a)*** = the total area of each feature affected by all Project components;
Area of feature located within the LSA ***(b)*** = the specific area of each feature within the LSA;
% of Project within portion of feature in LSA ***(a divided by b)*** = the total area of feature potentially affected area divided by the area of feature located within the LSA;
Total feature size ***(c)*** = the total area of each feature; and
% of feature affected by Project ***(a divided by c)*** = the Project Total area divided by the Total Parcel Size.

Source: BC MFLNRO Resource Management Objectives.

Obtained from: GeoBC, 2015.



Legend

- Populated Place
- Airport
- Aerodrome
- Existing Substation
- Existing Transmission Line
- Railway
- Park
- First Nation Reserve
- Highway
- Arterial
- Local Road
- Forest Service Road
- Watercourse
- Waterbody

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary
- Non-Traditional Land Use Local Study Area

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
DataBC Data Distribution Service (www.data.gov.bc.ca/)
Kalum LRMP-MFLNRO data.gov.bc.ca/dataset/non-legal-planning-features

CLIENT: Prepared for BC Hydro

PROJECT: Terrace to Kitimat Transmission Project (TKTP)

TITLE: Kalum Land and Resource Management Plan - Non-legal Resource Management Zones

DATE:	ANALYST:	QA/QC:	
October, 2016	WR	CH	**Figure 7.6-1**

GIS FILE: 18-02-005_LRMP_NonlegalRMZ_v2

JOB No: VE52379

COORDINATE SYSTEM: NAD 1983 UTM Zone 9N

amec foster wheeler

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Last updated by willem.van-riet

7.6.2.1.2 Kalum Sustainable Resource Management Plan

The Kalum SRMP was developed in 2006 to guide land use and resource management within the Kalum LRMP. The goal of the Kalum SRMP is to provide a landscape level plan that allows the Government of BC to implement the Kalum LRMP objectives.

The LSA intersects two areas designated for maintenance of wildlife and biodiversity—the Lakelse River SRMZ Subzone 1 and SRMZ Subzone 2. The Kalum SRMP establishes specific land use objectives for these areas:

- Subzone 1 – No harvesting of timber or blowdown salvage in this area; and
- Subzone 2 – Early seral stage target is a maximum of 27% with a maximum opening size of 15 ha with at least 50% selective harvesting.

In addition, the LSA intersects three Grizzly Bear Identified Watersheds (Lakelse – Cecil, Little Wedeene and Wedeene), which have specific objectives defined in the Kalum SRMP to maintain natural level of forage supply for grizzly bears (**Figure 7.6-2**). Forest tenure holders in those areas are committed to maintaining a natural level of forage supply as present in old growth forests and implementing regeneration and free to grow standards.

Table 7.6-3 provides a summary of the area and percent coverage for each of the legal zones overlapped by the LSA under the Kalum SRMP.

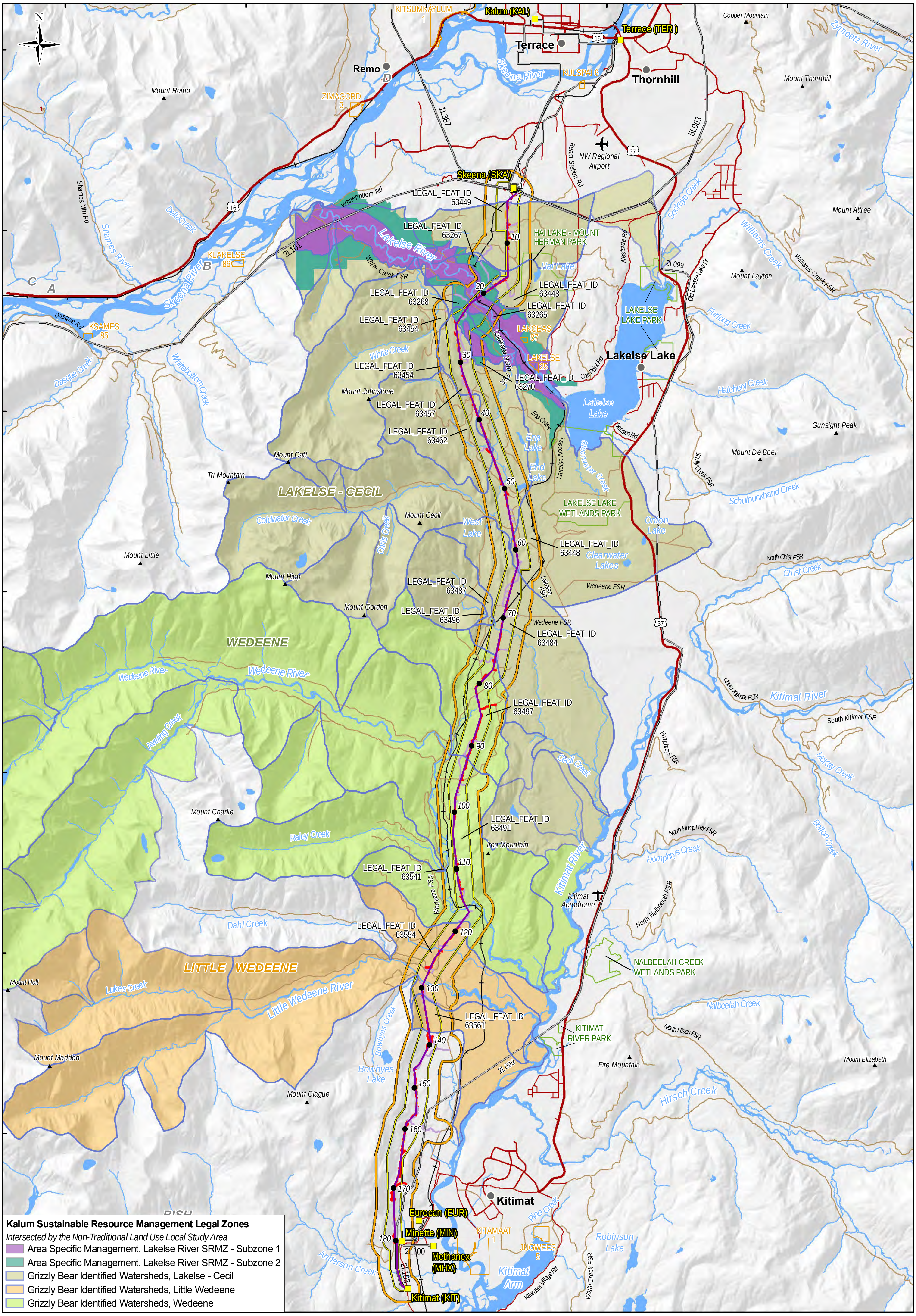
Table 7.6-3: Kalum Sustainable Resource Management Plan Zones within the Local Study Area

Legal Zones		Area Overlapped by Project Components					Area of Legal Zones within LSA (ha) (b)	% of Project within Portion of Legal Zones Located within LSA (%) (a/b)	Total Size of Legal Zones (ha) (c)	% of Legal Zones Affected by Project (%) (a/c)
		TL ROW (ha)	New Permanent Roads (ha)	New Temporary Roads (ha)	Reconstruction Roads (ha)	Total Area of Legal Zones Potentially Affected (ha) (a)				
Grizzly Bear Identified Watersheds	Lakelse – Cecil	260.54	2.06	0.39	31.25	294.23	4,562	6.45	31,483	0.93
	Little Wedeene	65.11	0.48	0	4.58	70.17	950	7.39	13,353	0.53
	Wedeene	149.77	2.52	0	10.15	162.44	2,393	6.79	31,111	0.52
Area Specific Management	Lakelse River SRMZ – Subzone 1	9.41	0.09	0	0.08	9.58	235	4.08	1,821	0.53
	Lakelse River SRMZ – Subzone 2	18.74	0.05	0	7.46	26.25	365	7.19	1,595	1.65

Notes: ha = hectare; % = percent; ROW = right-of-way; LSA = Local Study Area; SRMZ = Special Resource Management Zone; TL = transmission line.
Total area of feature potentially affected ***(a)*** = the total area of each feature affected by all Project components;
Area of feature located within the LSA ***(b)*** = the specific area of each feature within the LSA;
% of Project within portion of feature in LSA ***(a divided by b)*** = the total area of feature potentially affected area divided by the area of feature located within the LSA;
Total feature size ***(c)*** = the total area of each feature; and
% of feature affected by Project ***(a divided by c)*** = the Project Total area divided by the Total Parcel Size.

Source: BC MFLNRO Resource Management Objectives.

Obtained from: GeoBC, 2015.



Kalum Sustainable Resource Management Legal Zones

Intersected by the Non-Traditional Land Use Local Study Area

- Area Specific Management, Lakelse River SRMZ - Subzone 1
- Area Specific Management, Lakelse River SRMZ - Subzone 2
- Grizzly Bear Identified Watersheds, Lakelse - Cecil
- Grizzly Bear Identified Watersheds, Little Wedeene
- Grizzly Bear Identified Watersheds, Wedeene

Legend

- Populated Place
- Airport
- Aerodrome
- Existing Substation
- Existing Transmission Line
- Railway
- Park
- First Nation Reserve
- Highway
- Arterial
- Local Road
- Forest Service Road
- Watercourse
- Waterbody

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary
- Non-Traditional Land Use Local Study Area

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
DataBC Data Distribution Service (www.data.gov.bc.ca/)
Kalum SRMP - MFLNRO & ILMB data.gov.bc.ca/dataset/legal-planning-objectives

CLIENT:
Prepared for BC Hydro

PROJECT:
Terrace to Kitimat Transmission Project (TKTP)

TITLE:
Kalum Sustainable Resource Management Plan – Legal Resource Management Zones

DATE:	ANALYST:	QA/QC:	
October, 2016	WR	VG	**Figure 7.6-2**

GIS FILE: 18-02-004_SRMP_Legal_v2

JOB No: VE52379

COORDINATE SYSTEM: NAD 1983 UTM Zone 9N

amec foster wheeler

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7.6.2.1.3 District Land Use Planning

Settlement Zones, as part of the RMZs within the Kalum LRMP, include areas that are subject to separate planning processes under OCPs. Such lands are primarily planned and managed by local governments under the Municipal Act. Local government may also oversee planning in areas where other RMZ boundaries cross settlement lands. The primary population centres representing Settlement Zones in the vicinity of the route study areas include the City of Terrace and the District of Kitimat.

Under section 875 of the Local Government Act, an OCP is a statement of objectives and policies to guide decisions on planning and land use management, within the area covered by the OCP, respecting the purposes of local government. The District of Kitimat OCP identifies Crown lands within municipal boundaries that are important for the expansion of settlement and economic development (District of Kitimat, 2008). The developed commercial land area in Kitimat comprises 233 ha and vacant commercial land area comprises 104 ha. There is an estimated 1,600 ha of developed industrial land in Kitimat. Total undeveloped industrial land is estimated at 985 ha. Industrial lands comprise approximately 11% of Kitimat's land area. As of 2008, between 10% and 25% of the land area in townsite neighbourhoods are devoted to parks and open space, including playgrounds, walkways, sports fields and natural areas. Major institutional uses include the municipal offices, social services building, hospital, museum, community college, post office, library, churches, community centre, Royal Canadian Mounted Police (RCMP) office and courthouse. There are four First Nation Reserves within the District of Kitimat municipal boundary, none of which is populated.

The Kitimat OCP identifies Hazard Lands as lands that, if developed, will be susceptible to inherent environmental hazards such as floods, erosion, instability, or other physical conditions severe enough to pose a risk to occupants, loss of life, property damage or social disruption (District of Kitimat, 2008). Refer to the District of Kitimat OCP – Schedule C for maps of Hazardous Areas (District of Kitimat, 2008).

Hazardous areas are identified as those areas within the 200-year flood level of the Kitimat River and where slopes are equal to or greater than 25%. Any development on designated Hazard Lands is subject to terms provided in sub-section 4.4 of the OCP. The Minette–Kitimat section of the proposed route intersects a wide selection of Hazard Lands as described in the OCP.

With the application of proposed mitigation, the Project is consistent with district land use planning objectives.

7.6.2.2 Land Ownership

Table 7.6-4 and **Figure 7.6-3** illustrate land ownership within the LSA. The majority (66%) of the land in the LSA is unsurveyed Crown land (i.e. there is no historical survey of title registered for those areas). The majority of the ROW (69%) is also within unsurveyed Crown land. The LSA intersects 55 parcels of provincial Crown land and 53 parcels of private land. Of the 55 parcels of provincial Crown land, 26 are exclusively in the LSA and are not overlapped by Project components. The remaining 29 parcels are overlapped by the transmission line ROW, new temporary access roads and/or existing roads slated for reconstruction. Of the 53 parcels of private land, 32 are exclusively in the LSA and are not overlapped by Project components. The remaining

21 parcels are overlapped by the transmission line ROW, new temporary access roads and/or existing roads slated for reconstruction. A total of 155 ha of provincial Crown land will be affected by the Project, while 64 ha of private land will be affected. The LSA does not overlap with any federal or municipal Crown lands.

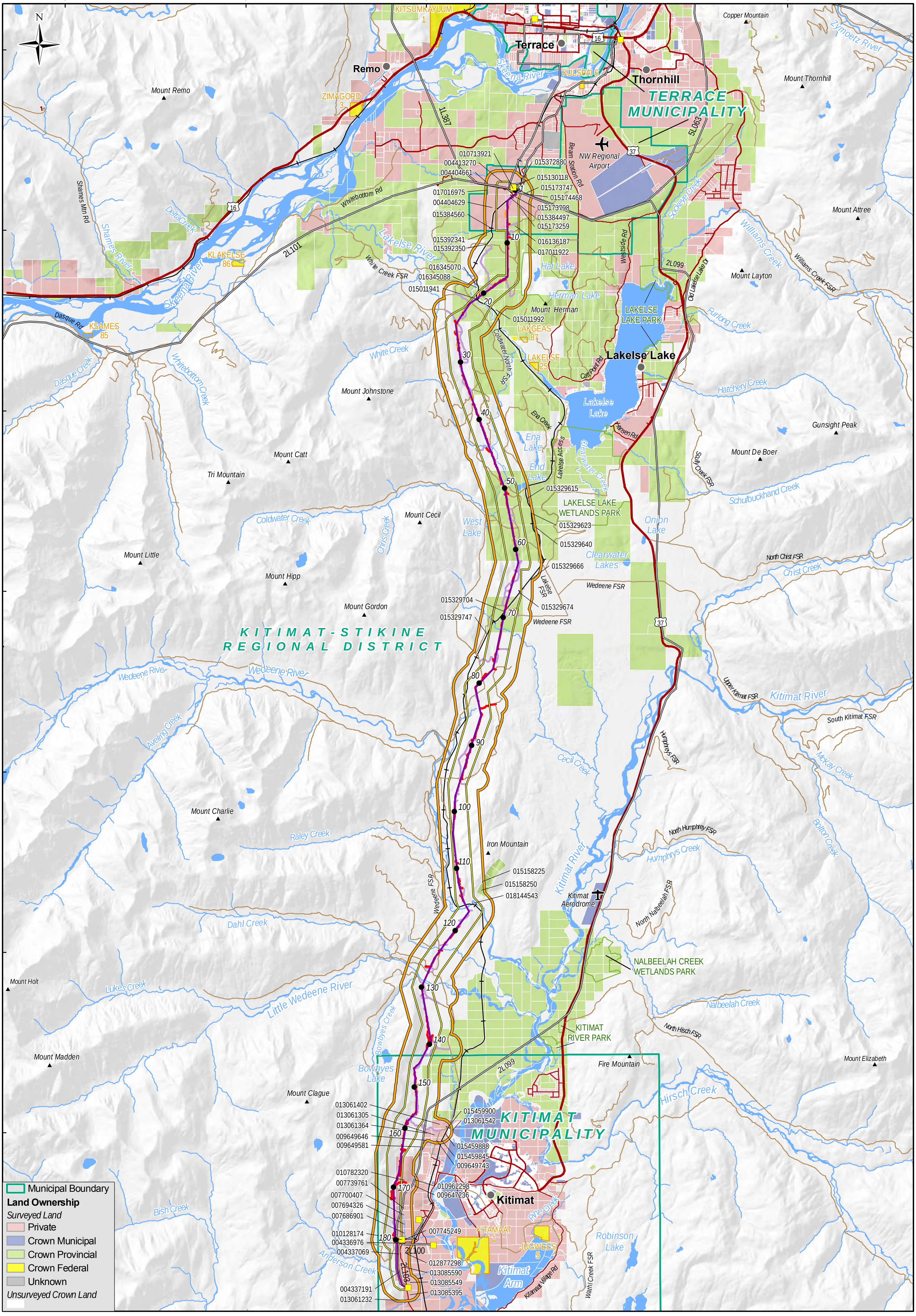
Table 7.6-4: Land Ownership within the Local Study Area

	Area Overlapped by Project Components									
Disposition Purpose Type	**Number of Parcels**	**TL ROW (ha)**	**New Permanent Roads (ha)**	**New Temporary Roads (ha)**	**Reconstruction Roads (ha)**	**Total Area of Feature Potentially Affected (ha) (a)**	**Area of Feature located within LSA (ha) (b)**	**% of Project within Portion of Feature Located within LSA (%) (a/b)**	**Total Feature Size (ha) (c)**	**% of Feature Affected by Project (%) (a/c)**
Crown Federal	0	-	-	-	-	-	-	-	-	-
Crown Provincial	55	137.91	1.33	0.08	16.08	155	2,464.62	6.31	3,971	3.91
Crown Municipal	0	-	-	-	-	-	-	-	-	-
Private	53	59.80	1.75	0.29	2.12	63.96	1,012.79	6.32	1,595	4.01
Unsurveyed*	-	435.29	7.33	0.01	37.49	480	7,041.00	6.82	n/a	n/a

Notes: ha = hectare; ROW = right-of-way; LSA = Local Study Area; % = percent; – = no data within the LSA; n/a = not applicable; TL=transmission line.
***Unsurveyed Crown Land = i.e. there is no historical survey of title registered for those areas.
Total area of feature potentially affected ***(a)*** = the total area of each feature affected by all Project components;
Area of feature located within the LSA ***(b)*** = the specific area of each feature within the LSA;
% of Project within portion of feature in LSA ***(a divided by b)*** = the total area of feature potentially affected area divided by the area of feature located within the LSA;
Total feature size ***(c)*** = the total area of each feature; and
% of feature affected by Project ***(a divided by c)*** = the Project Total area divided by the Total Parcel Size.

Source: BC Integrated Cadastral Information Society.

Obtained from: GeoBC, 2015



Legend

- Populated Place
- Airport
- Aerodrome
- Existing Substation
- Existing Transmission Line
- Railway
- Park
- First Nation Reserve
- Highway
- Arterial
- Local Road
- Forest Service Road
- Watercourse
- Waterbody

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary
- Non-Traditional Land Use Local Study Area

Municipal Boundary

Land Ownership

Surveyed Land

- Private
- Crown Municipal
- Crown Provincial
- Crown Federal
- Unknown

Unsurveyed Crown Land

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
DataBC Data Distribution Service (www.data.gov.bc.ca/)
Land Ownership by Tantalis
Project area data obtained from BC Hydro

CLIENT: Prepared for BC Hydro

PROJECT: Terrace to Kitimat Transmission Project (TKTP)

TITLE: Land Ownership

DATE:	ANALYST:	QA/QC:	
October, 2016	WR	VG	Figure 7.6-3

GIS FILE: 18-02-001_ownership_v4

JOB No: VE52379

COORDINATE SYSTEM: NAD 1983 UTM Zone 9N

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7.6.2.2.1 Crown Lands

The majority (94%) of land in BC is classified as provincial Crown land (land owned by the provincial government) (**Figure 7.6-4**). For clarity, BC Hydro recognizes that the majority of Crown land in BC is also the traditional territory of various First Nations and therefore may be subject to Aboriginal rights pursuant to section 35 of the *Constitution Act, 1982*. Crown land tenures within the LSA include nine activity disposition types or purposes as described in **Table 7.6-5**. Overall, the predominant tenure purpose in the LSA is Industrial, covering 8,758 ha, followed by Utility (4,825 ha) and Environmental Conservation Recreation (1,054 ha). There is also an intersection with identified First Nations treaty settlement lands[4] (415 ha). In total there are 56 Crown tenures within the LSA, covering areas that range between 49 ha and 8,758 ha of the LSA.

There are four types of Crown land tenures within the LSA: reserve/notation, permit, licence and ROW. Crown land reserves/notations grant an agency the right to implement a restriction on the use of Crown land. Federal and provincial government agencies and corporations may apply for the establishment of *Land Act* Reserves over high-value sites required for public purposes, including research and education. Depending on the type of reserve (Order in Council, Map Reserve, *Land Act* designation (which can be designated use or prohibitive use) and Notation of Interest), the area is withdrawn from disposition under the *Land Act.*

The most common tenure type with the LSA is reserve/notation (covering 10,085 ha in the LSA) followed by permit (4,659 ha in the LSA), licence (848 ha in the LSA) and ROW (44 ha in the LSA).

A detailed map of Non-Traditional Land Use tenures is provided in **Appendix E.1**.

7.6.2.3 Access and Transportation

7.6.2.3.1 Roads

Highway 37 runs parallel to the LSA between Kitimat and Terrace. North of the LSA, Highway 16 (Yellowhead Highway) connects Terrace to Prince Rupert.

A number of FSRs occur in the Non-Traditional Land Use LSA. The Wedeene FSR runs from Kitimat in the south, and the Lakelse FSR runs south from the region close to the SKA substation. These roads cross the transmission line ROW in several places and some of these existing roads have been identified to be reconstructed to facilitate clearing/construction and operation/ maintenance of the transmission line.

7.6.2.3.2 Railway

Canadian National Railway (CN Rail), which follows the Highway 16 corridor, provides freight services to Prince Rupert and offers routes from Kitimat, Prince Rupert and Vancouver through Terrace. The CN Rail Intermodal Terminal is designed to support customers shipping to and from Asia through the Port of Prince Rupert. Passenger service is available with VIA Rail through 'The Skeena' passenger train, reaching Terrace via Prince George and Jasper and extending to Prince

[4] In 2015, the Kitselas First Nation and BC and federal governments signed an agreement-in-principle that provides for 36,158 ha of land east of Terrace once a Final Agreement (treaty) is reached

Rupert. Passenger access from Vancouver and Edmonton is available by connecting to 'The Skeena' in Jasper from the 'The Canadian' passenger train that runs between Vancouver and Toronto.

The railway line runs parallel to the LSA and is within the ROW in several locations. **Figure 7.6-5** shows the location of the railway line in relation to the Project.

7.6.2.3.3 Air

Terrace has one airport, the Terrace North West Regional Airport (YXT), located 3.5 km (in a straight-line distance) east of the SKA substation. There are two helipads in Terrace—one at the Mills Memorial Hospital, approximately 7 km north of the Skeena substation, and one operated by BC Hydro, approximately 7 km northwest of the SKA substation.

There is one small aerodrome in Kitimat, the Kitimat Aerodrome (CBW2), located approximately 12 km (in a straight-line distance) north of Kitimat and 5.5 km east of the LSA. There is one helipad at the Kitimat Hospital located approximately 4 km east of the LSA.

Figure 7.6-5 shows the locations of the airports, airstrips and helipads near the LSA.

Table 7.6-5: Active and Approved Surface Dispositions (Crown Tenures) within the Local Study Area

Crown Tenure Purpose	Area Overlapped by Project Components						Area of Feature Located within LSA (ha) (b)	% of Project within Portion of Feature Located within LSA (%) (a/b)	Total Feature Size (ha) (c)	% of Feature Affected by Project (%) (a/c)
	Land Uses	ROW (ha)	New Permanent Roads (ha)	New Temporary Roads (ha)	Reconstruction Roads (ha)	Total Area of Feature Potentially Affected (ha) (a)				
Commercial Recreation	Guided Freshwater Recreation / Heli ski	1	0	0	0	1	86	1.22	214,812	0
Environment, Conservation and Recreation	Forest Management Research / Science Measurement / Research / Recreation Reserve	57	0	0	9	66	1,054	6.27	4,258	1.55
First Nations	Identified Treaty Settlement Lands	19	0	0	0	19	415	4.68	3,972	0.49
Industrial	Miscellaneous / Heavy Industrial	672	5	7	61	745	8,758	8.51	61,645	1.21
Institutional	Local-Regional Park	12	0	0	1	12	194	6.37	1,811	0.68
Quarrying	Sand and Gravel	6	0	0	0	6	75	7.99	79	7.59
Transportation	Roadway	3	0	0	7	11	49	22.15	223	4.89
Utility	Gas and Oil Pipeline / Electric Power Line	594	6	10	52	661	4,825	13.71	96,595	0.68
Waterpower	Investigative Phase / General Area	17	0	0	1	18	178	10.06	1,003	1.79

Notes: ha = hectare; % = percent; ROW = right-of-way; LSA = Local Study Area; TL=transmission line.
Total area of feature potentially affected ***(a)*** = the total area of each feature affected by all Project components;
Area of feature located within the LSA ***(b)*** = the specific area of each feature within the LSA;
% of Project within portion of feature in LSA ***(a divided by b)*** = the total area of feature potentially affected area divided by the area of feature located within the LSA;
Total feature size ***(c)*** = the total area of each feature; and
% of feature affected by Project ***(a divided by c)*** = the Project Total area divided by the Total Parcel Size.

Source: BC Integrated Land and Resource Registry.

Obtained from: GeoBC, 2015

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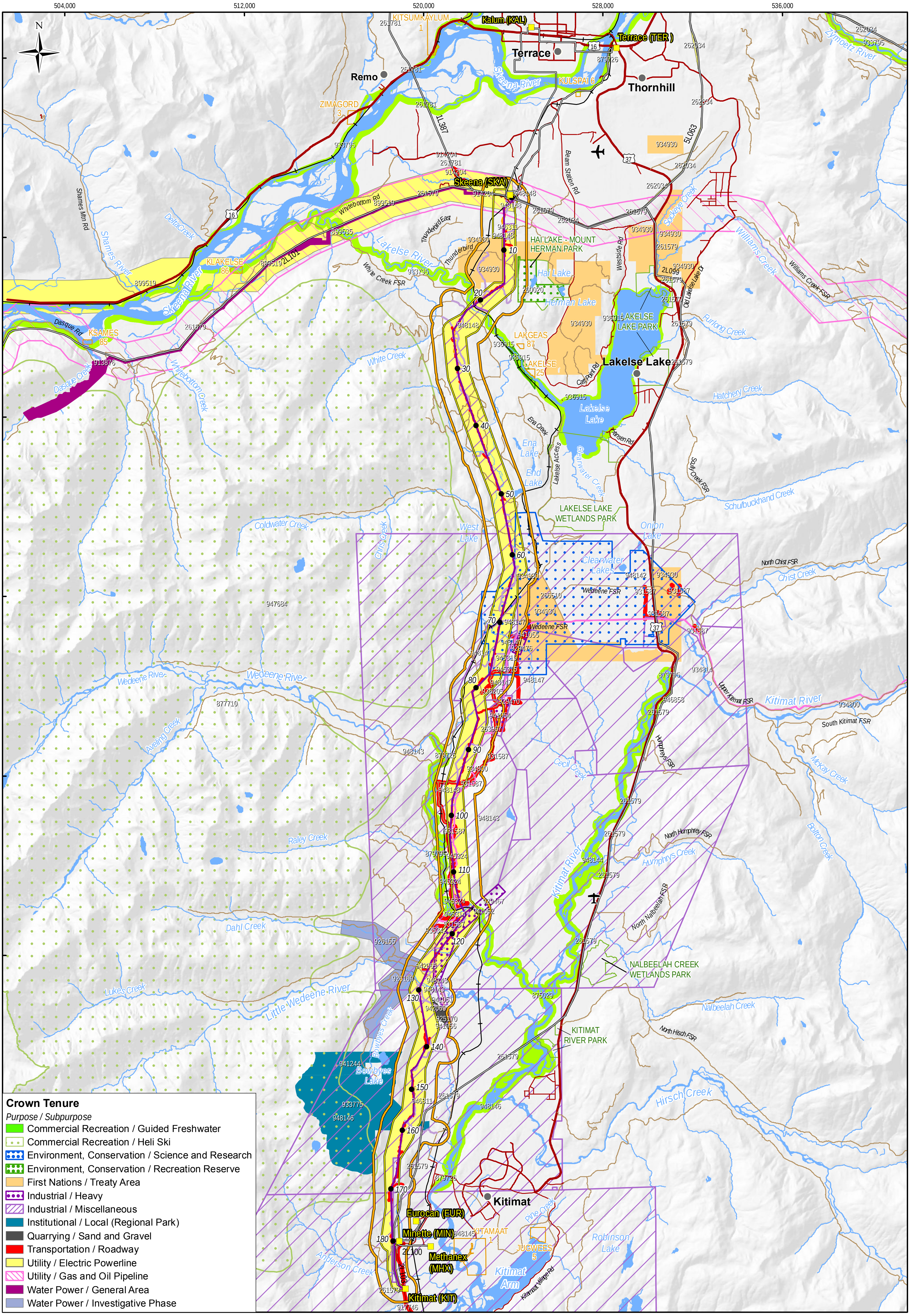

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Last updated by willem.van-riet

Legend

- Populated Place
- Airport
- Aerodrome
- Existing Substation
- Existing Transmission Line
- Railway
- Park
- First Nation Reserve
- Highway
- Arterial
- Local Road
- Forest Service Road
- Watercourse
- Waterbody

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary
- Non-Traditional Land Use Local Study Area

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
DataBC Data Distribution Service
data.gov.bc.ca/
Crown Tenure
data.gov.bc.ca/dataset/tantalis-crown-tenures

CLIENT:	PROJECT:
Prepared for BC Hydro	Terrace to Kitimat Transmission Project (TKTP)

TITLE:

Crown Land Activities and Status

DATE:	ANALYST:	QA/QC:	
October, 2016	WR	VG	**Figure 7.6-4**

GIS FILE: 18-02-012_CrownTenure_v2

JOB No: VE52379

COORDINATE SYSTEM: NAD 1983 UTM Zone 9N

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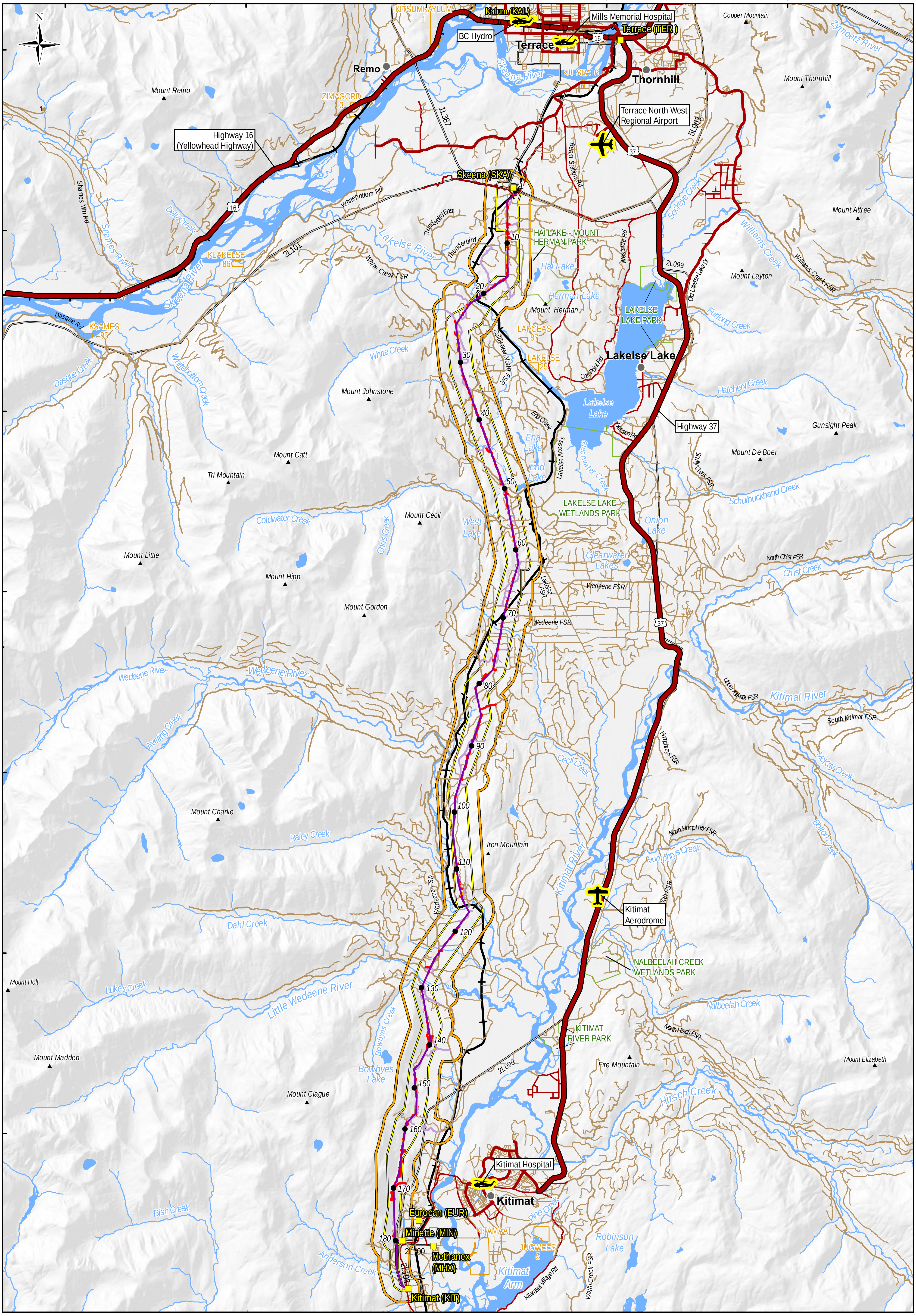

Legend

- Populated Place
- Airport
- Aerodrome
- Heliport
- Existing Substation
- Existing Transmission Line
- Railway
- Parks
- First Nation Reserve
- Highway
- Arterial
- Local Road
- Forest Service Road
- Other/Old Logging Road
- Watercourse
- Waterbody

Project Components

- Proposed Strcuture
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary
- Non-Traditional Land Use Local Study Area

0 0.5 1 2 3

Kilometers

Scale: 1:155,000

Reference: DataBC Data Distribution Service (http://www.data.gov.bc.ca/)

CLIENT:	PROJECT:
Prepared for BC Hydro	Terrace to Kitimat Transmission Project (TKTP)

TITLE:	DATE:	ANALYST:	QA/QC:	
Access and Transportation	October, 2016	WR	CH	**Figure 7.6-5**
	GIS FILE: 18-02-014_AccessTrans_v2			
	JOB No: VE52379			
	COORDINATE SYSTEM: NAD 1983 UTM Zone 9N			

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7.6.2.4 Forestry

Crown forest regulation is the responsibility of the BC MFLNRO, governed under the *Forest Act* and the *Forest and Range Practices Act*. The *Forest Act* has two categories of tenures for harvesting Crown timber: volume-based tenures that grant licensees the right to harvest a certain amount of timber within a specified Timber Supply Area (TSA), allowing several licensees to operate in the same management unit, and area-based tenures that grant the licensee virtually exclusive rights to harvest timber within a specified area. Walmsley (1990) identifies forestry values as one of the most important environmental factors related to a proposed 287 kV transmission line alignment in the same area as the LSA.

7.6.2.4.1 Forest Tenures and Old Growth Management Areas

Forest tenures can take the form of agreement, licence or permit.

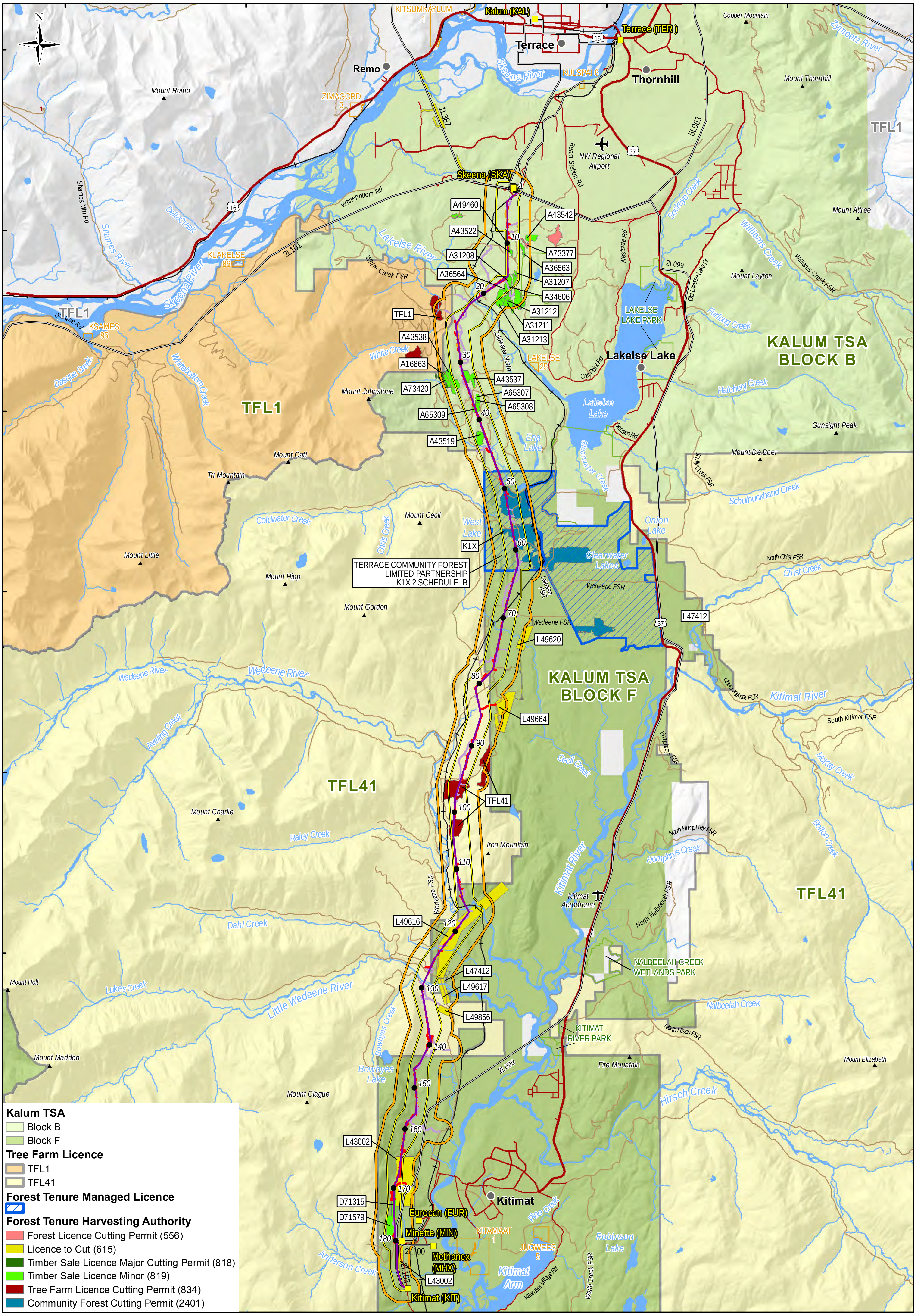
The LSA intersects nine active forest tenures that comprise an area of approximately 660 ha of the LSA. The tenures include one community forest agreement (associated with the woodlot owned by the Terrace Community Forest Limited Partners), two Tree Farm Licences (TFL 1 and TFL 41) and six occupant licences to cut. The community forest agreement, TFL 41 and the occupant licence to cut tenures are overlapped by the transmission line ROW, new temporary access roads and reconstruction roads. TFL 1 tenure is within the LSA but is not overlapped by the transmission line ROW or any access roads. **Table 7.6-6** and **Figure 7.6-6** summarize the active forest tenures overlapped by the LSA.

Table 7.6-6: Forest Tenures within the Local Study Area

Forest Tenure Type	Area Overlapped by Project Components						Area of Feature Located within LSA (ha) (b)	% of Project within Portion of Feature within LSA (%) (a/b)	Total Feature Size (ha) (c)	% of Feature Affected by Project (%) (a/c)
	Number of Tenures	TL ROW (ha)	New Permanent Roads (ha)	New Temporary Roads (ha)	Reconstruction Roads (ha)	Total Area of Feature Potentially Affected (ha) (a)				
Community Forest Agreement	1	24.53	0.17	0	1.43	26.14	289	9.04	497	5.26
Occupant Licence to Cut	6	29.37	0.30	0	1.26	30.94	323	9.32	533	5.64
Tree Farm Licence	2	19.25	0.02	0	0.73	20.00	181	11.03	253	7.89
Total	**9**	**73.15**	**0.49**	**0**	**3.42**	**77.08**	**793**	**9.72**	**1,283**	**6.01**

Note: ha = hectare; % = percent; ROW = right-of-way; LSA = Local Study Area; TL=transmission line.
Total area of feature potentially affected ***(a)*** = the total area of each feature affected by all Project components;
Area of feature located within the LSA ***(b)*** = the specific area of each feature within the LSA;
% of Project within portion of feature in LSA ***(a divided by b)*** = the total area of feature potentially affected area divided by the area of feature located within the LSA;
Total feature size ***(c)*** = the total area of each feature; and
% of feature affected by Project ***(a divided by c)*** = the Project Total area divided by the Total Parcel Size.

Source: DataBC, 2015



Legend

- Populated Place
- Airport
- Aerodrome
- Existing Substation
- Existing Transmission Line
- Railway
- Parks & Protected Areas
- First Nation Reserve
- Highway
- Arterial
- Local Road
- Forest Service Road
- Watercourse
- Waterbody

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary
- Non-Traditional Land Use Local Study Area

0 0.5 1 2 3 Kilometers
Scale: 1:155,000

Reference: DataBC Data Distribution Service data.gov.bc.ca/ MFLNRO - Forest Tenures data.gov.bc.ca/dataset/ forest-tenure-harvesting-authority

CLIENT: Prepared for BC Hydro

PROJECT: Terrace to Kitimat Transmission Project (TKTP)

TITLE: Forest Tenures and Licences

DATE:	ANALYST:	QA/QC:	
October, 2016	WR	VG	Figure 7.6-6

GIS FILE: 18-02-006_ForestTenures_v4

JOB No: VE52379

COORDINATE SYSTEM: NAD 1983 UTM Zone 9N

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The Terrace Community Forest was awarded a probationary area-based tenure granting the right to harvest up to 30,000 cubic metres (m^3) of timber per year effective in 2007. It now has a permanent licence valid for 25 years. The community forest's approximately 13,500 ha is split into three operating areas (Logging and Sawmilling Journal, 2014).

Crown forest land is also managed for other forest uses and values. For example, some biodiversity goals can be met by reserving OGMAs. OGMAs have been identified for conservation by the Kalum LRMP and SRMP. These plans dissuade clearing, harvesting and any activity that may lead to blowdowns within the boundaries of OGMAs. OGMAs were established to retain a variety of ecosystems and stand characteristics across a range of topography and biogeoclimatic units. The target amounts of OGMAs are agreed upon during plan negotiations, such as those that were carried out for the Kalum LRMP and SRMP. There are a total of 22 spatially defined legal OGMAs that occur within the LSA. Detailed information about the overlaps of OGMAs with the LSA and Project components are provided in the vegetation assessment (**Section 5.6.2.5**).

7.6.2.4.2 Forest Tenures Cutblock Activity and Status

Available information indicates that approximately 940 ha of the LSA are occupied by historical and recent forest cutblock. Each cutblock has a life cycle status that is classified as Pending—submitted as a new cutblock but not yet approved or rejected; Active—approved and activities taking place; or Retired—all harvesting activities completed. Once retired, cutblocks are registered as previously harvested areas with silviculture obligations, where management activities intend to rehabilitate vegetation cover to free growing status.

Approximately 940 ha of the LSA are occupied by forest cutblocks (**Figure 7.6-7**). The LSA intersects eleven active cutblocks (550 ha). Two cutblocks are overlapped by the transmission line ROW, new permanent access roads and reconstruction roads. Two cutblocks are overlapped by new permanent roads. A fifth cutblock is overlapped by reconstruction roads. The Project will affect 41 ha of active cutblock tenures. There are also 29 retired cutblocks (390 ha) within the LSA. **Table 7.6-7** summarizes forest cutblocks within the LSA.

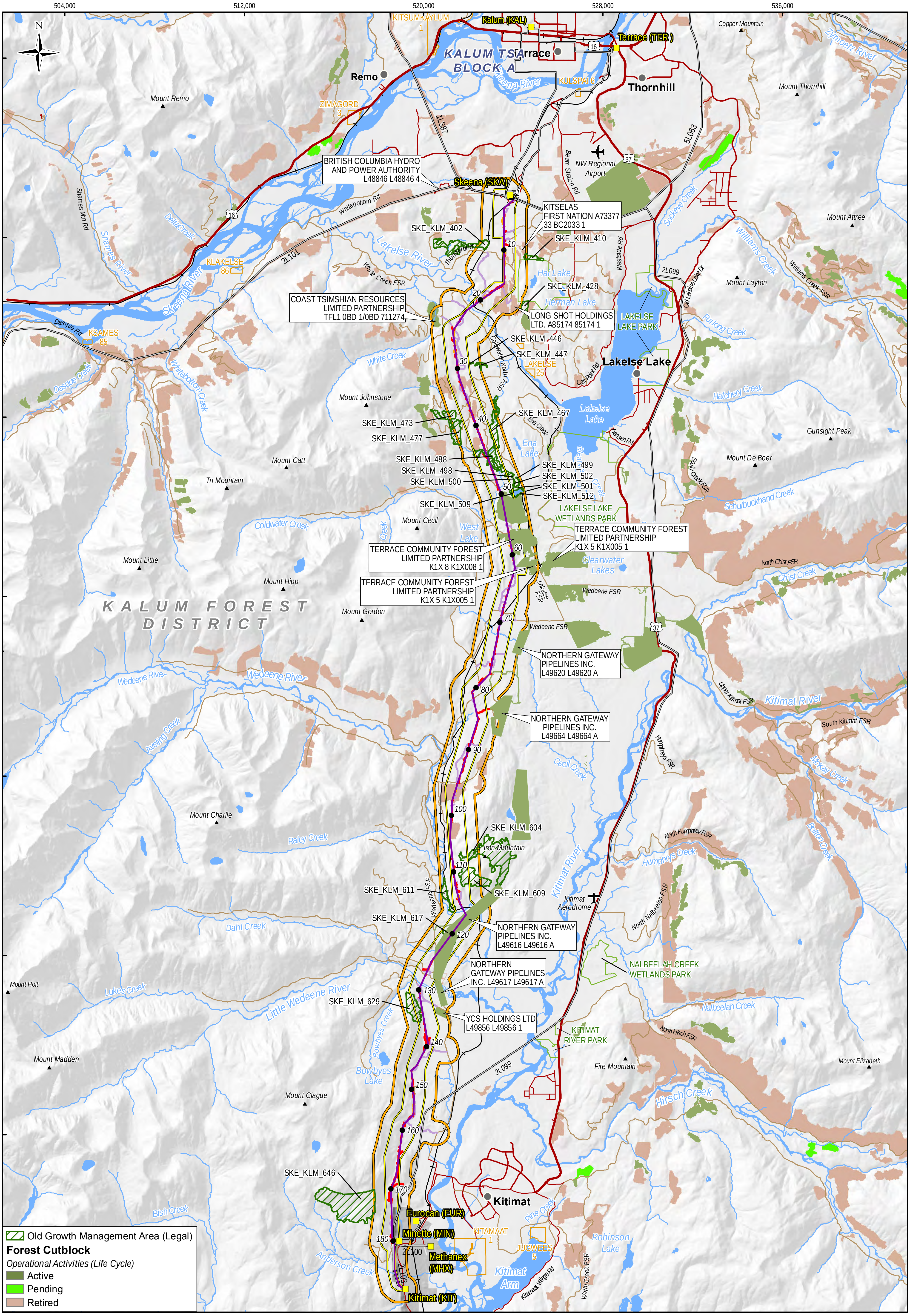
Table 7.6-7: Forest Cutblock Status

Forest Cutblocks	Status	Area Overlapped by Project Components					Area of Feature Located within LSA (ha) (b)	% of Project within Portion of Feature Located within LSA (%) (a/b)	Total Feature Size (ha) (c)	% of Feature Affected by Project (%) (a/c)
		TL ROW (ha)	New Permanent Roads (ha)	New Temporary Roads (ha)	Reconstruction Roads (ha)	Total Area of Feature Potentially Affected (ha) (a)				
Operation / Maintenance Activities	Pending	-	-	-	-	-	-	-	-	-
	Active	38.51	0.30	0	2.13	40.95	549.66	7.45	845.76	4.84
	Retired	36.24	0.12	0.64	2.69	40	389.90	10.18	490.35	8.09

Note: ha = hectare; % = percent; ROW = right-of-way; LSA = Local Study Area; - = none found; TL=transmission line.
Total area of feature potentially affected ***(a)*** = the total area of each feature affected by all Project components;
Area of feature located within the LSA ***(b)*** = the specific area of each feature within the LSA;
% of Project within portion of feature in LSA ***(a divided by b)*** = the total area of feature potentially affected area divided by the area of feature located within the LSA;
Total feature size ***(c)*** = the total area of each feature; and
% of feature affected by Project ***(a divided by c)*** = the Project Total area divided by the Total Parcel Size.

Source: BC MFLNRO Forest Tenures branch.

Obtained from: GeoBC, 2015.



Legend

- Populated Place
- Airport
- Aerodrome
- Existing Substation
- Existing Transmission Line
- Railway
- Park
- First Nation Reserve
- Highway
- Arterial
- Local Road
- Forest Service Road
- Watercourse
- Waterbody

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary
- Non-Traditional Land Use Local Study Area

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
DataBC Data Distribution Service (www.data.gov.bc.ca/)
Operational Activities data.gov.bc.ca/dataset/forest-tenure-cutblock
OGMA data.gov.bc.ca/dataset/old-growth-management-areas

CLIENT: Prepared for BC Hydro		PROJECT: Terrace to Kitimat Transmission Project (TKTP)	
TITLE: Forest Cut Block Licenses and Old Growth Management Areas	DATE: October, 2016	ANALYST: WR	QA/QC: CH
	GIS FILE: 18-02-007_ForestCutblocks_v3	Figure 7.6-7	
	JOB No: VE52379		
	COORDINATE SYSTEM: NAD 1983 UTM Zone 9N	amec foster wheeler	

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7.6.2.4.3 Merchantable Timber

The entire LSA falls within the Kalum TSA, which covers an area of 2.3 Mha ranging from the Kitlope River in the south to the lower Nass River in the north. The Kalum TSA boundary encompasses TFL 1 and 41[5], a portion of the Nisga'a private land under the Nisga'a Final Agreement, and several protected areas. These areas do not contribute to the TSA's timber supply (timber that is forecast to be available for harvesting). The core area of the TSA without these areas is approximately 522,700 ha. The current annual allowable cut for the Kalum TSA is 424,000 m^3, effective February 16, 2011 (BC MFLNRO, 2014d). The Kalum TSA is administered by the Coast Mountains Natural Resource District.

The LSA overlaps with portions of the TFL 41 (2,876 ha in the LSA), the TFL 1 (168 ha in the LSA) and the core Kalum TSA (Block B and Block F).

The Kalum LRMP covers the core area of the Kalum TSA, TFL 1 and TFL 41. A significant portion of the Kalum LRMP land base is not available for timber harvesting because of the lack of forest cover or unsuitability for timber harvesting due to environmental sensitivities, rough terrain, difficult access or unmerchantable timber (Government of BC, 2002). The 2006 Kalum SRMP guides land use and resource management within the Kalum TSA.

A merchantable timber volume analysis was conducted to estimate the total merchantable timber volume that would be affected by the Project as presented in **Appendix E.2**. The merchantable timber assessment was carried out for the Statutory ROW as the lands within represent the permanent removal of lands from the forestry landbase. The Non-traditional Land Use assessment uses the maximum clearing ROW. The potential effects of the Project on merchantable timber are discussed in **Section 1.1.1.1.**

7.6.2.5 Hunting, Trapping and Guide Outfitting

The BC MFLNRO has legislated responsibility for monitoring wildlife populations and adjusting hunting seasons and regulations, including closures and bag limits. The first priority of the BC MFLNRO is to ensure the long-term conservation of wildlife populations and their habitats. There are three categories of hunters in BC—resident, non-resident and First Nations—each of which has specific laws and regulations. First Nations residing in BC are required to comply with hunting regulations related to public health and safety but are not required to obtain a hunting licence under the BC *Wildlife Act*. Since the completion of this assessment traditional use information has been made available by several First Nations. An addendum has been prepared to consider this additional information..

Recreational hunting occurs in a variety of areas within the region in particular along the Skeena River. Hunters come from across the province to hunt in the Kalum LRMP area. Although province-wide participation rates are declining, the area draws a large number of local hunters (Government of BC, 2002).

[5] A TFL is a 25-year licence (replaceable every five years) that grants the right to carry out forest management on a specific area of Crown land (area-based tenure).

Wildlife management units (WMUs) support informed management decisions for land and natural resource planning, including wildlife management, protection of biodiversity and resource-based industries. The Project is located within the Skeena Region (Region 6) WMUs 6-3 and 6-11. WMU 6-3 is overlapped by the transmission line ROW. WMU 6-11 is overlapped by the transmission line ROW, both permanent and temporary new access roads as well as reconstruction roads. Specific regulations set for hunting within those WMUs are summarized in the 2014–2016 Hunting and Trapping Regulations Synopsis (BC MFLNRO, 2014b). Additional information relevant to hunting is presented in the wildlife section (**Section 6**). **Table 7.6-8** summarizes the percent of each WMU within the LSA.

Walmsley (1990) identifies wildlife values as one of the most significant environmental factors related to a proposed 287 kV transmission line alignment in the same area as the LSA.

Figure 7.6-8 shows the locations of an ungulate hunting stand, within the transmission line ROW, as well as a site used by hunters to camp within the LSA.

Table 7.6-8: Wildlife Management Units in the Local Study Area

Wildlife Management Unit	Area Overlapped by Project Components					Area of Feature Located within LSA (ha) (b)	% of Project within Portion of Feature in LSA (%) (a/b)	Total Feature Size (ha) (c)	% of Feature Affected by Project (%) (a/c)
	TL ROW (ha)	New Permanent Roads (ha)	New Temporary Roads (ha)	Reconstruction Roads (ha)	Total Area of Feature Potentially Affected (ha) (a)				
6-3	1.12	0	0	0	1.12	86	1.30	2,435,096	0
6-11	631.69	10.41	0.39	55.69	698.19	10,434	6.69	1,588,853	0.04

Note: ha = hectare; % = percent; ROW = right-of-way; LSA = Local Study Area; TL=transmission line.
Total area of feature potentially affected ***(a)*** = the total area of each feature affected by all Project components;
Area of feature located within the LSA ***(b)*** = the specific area of each feature within the LSA;
% of Project within portion of feature in LSA ***(a divided by b)*** = the total area of feature potentially affected area divided by the area of feature located within the LSA;
Total feature size ***(c)*** = the total area of each feature; and
% of feature affected by Project ***(a divided by c)*** = the Project Total area divided by the Total Parcel Size.

Source: BC MFLNRO Fish, Wildlife and Habitat Management.

Obtained from: GeoBC, 2015.

7.6.2.5.1 Traplines

To protect furbearers and address overharvesting, a trapline registry was started in 1926. The BC *Wildlife Act* establishes regulations on harvest and harvesting methods, and trappers are obligated to purchase exclusive trapping rights within certain areas. In BC, approximately 3,500 trappers actively manage 17 furbearing animal species, following standards, legislation and regulations developed by BC MFLNRO (BC MFLNRO, 2014b).

Trapping seasons have been developed to regulate harvests by considering a variety of criteria including pelt primeness, relative vulnerability of age and sex classes to harvesting, abundance and capture technique (BC MFLNRO, 2014b). The registered trapline system is the primary system for setting harvest guidelines and managing furbearing animals.

Trapping, by both First Nations and non–First Nations trappers, has long been a part of the economy and culture of the Kalum LRMP area (Government of BC, 2002). The furbearers harvested in the area include marten, lynx and beaver. Trapping is not a full-time occupation for anyone; however, some trappers are dependent on trapping for part of their annual income, while others are involved primarily for recreational purposes (Government of BC, 2002).

Seven traplines overlap the LSA as summarized in **Table 7.6-9** and on **Figure 7.6-8**. Of these, two traplines (TR0610T001 and TR0611T004) make up the majority of the overlap. One trapline is overlapped by all of the Project components. One trapline (TR0610T014) is overlapped by the transmission line ROW and reconstruction roads. Trapline TR0611T001 is overlapped by all Project components with the exception of the new temporary access roads and four traplines are overlapped by all Project components with the exception of the new temporary access roads. The Project will affect 699 ha of trapline tenures within the LSA.

Figure 7.6-8 shows the locations of four old marten trap sites, two of which are within the ROW and two are within the LSA. More information on the marten trap sites are provided in **Section 11.6.2**.

Table 7.6-9: Traplines within the Local Study Area

Trapline Identifier	Area Overlapped by Project Components					Area of Feature Located within LSA (ha) (b)	% of Project within Portion of Feature within LSA (%) (a/b)	Total Feature Size (ha) (c)	% of Feature Affected by Project (%) (a/c)
	TL ROW (ha)	New Permanent Roads (ha)	New Temporary Roads (ha)	Reconstruction Roads (ha)	Total Area of Feature Potentially Affected (ha) (a)				
TR0610T001	177	2.05	0.38	21.29	200	3,099	6.46	20,551	0.97
TR0610T014	11	0.00	0.00	0.48	11	280	4.01	4,151	0.27
TR0611T001	65	0.01	0.00	8.15	73	993	7.33	3,657	1.99
TR0611T003	84	2.91	0.00	9.07	96	1,361	7.02	4,846	1.97
TR0611T004	159	2.52	0.00	10.92	172	2,684	6.42	37,483	0.46
TR0611T005	77	1.17	0.00	5.34	83	1,286	6.49	19,331	0.43
TR0611T007	62	1.74	0.00	0.44	64	817	7.81	8,223	0.78
Total	**633**	**10.41**	**0.39**	**55.69**	**699**	**10,520**	**6.65**	**98,243**	**0.71**

Note: ha = hectare; % = percent; ROW = right-of-way; LSA = Local Study Area; TL=transmission line.

Total area of feature potentially affected ***(a)*** = the total area of each feature affected by all Project components;
Area of feature located within the LSA ***(b)*** = the specific area of each feature within the LSA;
% of Project within portion of feature in LSA ***(a divided by b)*** = the total area of feature potentially affected area divided by the area of feature located within the LSA;
Total feature size ***(c)*** = the total area of each feature; and
% of feature affected by Project ***(a divided by c)*** = the Project Total area divided by the Total Parcel Size.

Source: BC MFLNRO Fish, Wildlife and Habitat Management.

Obtained from: GeoBC, 2015.

7.6.2.5.2 Guide Outfitting

In order to hunt big game in BC, non-residents must be accompanied by either a licensed guide (in the case of hunters from other countries) or a resident holding a Permit to Accompany (in the case of Canadian hunters not residing in BC).

The guide outfitter reporting system tracks non-resident hunter and harvest data. Guide outfitters are required to report on every hunt they guide within 10 days of the end of the hunt under the BC *Wildlife Act*. Reports must include species hunted, duration and location of the hunt, name of the individual guided and success of the hunt.

A valid BC Guide Outfitter Licence or an Assistant Guide Outfitter Licence is required to legally guide hunters (BC MFLNRO, 2014b). A Guiding Territory Certificate provides exclusive control over guiding privileges within a specific guiding territory.

The LSA falls entirely within guide outfitter certificate area 601036 (**Figure 7.6-8**). The LSA represents a very small proportion of the guide outfitter area, as shown in **Table 7.6-10**. Project activities will result in an affected area of 699 ha within the guide outfitting area.

Table 7.6-10: Guide Outfitter Area within the Local Study Area

Guide Outfitter Certificate	Species Hunted	Area Overlapped by Project Components				Total Area of Feature Potentially Affected (ha) (a)	Area of Feature Located within LSA (ha) (b)	% of Project within Portion of Feature within LSA (%) (a/b)	Total Feature Size (ha) (c)	% of Feature Affected by Project (%) (a/c)
		TL ROW (ha)	New Permanent Roads (ha)	New Temporary Roads (ha)	Reconstruction Roads (ha)					
601036	Black Bear, Grizzly Bear, Moose, Mountain Goat	633	10.41	0.39	55.69	699	10,520	6.65	2,668,115	0.03

Note: ha = hectare; % = percent; ROW = right-of-way; LSA = Local Study Area; TL= transmission line.
Total area of feature potentially affected ***(a)*** = the total area of each feature affected by all Project components;
Area of feature located within the LSA ***(b)*** = the specific area of each feature within the LSA;
% of Project within portion of feature in LSA ***(a divided by b)*** = the total area of feature potentially affected area divided by the area of feature located within the LSA;
Total feature size ***(c)*** = the total area of each feature; and
% of feature affected by Project ***(a divided by c)*** = the Project Total area divided by the Total Parcel Size.

Source: BC MFLNRO Fish, Wildlife and Habitat Management.

Obtained from: GeoBC, 2015.

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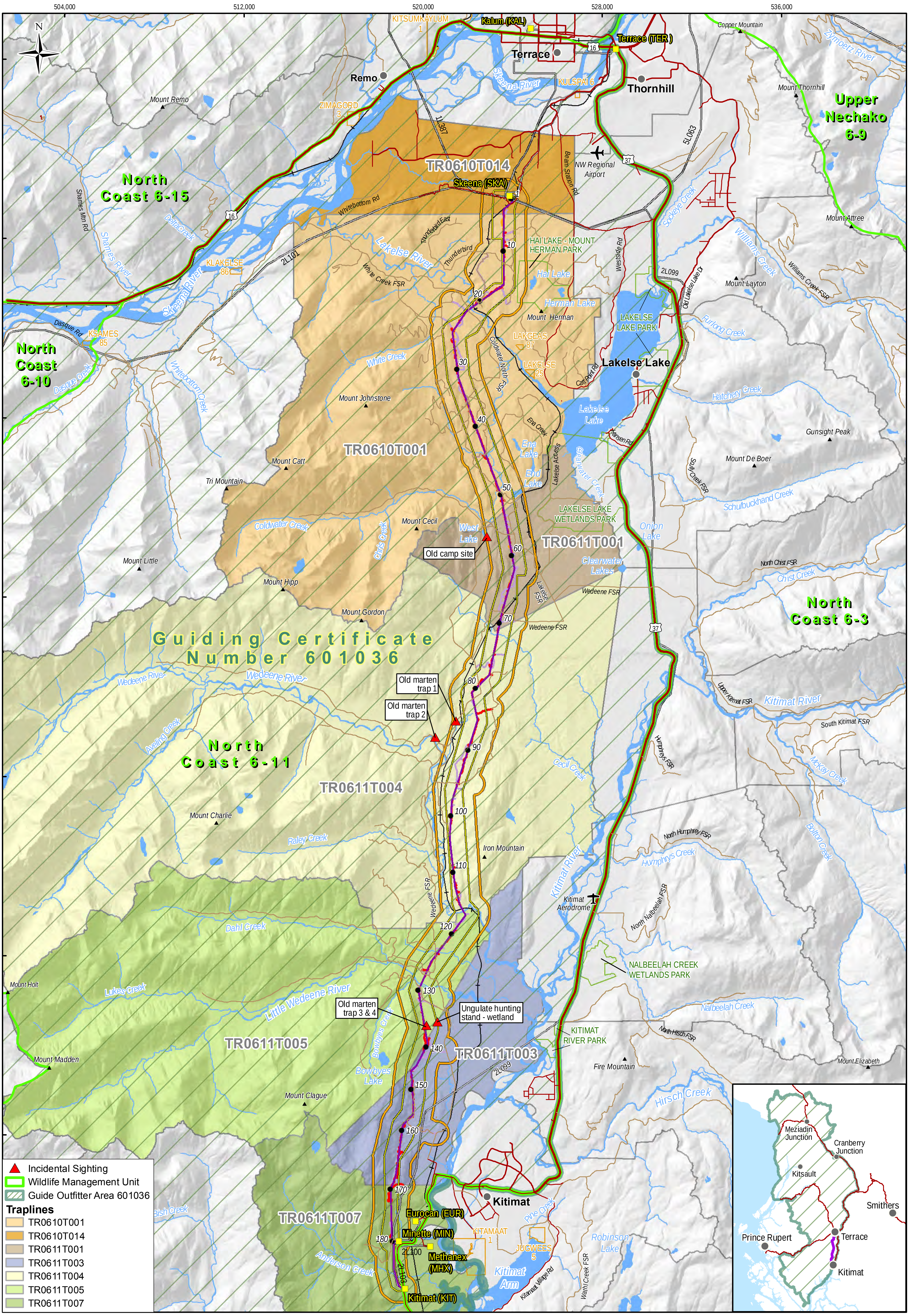

Legend

- Populated Place
- Airport
- Aerodrome
- Existing Substation
- Existing Transmission Line
- Railway
- Parks
- First Nation Reserve
- Highway
- Arterial
- Local Road
- Forest Service Road
- Watercourse
- Waterbody

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary
- Non-Traditional Land Use Local Study Area

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
DataBC Data Distribution Service (hwww.data.gov.bc.ca/)
Guide Outfitter Areas: data.gov.bc.ca/dataset/guide-outfitter-areas
Traplines: data.gov.bc.ca/dataset/traplines

CLIENT:	PROJECT:
Prepared for BC Hydro	Terrace to Kitimat Transmission Project (TKTP)

TITLE: **Registered Traplines and Guide Outfitter Areas**

DATE:	ANALYST:	QA/QC:	
October, 2016	WR	CH	**Figure 7.6-8**

GIS FILE: 18-02-003_TraplinesGO_v3
JOB No: VE52379
COORDINATE SYSTEM: NAD 1983 UTM Zone 9N

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7.6.2.6 Tourism, Parks and Recreation

7.6.2.6.1 Tourism

During summer, Kitimat and Terrace are popular destinations for hiking, horseback riding, mountain biking, camping, rock climbing, canoeing, kayaking, boating and fishing. In winter, deep snow conditions facilitate powder and cross-country skiing, snowshoeing and snowmobiling. Outdoor ice-skating is possible on lakes when the temperature is cold enough. Developed and undeveloped local hot springs are popular areas (Government of BC, 2002). Key advantages of the area include accessible alpine ridges and wilderness. Variety of businesses offers commercial recreation opportunities along Highway 37 between Terrace and Kitimat.

7.6.2.6.2 Parks and Protected Areas

There are no designated national parks, national historical sites or migratory bird sanctuaries within the LSA or in the region (Environment Canada, 2013a; 2013b; Parks Canada, n.d.). There are six provincial parks near the LSA: Hai Lake–Mount Herman, Kitimat District Regional Park, Lakelse Lake Wetland, Kitimat River, Lakelse Lake and Nalbeelah Creek Wetlands (**Table 7.6-11**). The Kitimat River and Nalbeelah Creek Wetlands Provincial Parks are identified as proposed protected areas in the LRMP. Both were proclaimed as parks in 2004 after recommendation by the Kalum LRMP.

Although the LSA intersects 61 ha of the Hai Lake–Mount Herman Provincial Park, the footprint of Project components does not overlap with any portion of the park (**Table 7.6-12**). The Hai Lake–Mount Herman Park is located about 15 km south of Terrace on the Beam Station Road (**Figure 7.6-9**) and protects regionally significant and remnant old growth forest and bog ecosystems. Activities in the park include day hiking, camping, fishing and hunting. Backcountry walk-in camping is allowed at two basic campsites at Hai Lake with picnic tables, fire rings, a pit toilet and a lake dock. (BC Parks, n.d.). In addition, the LSA intersects 194 ha of the proposed Kitimat District Regional Park, of which 12 ha are within the transmission line ROW (**Figure 7.6-9**).

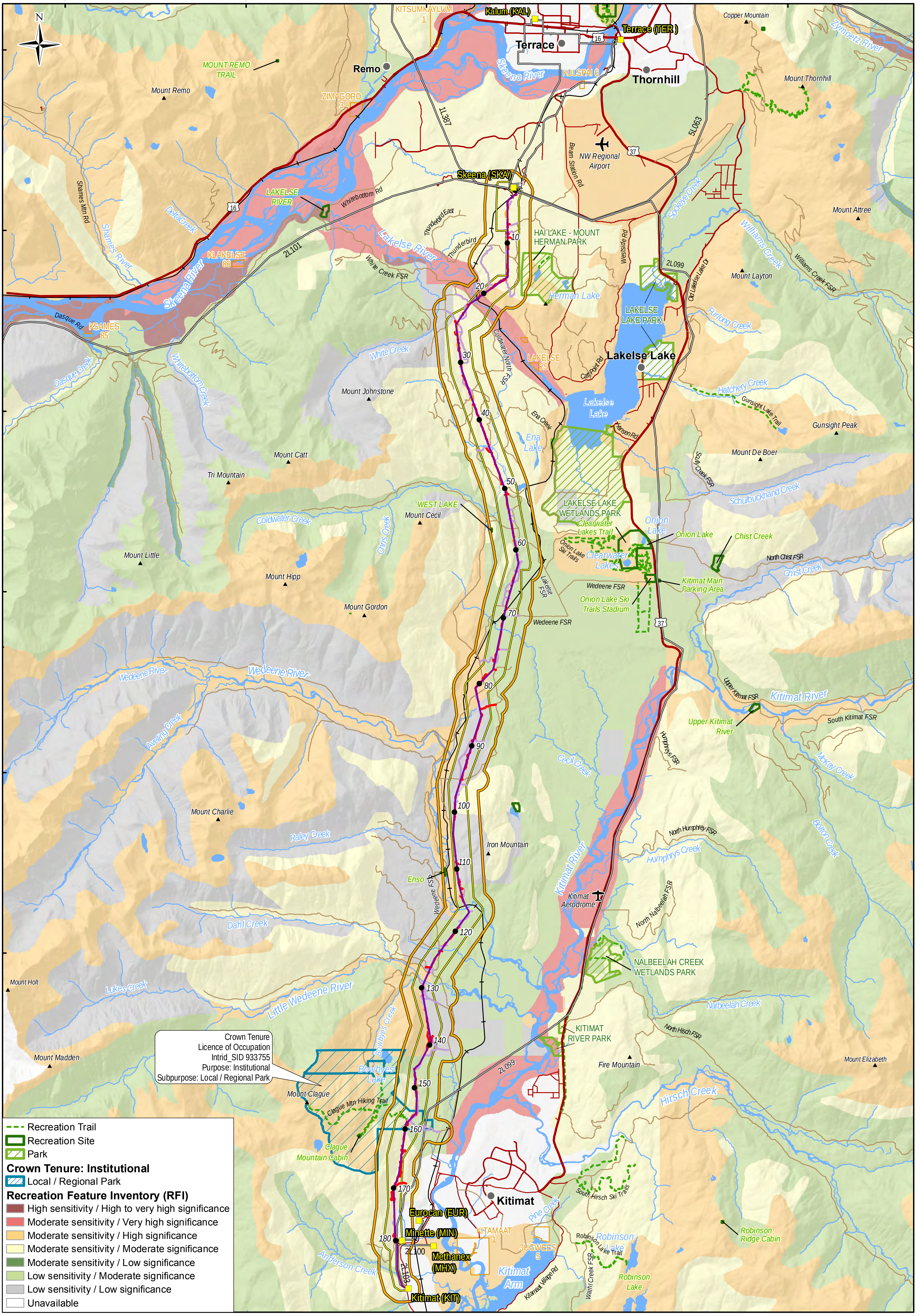
Table 7.6-11: Description of Parks and Protected Areas Located near the Local Study Area

Park or Protected Area	Type	General Description	Approximate Distance from Route Study Area (km)
Hai Lake–Mt. Herman	Provincial Park	323 ha park protects regionally significant and remnant old growth forest and bog ecosystems. It also provides local day hiking, camping, fishing and hunting opportunities. Hai Lake trail is accessed via the South Thunderbird Forest Service Road and Herman Lake is accessed via Beam Station Road.	Directly adjacent and east of the LSA
Lakelse Lake Wetlands	Provincial Park	1,214 ha park at the south end of Lakelse Lake, the largest warm water lake in northwestern BC. The park contains internationally significant salmon spawning and rearing habitat and regionally important migratory and over-wintering waterfowl and moose winter range. Trumpeter swans over-winter, breed and nest in the wetlands and grizzly	<1 km east of LSA

Park or Protected Area	Type	General Description	Approximate Distance from Route Study Area (km)
		bears frequent the area in spring and fall. Activities include walk-in wilderness camping, hunting, canoeing, fishing and hiking.	
Kitimat River	Provincial Park	57 ha park protects two parcels of small but highly productive old growth Sitka spruce and redcedar forest on the natural floodplain and fluvial terraces of the Kitimat River. It also protects grizzly bear habitat and culturally modified trees. Activities include walk-in wilderness camping, hunting, canoeing, fishing and hiking.	<5 km east of LSA
Lakelse Lake	Provincial Park	Situated in the Skeena River Watershed the 354 ha park preserves stands of old growth cedar, hemlock and Sitka spruce forests. Located approximately 20 km south of Terrace and 40 km north of Kitimat on Highway #37. Located approximately 2.5 km north of the Mount Layton Hot Springs. Activities and amenities include a boat launch, camping (Furlong campground), fishing, cycling, hiking, swimming and waterskiing.	>5 km east of LSA
Nalbeelah Creek Wetlands	Provincial Park	171 ha park protects a provincially significant wetland complex with unique geological features. The wetlands formed in an earth-flow crater and evolved into a complex of raised acidic bogs. In addition, the park protects the habitat for grizzly bear, one Blue-listed plant species (bog adder's-mouth orchid) and one Blue-listed plant community (Black cottonwood / Red-osier dogwood). The wetlands also provide high-value coho salmon and cutthroat trout rearing habitat. Activities include walk-in wilderness camping, hunting, canoeing, fishing and hiking.	>5 km east of the LSA
Kitimat District Regional Park	Regional District Park (Proposed)	1,811 ha park managed by the Kitimat Regional District. The park includes the Mount Clague Recreation Trail.	Within the LSA

Note: BC = British Columbia; ha = hectare; km = kilometre; LSA = Local Study Area

Source: BC Parks, nd



Legend

- Populated Place
- Airport
- Aerodrome
- Existing Substation
- Existing Transmission Line
- Railway
- First Nation Reserve
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- Local Road
- Forest Service Road
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Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary
- Non-Traditional Land Use Local Study Area

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
Recreation Feature Inventory
data.gov.bc.ca/ dataset/ recreational-features-inventory
Recreation Sites and Trails
data.gov.bc.ca/dataset/ recreation

CLIENT:
Prepared for BC Hydro

PROJECT:
Terrace to Kitimat Transmission Project (TKTP)

TITLE:
Parks and Recreation Areas

DATE:	ANALYST:	QA/QC:	
October, 2016	WR	CH	**Figure 7.6-9**

GIS FILE: 18-02-010_RecreationFeatures_v4
JOB No: VE52379
COORDINATE SYSTEM: NAD 1983 UTM Zone 9N

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7.6.2.6.3 Recreation Sites and Trails

Two active recreation sites are located in the LSA. One site, Enzo, is a small scenic area with six camping spots adjacent to the Wedeene River in a stand of old growth forest. The other site is the West Lake Recreation Site, which is a small rustic site with two camping spots next to West Lake, south of the Coldwater Creek. Neither recreation site is overlapped by Project components.

The LSA intersects the Mount Clague Recreation Trail (also referred as the Clague Mountain Hiking Trail).This is a strenuous 7 km trail that starts near Saunders Road and leads to alpine areas on the west side of the Kitimat Valley, with a return time of 8 to 10 hours. It provides views of the Kitimat Valley and Douglas Channel from the alpine. A side route to a small cabin is located in the subalpine. The cabin is managed and maintained by the Kitimat Snowmobile Club under an agreement with the BC Ministry of Tourism, Culture and the Arts. This trail has been identified as having high suitability for increased usage (Government of BC, 2002). Mount Clague Recreation Trail overlaps the transmission line ROW for 150 m and is located within the Kitimat District Regional Park. **Table 7.6-12** and **Figure 7.6-9** summarize recreation sites and trails in the LSA.

Table 7.6-12: Parks, Recreation Sites and Trails in the Local Study Area

Forest File ID	Park, Recreation Site or Trail	Type	Area Overlapped by Project Components: TL ROW (ha/km)	New Permanent Roads (ha/km)	New Temporary Roads (ha/km)	Reconstruction Roads (ha/km)	Project Total (ha/km) (a)	Feature Size/ Length within LSA (ha/km) (b)	% of Project within Portion of Feature within LSA (%) (a/b)	Total Feature Size/Length (ha/km) (c)	% of Feature Overlapped by Project Components (%) (a/c)
6TU1887	Hai Lake – Mount Herman Park	Provincial Park	0	0	0	0	0	61	0	323	0
SK910854	Kitimat District Regional Park	Regional Park	11.75	0.16	0	3.13	15.04	190	7.91	1,456	1.03
REC6418	West Lake	Recreation Site	0	0	0	0	0	1	0	1	0
REC6420	Enzo	Recreation Site	0	0	0	0	0	3	0	3	0
REC136102	Mount Clague Recreation Trail	Recreation Trail	0.15 km	0	0	0.02 km	0.17 km	2.00 km	8.25	7.08 km	2.33

Note: ha = hectare; km = kilometre; % = percent; ROW = right-of-way; LSA = Local Study Area; TL= transmission line.
Total area of feature potentially affected ***(a)*** = the total area of each feature affected by all Project components;
Area of feature located within the LSA ***(b)*** = the specific area of each feature within the LSA;
% of Project within portion of feature in LSA ***(a divided by b)*** = the total area of feature potentially affected area divided by the area of feature located within the LSA;
Total feature size ***(c)*** = the total area of each feature; and
% of feature affected by Project ***(a divided by c)*** = the Project Total area divided by the Total Parcel Size.

Source: GeoBC, 2015.

7.6.2.6.4 Recreation Features Inventory

The Recreation Features Inventory (RFI) identifies areas of land and water encircling a recreation feature that supports one or more recreation activities. Areas are rated for their significance to recreation and their sensitivity to alteration. Significance is based on the potential to attract recreational users, uniqueness, scarcity, scenic view, current recreational use and accessibility (BC Ministry of Forests (BC MOF), 1998). Sensitivity is based on the potential for public concern if areas are altered.

Recreationally significant areas are usually associated with access and shoreline areas along rivers (**Figure 7.6-9**). No areas rated as high or very high sensitivity from a recreational perspective are overlapped by the LSA. The majority of the LSA is rated as low to moderate sensitivity / low to moderate significance (83%). A small portion of the LSA (169 ha) intersects the shoreline along Lakelse River, which is rated as having moderate sensitivity / very high significance. Project activities will affect 8 ha of the Lakelse River recreational area.

Approximately 12% of the LSA (1,322 ha) along the Wedeene River and Little Wedeene River Valleys and the west-facing slopes of Mount Clague are rated as having moderate sensitivity / high significance.

A rating of high sensitivity / very high significance was given to the area along the Skeena River, which is located outside of the LSA.

7.6.2.7 Fishing

Federal fishing regulations for the Skeena Region (Region 6) overlapped by the LSA are summarized in the BC Sport Fishing Guide (DFO, 2014). Provincial fishing regulations are summarized in the 2013–2015 Freshwater Fishing Regulations Synopsis (BC MFLNRO, 2015a).

The area is internationally known for freshwater and salt water fishing opportunities (Government of BC, 2002). Freshwater angling is the best known tourism activity in the Kalum LRMP area. The streams and rivers attract anglers for a variety of species throughout the year. Walmsley (1990) identifies fisheries values as one of the most significant environmental factors related to a 287 kV transmission line alignment in the same area as the LSA.

The coastal geography of Kitimat provides fishing opportunities in both freshwater and salt water. Kitimat is located along the banks of the Kitimat River, which provides an abundance of salmon during each of the major runs in late spring, summer and early fall (Tourism Kitimat, 2013). Trout may be fished year-round and steelhead is also found. Kitimat is located at the head of Kitimat Arm, a fjord‑like waterbody that extends northeast from Douglas Channel and the Pacific Ocean. Channel fishing species include salmon, halibut, cod, snapper, rock fish, crab and prawn.

A variety of freshwater fishing opportunities are also available in the Terrace area in the Skeena River and its tributaries (Kermodei Tourism Society, 2015).

7.6.2.7.1 Recreational Fishing

Many rivers, streams and lakes in the route LSA are used for recreational fishing. The rivers and streams within the LSA are shown on **Figure 7.6-9**. Numerous boat launches, as well as mapped and unmapped fishing sites, are located within the route study areas. Recreational freshwater fishing is a year-round activity in the Terrace and Kitimat area (BC MFLNRO, 2014e).

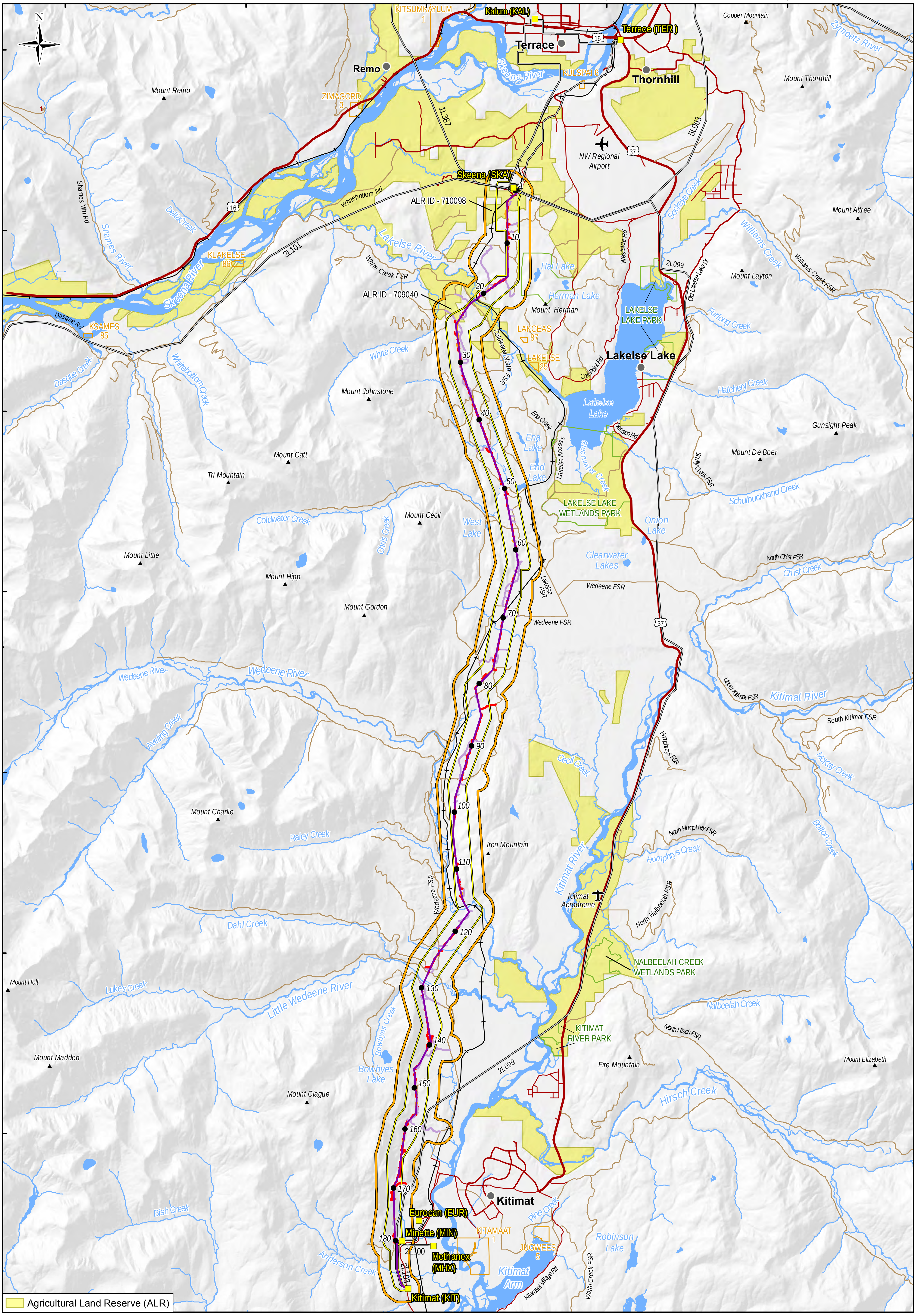
7.6.2.7.2 Commercial Fishing

The commercial fishery is a small contributor to the region's economic base, accounting for approximately one percent of the total basic sector employment (Government of BC, 2002). Commercial fisheries also operate out of Kitimat along the North Coast.

7.6.2.8 Agriculture

The LSA overlaps with portions of the Agricultural Land Reserve (ALR). The ALR is managed in BC under the *Agricultural Land Commission Act,* while agricultural Crown land tenures are administered under the *Range Act* and the *Land Act.* Agriculture is not a major economic sector in the area, but there are some relatively good soil and growing conditions in river valleys that are used for mixed use agricultural with crop production directed to local markets (Government of BC, 2002).

The ALR parcels in the Project area are located along the Lakelse River and South of Terrace from the Skeena River to the north of Lakelse Lake (**Figure 7.6-10**). A total of 457 ha of ALR fall within the LSA, with two ALR properties overlapped by the LSA and Project activities (**Table 7.6-13**). ALR parcel 709040 is overlapped by the transmission line ROW and reconstruction roads, and ALR parcel 710098 is overlapped by the ROW, new temporary access roads, as well as reconstruction roads. Approximately 25 ha of ALR lands will be affected by the Project. No range tenures are overlapped by the LSA.



Legend

- Populated Place
- Airport
- Aerodrome
- Existing Substation
- Existing Transmission Line
- Railway
- Park
- First Nation Reserve
- Highway
- Arterial
- Local Road
- Forest Service Road
- Watercourse
- Waterbody

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary
- Non-Traditional Land Use Local Study Area

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
DataBC Data Distribution Service (www.data.gov.bc.ca/)
Water Licences
ALR - BC Agricultural Land Commission data.gov.bc.ca/dataset/alc-alr-polygons

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Last updated by willem.van-riet

CLIENT:
Prepared for BC Hydro

PROJECT:
Terrace to Kitimat Transmission Project (TKTP)

TITLE:
Agricultural Land Reserves

DATE:	ANALYST:	QA/QC:	
October, 2016	WR	VG	**Figure 7.6-10**

GIS FILE: 18-02-002_ALR_v4

JOB No: VE52379

COORDINATE SYSTEM: NAD 1983 UTM Zone 9N

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Table 7.6-13: Agricultural Land Reserve Parcels within the Local Study Area

ALR ID	Area Overlapped by Project Components					Area of Feature Located within LSA (ha) (b)	% of Project within Portion of Feature within LSA (%) (a/b)	Total Feature Size (ha) (c)	% of Feature Affected by Project (%) (a/c)
	TL ROW (ha)	New Permanent Roads (ha)	New Temporary Roads (ha)	Reconstruction Roads (ha)	Total Area of Feature Potentially Affected (ha) (a)				
709040	6.87	0	0	1.86	8.73	252	3.47	592	1.48
710098	15.22	0	0.29	0.50	16.00	205	7.81	4,434	0.36
Total	**22.09**	**0**	**0.29**	**2.36**	**24.74**	**457**	**5.42**	**5,026**	**0.49**

Notes: ha = hectare; % = percent; NP = new permanent access roads; NT = new temporary access roads; Recon = reconstruction roads; TL= transmission line.
Total area of feature potentially affected ***(a)*** = the total area of each feature affected by all Project components;
Area of feature located within the LSA ***(b)*** = the specific area of each feature within the LSA;
% of Project within portion of feature in LSA ***(a divided by b)*** = the total area of feature potentially affected area divided by the area of feature located within the LSA;
Total feature size ***(c)*** = the total area of each feature; and
% of feature affected by Project ***(a divided by c)*** = the Project Total area divided by the Total Parcel Size.

Source: BC Agricultural Land Commission.

Obtained from: GeoBC, 2015.

7.7 Non-Traditional Land Use Effects Assessment

7.7.1 Potential Effects and Proposed Mitigation

An interaction matrix for selected VCs and Project components and/or activities was developed in order to identify and asses the linkages between Project components and activities and the selected VCs (**Table 7.7-1**).

Three types of interactions were identified:

- **Key interaction:** Potential adverse effect of significant concern; consideration in the assessment.
- **Moderate interaction:** Potential adverse effect requiring additional mitigation; consideration in the assessment.
- **No interaction:** No or negligible adverse effect expected; no further consideration needed for the assessment.

Selected VCs that have key interactions with Project components and/or activities are the focus of the assessment. Selected VCs with moderate interactions are also discussed in the assessment. No further consideration is needed for the assessment if no interaction was identified.

Table 7.7-1: Project Components and Activities Interaction with Selected VCs

Project Phase	Project Component	Project Activities	Non-Traditional Land Use							
			Land Use Planning and Management	Land Ownership	Access and Transportation	Forestry	Hunting, Trapping and Guide Outfitting	Tourism, Parks and Recreation	Fishing	Agriculture
Clearing / Construction	Transmission Line and Structures	Land clearing (cutting trees and removing vegetation) for ROW, helicopter logging, skidding - ground logging, grubbing, blasting, foundation excavation, dewatering of holes and excavation pits, foundation concrete pouring, assembly and installation of structures, stringing the line, construction waste management, and construction equipment servicing.	K	K	M	K	M	K	M	M
	New Access Roads (i.e. Temporary and Permanent Roads)	Land clearing (cutting trees and removing vegetation) for new access road, helicopter logging, skidding - ground logging, grubbing, cut and fill, blasting, ditching and grading, transportation of workers and materials. New temporary access roads will be decommissioned, revegetated and restored to a state similar to existing conditions.	M	M	M	M	M	M	M	M
	Existing Access Roads (i.e. Reconstruction Roads)	Widening, new culverts, new bridges and new ditches or widening existing ones, transportation of workers and materials.	M	M	M	M	M	M	M	M
Operation / Maintenance	Transmission Line and Structures	Operation of the energized transmission line. Vegetation maintenance (manual and chemical), site rehabilitation, erosion control maintenance, transmission line maintenance and monitoring and maintenance vegetation and invasive plants.	K	K	M	K	M	K	M	M
	Existing and new access roads	Maintenance of permanent access roads, maintenance of ditches and monitoring and maintenance vegetation and invasive plants. Transportation of workers and materials for maintenance.	M	M		M		M		
Closure	Transmission Line and Structures	Decommissioning, revegetation and restoration to a state similar to existing conditions or desired conditions at that time.	K	K	M	K	M	K	M	M
	Existing and new access roads	Maintenance of permanent access roads, maintenance of ditches and monitoring and maintenance vegetation and invasive plants. Transportation of workers and materials (structures, cables etc.) to decommission the line.	M	M	M	M	M	M		
Post-Closure	Transmission Line and Structures	Environmental monitoring along the transmission line ROW.	M	M	M	M	M	M		
	Existing and new access roads	Maintenance of roads for transportation of workers that will conduct environmental monitoring.	M	M	M	M	M	M		

Legend:
K Key interaction: Resulting in potential adverse effect of significant concern; consideration in the assessment.
M Moderate interaction: Potential adverse effect requiring additional mitigation; consideration in the assessment.
Blank No interaction: No or negligible adverse effect expected; no further consideration needed for the assessment.

Source: BC EAO, 2013

7.7.1.1 Land Use Planning and Management

Project components and activities have the potential to affect land under the regulatory framework of the Kalum LRMP and the Kalum SRMP Project components overlap with several RMZs as presented in **Table 7.6-2** and **Table 7.6-3**.

Non-legal RMZs under the Kalum LRMP are potentially affected by Project components as follows:

- 175 ha of land designated as private zones, settlement zones and SRMZs under the Kalum LRMP are affected by the transmission line ROW during clearing/construction, operation/maintenance and closure phases;
- 3.82 ha of land private zones, settlement zones and SRMZs under the Kalum LRMP are affected by new permanent access roads;
- 0.26 ha of land designated as private zones under the Kalum LRMP are affected by new temporary access roads, which will be required during all Project phases; and
- 20.94 ha of land designated as private zones, settlement zones and SRMZs under the Kalum LRMP are reconstruction roads for use during all Project phases.

The total area affected by the Project represents 6.41% of the non-legal RMZs under the Kalum LRMP within the LSA and 0.88% of the total area covered by the non-legal RMZs.

A total of 563 ha of legal RMZs managed under the Kalum SRMP are potentially affected by Project components as follows:

- 504 ha of land designated as Grizzly Bear Identified Watersheds and SRMZs under the Kalum SRMP are affected by the transmission line ROW during clearing/construction, operation/maintenance and closure phases;
- 5.20 ha of land designated as Grizzly Bear Identified Watersheds and SRMZs under the Kalum SRMP are affected by new permanent access roads;
- 0.39 ha of land designated as Grizzly Bear Identified Watersheds under the Kalum SRMP are affected by new temporary access roads, which will be required during all Project phases; and
- 53.52 ha of land designated as Grizzly Bear Identified Watersheds and SRMZs under the Kalum SRMP are reconstruction roads for use during all Project phases.

The total area affected by the Project represents 6.62% of the legal RMZs under the Kalum SRMP within the LSA and 0.71% of the legal RMZs covered under the Kalum SRMP.

Mitigation in design: the transmission line alignment has already been altered in order to for the most part avoid SRMZs described in the Kalum LRMP and the Kalum SRMP.

The Kalum LRMP identifies Lakelse River as an important resource to a variety of interests and values and has demarcated a SRMZ to either side of the river. The management of the Lakelse River Corridor SRMZ focuses on maintaining fish habitat, a quality angling/recreation experience and wildlife habitat. Other objectives are to prohibit harvesting (Subzone 1) and to manage for characteristics that maintain the integrity of old forest conditions within Subzone 1 (i.e. prevent blowdown) in Subzone 2. Potential effects such as clearing of some riparian vegetation during clearing/construction of the transmission line and access roads and mitigation measures are presented in the fish and fish habitat effects assessment (**Section 4**), in the vegetation effects assessment (**Section 5**) and in the wildlife effects assessment (**Section 6**).

Mitigation measures proposed include using helicopters to string sock line across the Lakelse River to avoid the need for any instream works or disturbance to the Lakelse River during the construction phase. BC Hydro will also prepare a CEMP outlining how the Project will protect riparian and stream habitat and avoid causing serious harm to fish and fish habitat. With respect to vegetation, as stated in vegetation mitigation VM3, there will be minimal clearing of old forest in the Lakelse River SRMZ Subzone 1 during all phases. BC Hydro has consulted with the LRMP Implementation Committee and will continue to consult with them as the Project moves ahead. Mitigation in design has been specifically applied to the Lakelse River crossing whereby BC Hydro redesigned the river crossing to minimize cutting any of the old growth trees within 200 m of either side of the river (SRMZ Subzone 1). The Kalum LRMP, section 3.1 states “no logging will occur in Subzone 1.” This was for the most part achieved by relocating the crossing to a new location and increasing structure height of both structures on either side of the river.

Potential effects on non-legal and legal land use and RMZs may also include sensory disturbance during clearing/construction and closure of infrastructure. The effects on visual resources and proposed mitigation are presented in **Section 8**.

Potential effects related to access along new access roads and reconstruction roads are discussed in **Section 7.7.1.3**.

Table 7.7-2 presents the potential effects and proposed mitigation for Land Use Planning and Management.

Table 7.7-2: Potential Effects and Proposed Mitigation on Land Use Planning and Management

Potential Effect	Project Phase	Proposed Mitigation*
Potential conflict with local and regional management strategies and planned land uses	Clearing/Construction	• Using helicopters to string sock line across the Lakelse River to avoid the need for any instream works or disturbance to the Lakelse River; • BC Hydro will also prepare a CEMP outlining how the Project will protect riparian and stream habitat and avoid causing serious harm to fish and fish habitat; • As stated in vegetation mitigation VM3, there will be minimal clearing of old forests in the Lakelse River SRMZ Subzone 1; • Avoidance of SRMZs wherever practicable; • Early consultation with First Nations, the public, stakeholders and provincial and local government representatives involved in the management of the LRMPs on the Project schedule and activities; • Revegetation and restoration of temporary Project areas to a state similar to existing conditions, to the extent practicable.
	Operation/Maintenance	• As stated in vegetation mitigation VM3, there will be minimal clearing of old forests in the Lakelse River SRMZ Subzone 1;

Potential Effect	Project Phase	Proposed Mitigation*
		• Ongoing consultation with First Nations, the public, stakeholders and provincial and local government representatives involved in the management of the LRMPs on the Project schedule and activities.
	Closure	• As stated in vegetation mitigation VM3, there will be minimal clearing of old forests in the Lakelse River SRMZ Subzone 1; • Ongoing consultation with First Nations, the public, stakeholders and provincial and local government representatives involved in the management of the LRMPs on the Project schedule and activities; • Revegetation and restoration of Project areas to a state similar to existing conditions, to the extent practicable.
	Post-Closure	• As stated in vegetation mitigation VM3, there will be minimal clearing of old forests in the Lakelse River SRMZ Subzone 1; • Environmental monitoring along the transmission line ROW and access roads during the PC phase.

Notes: *Additional mitigation measures are presented in the fish and fish habitat effects assessment (**Section 4**), in the vegetation effects assessment (**Section 5**), in the wildlife effects assessment (**Section 6**) and in the visual resources effects assessment (**Section 8**).

7.7.1.2 Land Ownership

Project components and activities have the potential to affect provincial Crown lands as well as private lands. Project components overlap with 26 Crown land parcels and 16 private land parcels as presented in **Table 7.6-4**.

A total of 155 ha of the 30 provincial Crown land parcels are potentially affected by Project components as follows:

- 138 ha of land of 19 provincial Crown land parcels are affected by the transmission line ROW during clearing/construction, operation/maintenance and closure phases;
- 1.33 ha of land of seven provincial Crown land parcels are affected by new permanent access roads;
- 0.08 ha of land of three provincial Crown land parcels are affected by new temporary access roads, which will be required during all Project phases; and
- 16.08 ha of land of 16 provincial Crown land parcels are existing roads to be reconstructed for use during all Project phases.

The total area affected by the Project represents 6.31% of provincial Crown land within the LSA and 3.91% of the total tenure.

A total of 64 ha of the 21 private land parcels are potentially affected by Project components as follows:

- 59.80 ha of land of 18 private parcels are affected by the transmission line ROW during clearing/construction, operation/maintenance and closure phases;

- 1.75 ha of land of one private parcel are affected by new permanent access roads;
- 0.29 ha of one private land parcel are affected by new permanent access roads, which will be required during all Project phases; and
- 2.12 ha of land of six private land parcels are reconstruction roads for use during all Project phases.

The total area affected by the Project represents 6.32% of private lands within the LSA and 4.01% of the total tenure.

Potential effects on owners of private lands may also include sensory disturbance during clearing/construction and closure of infrastructure. The effects on visual resources and proposed mitigation are presented in **Section 8**.

Clearing/construction, operation/maintenance, or closure might conflict with planned activities of tenure holders including access and use of their tenures in the LSA.

Potential effects related to access along new access roads and reconstruction roads are discussed in **Section 7.7.1.1.3**.

Table 7.7-3 presents the potential effects and proposed mitigation for land ownership.

Table 7.7-3: Potential Effects on and Proposed Mitigation for Land Ownership

Potential Effect	Project Phase	Proposed Mitigation*
Potential conflict with other crown tenure holders or private owners	Clearing/Construction	• Avoid privately owned land and existing Crown land tenures to the greatest extent practicable; • Potentially affected private land owners will be engaged by BC Hydro to negotiate Statutory ROW agreements as appropriate; • Communicate with holders of Crown land tenure to enable potential effects to be identified, considered and addressed as much as practicable; • Revegetate and restore temporary Project areas to a state similar to existing conditions to the extent practicable.
	Closure	• Revegetate and restore Project areas to a state similar to existing conditions to the extent practicable.
	Post-Closure	• Environmental monitoring along the transmission line ROW and access roads as required would evaluate success of restoration and closure plan, which is yet to be developed.

Notes: *Additional mitigation measures are presented in the Visual Resources effects assessment (**Section 8**).

7.7.1.3 Access and Transportation

The Project will require access to the transmission ROW corridors and substation sites during clearing/construction, and year-round access during the operation/maintenance phase for maintenance and monitoring activities. Access to transmission ROW corridors will require the use of existing FSRs and the creation of new temporary and permanent access roads. The transmission line corridors and the new access to the ROW will create new linear access where corridors and access routes are currently non-existent.

The Project may affect access to land during the clearing/construction, operation/maintenance and closure phases. During construction of new temporary and permanent roads as well as during reconstruction of existing roads access may potentially be restricted, and these roads will not be available for use.

New temporary roads and new permanent roads will provide increased access to lands. Increased access due to new temporary roads will occur during the clearing/construction phase only, as these new temporary roads will be deactivated and reclaimed post-construction. New permanent access roads will remain post-closure.

An increase in access can have positive and/or adverse effects for various land uses and users. Consumptive and non-consumptive recreational uses can be enhanced by year-round access, which the addition of new transmission ROWs may provide. However, increased access has the potential to increase pressure on Non-Traditional Land Use resources and competition on recreational uses (hunting, fishing and other Non-Traditional Land Use).

Project works will generate increased traffic and additional wear on local roads (secondary roads and FSRs) during the clearing/construction phase and during the closure phase due to decommissioning. During the clearing/construction phase, there could be minor disruptions to access and considerations associated with heavy trucks transporting structure structures, cable and equipment to the ROW, and substation sites via the FSRs. Outside of the construction period, the Project will not disrupt access on FSRs and other local roads because Project-related traffic will be minimal and no heavy truck loads are anticipated.

Project works during clearing/construction and closure will generate noise, emissions and dust, which may temporarily disrupt nearby land and resource use activities (i.e. hunting, trapping and guide outfitting, forestry and recreation and tourism activities), users and local residents.

Potential effects and proposed mitigation is also discussed under the Traffic and Transportation VC in the socio-economic effects assessment (**Section 9.7.1.1.3**).

Table 7.7-4 presents the potential effects and proposed mitigation for access and transportation.

Table 7.7-4: Potential Effects on and Proposed Mitigation for Access and Transportation

Potential Effect	Project Phase	Proposed Mitigation*
Access restrictions to lands currently available for non-traditional land uses	Clearing/Construction	• Early notification to stakeholders of the Project schedule and activities. • BC Hydro will post signage as necessary and implement a transportation and access management plan.
Increased traffic and additional wear on existing local roads	Clearing/Construction	• Early notification to stakeholders of the Project schedule and activities. • BC Hydro will post signage as necessary and implement a transportation and access management plan. • Project-related vehicles will comply with traffic safety guidelines when using the FSRs.

Potential Effect	Project Phase	Proposed Mitigation*
		• BC Hydro will review access plans with neighbouring tenure holders and private land owners. • Where the Project requires new or upgraded bridge crossings, they will be built to a sufficient load design for multiple resource users where necessary (minimum BCL 625 load rating).
Increased dust and decreased air quality	Clearing/Construction	• Early notification of Project schedules to relevant recreational stakeholders (i.e. known recreational groups, lodges, campsites, etc.), and rural residents who will be in close proximity to Project activities. • Erecting appropriate signage on affected recreational and snowmobiling trails, warning users of temporary trail closures, if scheduling to avoid trail users is not practicable. • Controlling dust with wetting agent at regular intervals and/or when necessary, as practicable. • Implementing a transportation and access management plan. • Implement appropriate BMPs and CEMP/EPPs to control fugitive dust.
Increased access to lands available for non-traditional land uses	Clearing/Construction	• Revegetation and restoration of temporary Project areas to a state similar to existing conditions, to the extent practicable. • BC Hydro will post signage as necessary and implement a transportation and access management plan.
	Operation/Maintenance	• BC Hydro will post signage as necessary and implement transportation and access measures, as appropriate..
	Closure	• BC Hydro will post signage as necessary and implement transportation and access management measures, as appropriate. • Revegetation and restoration of Project areas to a state similar to existing conditions, to the extent practicable.

Notes: *Additional mitigation measures are presented in the socio-economic effects assessment (**Section 9**) and in **Appendix E.2**.

7.7.1.4 Forestry

Project components and activities have the potential to affect forestry tenures. Project components overlap with community forest agreement and occupant licence to cut tenures, OGMAs and active cutblocks.

A total of 77.08 ha of forestry tenures are potentially affected by Project components as follows:

- 73.15 ha of forestry tenures are affected by the transmission line ROW during clearing/construction, operation/maintenance and closure phases;
- 0.49 ha of forestry tenures are affected by new permanent access roads, which will be required during all Project phases;
- No forestry tenures are affected by new temporary access roads; and
- 3.42 ha of forestry tenures are reconstruction roads for use during all Project phases.

The total area affected by the Project represents 9.72% of forestry tenures within the LSA and 6.01% of the total forestry tenure.

A total of 40.95 ha of active cutblocks are potentially affected by Project components as follows:

- 38.51 ha of active cutblocks are affected by the transmission line ROW during clearing/construction, operation/maintenance and closure phases;
- 0.30 ha of active cutblocks are affected by new permanent access roads, which will be required during all Project phases;
- No active cutblocks are affected by new temporary access roads; and
- 2.13 ha of active cutblocks are reconstruction roads for use during all Project phases.

The total area affected by the Project represents 7.45% of active cutblocks within the LSA and 4.84% of the total active cutblock lands.

Potential effects on OGMA and proposed mitigation measures are provided in the vegetation effects assessment (**Section 5.7.1.6**); therefore, the scope of the assessment provided in this section is focused on potential effects on merchantable timber.

A merchantable timber volume analysis was conducted to estimate the total merchantable timber volume that would be affected by the Project. The timber analysis is predominately a GIS spatial analysis of the area within each of the Project components as described below. It incorporates current industry standards in terms of the BC MFLNRO approved process for Vegetation Resources Inventory (VRI) data analysis and predicting forest vegetation volume and species composition. The merchantable timber volume analysis uses the 42 m wide Statutory ROW as described below whereas the remaining indicators in the Non-Traditional Land Use valued component were assessed based on the maximum clearing width of 120 m for the ROW. The Statutory ROW was applied to the merchantable timber assessment as it represents a permanent removal from the forestry landbase.

7.7.1.4.1 Project Components

Inventory polygons were spatially linked to the following forestry Project Components:

1. *Project Footprint*— includes all areas within the November 10, 2015 GIS file. The Project Footprint is predominantly surrounded by the Study Area with exception of a small (0.13 ha) portion that extends beyond the Study Area on the North boundary. The Project Footprint is further stratified to include:
   a. A 42 m wide *Statutory Right-Of-Way* that surrounds the proposed transmission line (21 m each side of centerline). These areas are assumed to be de-forested and not regenerated to commercial tree species. New road openings within the Statutory Right-of-Way clearing area were identified separately but were included in the Statutory Line Right-of-Way clearing area.
   b. *New Road Openings* (or portions) outside the 42 m wide Statutory Right-of-Way were identified separately. All new road lines in the GIS file were buffered 10 m on either side to represent a 20 m wide road opening. All road openings are assumed to be permanently deforested.

   c. *Areas Outside the 42 m wide Statutory Right-of-Way Clearing and Outside the New Road Openings* proposed for a one-time danger tree clearing. These areas are not assumed a permanent loss to the Timber Harvesting Land Base.

2. *New Roads outside the Project Footprint but within Study Area* –proposed new road openings built outside of the Project Footprint in the November 10, 2015 GIS file, but with within the boundaries of the identified Study Area. All new road lines in the GIS file were buffered 10 m on either side to represent a 20 m wide road opening.
3. *New Roads Outside Study Area* – proposed new road openings built outside the Study Area. New road lines were buffered 10 m on either side to represent a 20 m wide road opening.
4. *Study Area* – area of interest that includes items 1 & 2 above, plus a buffer area that surrounds them. It is assumed there will be no clearing of timber for Project development in the buffer area that surrounds items 1 & 2; therefore, this area was not assessed in this report.

The Timber Harvesting Land Base (THLB) is an estimate of the forested area available for growing trees. For this assessment, all timbered inventory polygons were included in the THLB except those areas with obvious deficiencies in timber production. Such polygons include those without site productivity information, non-forested areas like lakes, gravel pits and rock and non-productive areas. No allowances were made for non-spatial attributes that may reduce the harvestable land base component in a conventional timber supply analysis such as old seral targets. All forested land, both Crown-owned and private, was assumed to be in the THLB for this analysis as the timber component may be an important compensation factor in negotiations with land owners.

Table 7.7-5 shows a summary of the THLB area within each Project component by ownership category. The THLB is further distinguished to those areas where the current stand volume is greater than or less than 250 m^3/ha as a proxy for stand merchantability. Young stands with less than 250 m^3/ha are assumed to be unsuitable for harvest.

The merchantable timber volume was summarized by coniferous and deciduous species, as there is a market for each species present. **Table 7.7-6** provided a summary of the merchantable timber volume by ownership and tree classification for each Project component.

See **Appendix E.2** for additional details of the merchantable timber analysis.

The Project may cause a reduction in timber production and yield due to the harvest of existing stands of timber for the transmission line clearing and the lost opportunity to grow timber in areas that are proposed for permanent clearing (i.e. Statutory ROW and roads).

Transmission lines have the potential to isolate adjacent stands of timber and may restrict conventional logging activities when the lines are located across or along forestry roads. Transmission lines also have the potential to restrict aerial harvesting flight paths as helicopters carrying logs cannot cross transmission lines without risk to the circuit (i.e. potential for logs and/or debris to fall on the circuit). These effects have the potential to affect the economic and practical feasibility of harvesting timber (**Appendix E.2**).

Table 7.7-5: Timber Harvesting Land Base Summary within the Project Footprint

	Ownership			Area (ha)		
Project Footprint	**Owner**	**Percentage (%)**	**Total Area (ha)**	**Merchantable Timber <250 m³/ha**	**Merchantable Timber >250 m³/ha**	**Non-Timber (ha)**
Statutory ROW in Project Footprint	Crown	94	199.3	155.1	26.2	5.8
	Private	6	12.3	8.9	0.2	3.3
	Total		**211.6**	**164.0**	**37.8**	**9.8**
New Roads outside of Statutory ROW, within Project Footprint	Crown	98	4.2	3.1	1.1	0
	Private	2	0.1	0.1	0	0
	Total		**4.3**	**3.2**	**1.1**	**0**
New Roads outside Project Footprint	Crown	85	26.0	17.2	8.1	0.7
	Private	15	4.7	4.7	0	0
	Total		**30.7**	**21.9**	**8.1**	**0.7**
New Roads outside Project Footprint and LSA	Crown	88	3.7	3.7	0	0
	Private	12	0.5	0.5	0	0
	Total		**4.2**	**4.2**	**0**	**0**
Total Permanent Clearing ROW and Roads			**250.6**	**193.1**	**46.9**	**10.6**
Temporarily Cleared Area Outside Statutory ROW and New Roads	Crown	94	36.5	24.0	12.4	0.2
	Private	6	2.5	2.2	0	0.3
	Total		**39.0**	**26.2**	**12.3**	**0.5**
Total Area			**289.6**	**219.2**	**59.3**	**11.1**

Notes: ha = hectare; % = percent; ROW = right-of-way; LSA = Local Study Area; m^3/ha = cubic metre per hectare; <= less than; > = greater than.

Table 7.7-6: Merchantable Timber Volume by Ownership and Tree Species within the Project Components

Project Footprint	Ownership	Softwood Species Volume (m³)											Hardwood Species Volume (m³)							Total Merchantable Timber (m³)
		Hemlock		Balsam		Cedar		Pine and Larch		Spruce		Total	Aspen and Cottonwood		Red Alder		Birch		Total	
		>250 m³/ha	<250 m³/ha	>250 m³/ha	<250 m³/ha	>250 m³/ha	<250 m³/ha	>250 m³/ha	<250 m³/ha	>250 m³/ha	<250 m³/ha		>250 m³/ha	<250 m³/ha	>250 m³/ha	<250 m³/ha	>250 m³/ha	<250 m³/ha		
Statutory ROW in Project Footprint	Crown	10,545	11,023	3,538	2,706	1,765	797	48	48	1,872	538	32,880	325	0	359	589	0	9	1,282	**34,162**
	Private	7	505	0	9	4	82	0	0	11	47	665	0	0	35	80	0	114	229	**894**
	Total	**10,552**	**11,528**	**3,538**	**2,715**	**1,769**	**879**	**48**	**48**	**1,883**	**585**	**33,545**	**325**	**0**	**394**	**669**	**0**	**123**	**1,511**	**35,056**
New Roads outside Statutory ROW within Project Footprint	Crown	246	221	57	62	81	19	0	0	83	6	775	13	0	4	9	0	0	26	**801**
	Private	0	8	0	0	0	0	0	0	0	0	8	0	0	0	3	0	1	4	**12**
	Total	**246**	**229**	**57**	**62**	**81**	**19**	**0**	**0**	**83**	**6**	**783**	**13**	**0**	**4**	**12**	**0**	**1**	**30**	**813**
New Roads outside Project Footprint within LSA	Crown	2,656	1,103	658	235	318	96	0	1	21	52	5,140	4	0	1	87	0	0	92	**5,232**
	Private	0	309	0	14	0	12	0	0	0	0	335	0	0	0	28	0	9	37	**372**
	Total	**2,656**	**1,412**	**658**	**249**	**318**	**108**	**0**	**1**	**21**	**52**	**5,475**	**4**	**0**	**1**	**115**	**0**	**9**	**129**	**5,604**
New Roads outside Project Footprint and LSA	Crown	0	408	0	59	0	0	0	0	0	58	525	0	0	0	1	0	0	1	**526**
	Private	0	15	0	0	0	2	0	0	0	0	17	0	0	0	0	0	0	0	**17**
	Total	**0**	**423**	**0**	**59**	**0**	**2**	**0**	**0**	**0**	**58**	**542**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**543**
Total Permanent Clearing ROW and Roads		**34,598**	**13,454**	**13,591**	**4,252**	**3,083**	**2,169**	**1,008**	**48**	**50**	**1,987**	**702**	**40,344**	**342**	**0**	**399**	**798**	**0**	**134**	**1,673**
Temporarily Cleared Area Outside Statutory ROW and New Roads	Crown	3,791	2,065	1,110	508	536	117	7	9	593	101	8,837	134	0	31	150	0	3	318	**9,155**
	Private	0	172	0	7	0	45	0	0	0	33	257	0	0	0	25	0	66	91	**348**
	Total	**3,791**	**2,235**	**1,109**	**516**	**536**	**161**	**7**	**8**	**592**	**134**	**9,089**	**134**	**0**	**31**	**175**	**0**	**69**	**409**	**9,498**
Total Volume		**17,245**	**15,827**	**5,361**	**3,599**	**2,705**	**1,169**	**56**	**58**	**2,580**	**837**	**49,437**	**476**	**0**	**430**	**974**	**0**	**203**	**2,082**	**51,519**

Notes: m³ = cubic metre; ROW = right-of-way; LSA = Local Study Area; m³/ha = cubic metre per hectare; <= less than; > = greater than.

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Table 7.7-7 presents the potential effects and proposed mitigation for forestry.

Table 7.7-7: Potential Effects and Proposed Mitigation on Forestry

Potential Effect	Project Phase	Proposed Mitigation*
Direct Effects • Reduction in timber production and yield due to the harvest of existing stands of timber for the transmission line ROW clearing and the lost opportunity to grow timber in areas that are proposed for permanent clearing (i.e. Statutory ROW and roads) • Potential site degradation on areas stripped/grubbed for temporary use during construction	Clearing/Construction	• Minimize clearing where practicable • Use best efforts to utilize merchantable timber and provide harvest opportunities and access to this timber by the respective tenure holders or private land owners, where practicable • Follow BMPs and CEMP/EPPs developed for the Project where practicable • Sort, separate and store top soil on sites where short-term soil stripping and grubbing is required during construction, where practicable. This material can be spread back onto sites during restoration • Give consideration to access improvements in any offset negotiation discussions with adjacent area based forest tenure and private land holders for lost timber growing space
	Operation/Maintenance	• Follow BMPs and CEMP/EPPs developed for the Project where practicable
Indirect Effects • Potential isolation of adjacent stands of timber and restrictions to conventional logging activities and aerial flight paths	Clearing/Construction	• Provide BC MFLNRO, surrounding area based tenure holders and private land owners an opportunity to review the Project plans and provide comment • Project design will consider appropriate limits of approach under transmission lines on FSRs for forestry harvesting equipment to cross, even when travelling on a low-bed • Where timber harvesting activities are planned, review the Project plans with BC MFLNRO and affected area based tenure holders to minimize flight path effects and potential timber isolation • Review access plans with BC MFLNRO, area based tenure holders and private land owners to minimize potential timber access conflicts • Design bridge crossings required for the Project to a minimum BCL 625 load rating (legal highway load rating)
	Operation/Maintenance	• Where timber harvesting activities are planned, review the Project plans with BC MFLNRO and affected area based tenure holders to minimize flight path effects and potential timber isolation • Review access plans with BC MFLNRO, area based tenure holders and private land owners to minimize potential timber access conflicts

Notes: BC MFLNRO = British Columbia Ministry of Forests, Lands and Natural Resource Operations; BMP= best management practices; EMP = environmental management plan; EPP = environmental protection plan; FSR = forest service road; ROW = right-of-way.
*Additional mitigation measures are presented in the Vegetation effects assessment (Section 5), and in **Appendix E.2**.

7.7.1.5 Hunting, Trapping and Guide Outfitting

Project components and activities have the potential to disrupt recreational hunting activities and seven registered traplines (TR0610T001, TR0610T014, TR0611T001, TR0611T003, TR0611T004, TR0611T005 and TR0611T007) and one guide outfitting area (601036) overlapped by Project components.

A total of 699 ha of the seven traplines are potentially affected by Project components as follows:

- 633 ha land of the seven traplines are affected by the transmission line ROW during clearing/construction, operation/maintenance and closure phases;
- 10.41 ha land of six traplines are affected by new temporary access roads during the clearing/construction phase; trapline TR0610T014 is not affected by new temporary roads;
- 0.39 ha land of one trapline (TR0610T001) are affected by new permanent access roads, which will be required during all Project phases; and
- 55.69 ha land of the seven traplines are reconstruction roads for use during all Project phases.

The total area affected by the Project represents 6.65% of traplines within the LSA and 0.71% of the total tenure.

A total of 699 ha of guide outfitter tenure 601036 are potentially affected by Project components as follows:

- 633 ha of guide outfitter tenure are affected by the transmission line ROW during clearing/construction, operation/maintenance and closure phases;
- 10.41 ha of this tenure are affected by new temporary access roads during the clearing/construction phase;
- 0.39 ha land of this tenure are affected by new permanent access roads, which will be required during all Project phases; and
- 55.69 ha of guide outfitter tenure are reconstruction roads for use during all Project phases.

The total area affected by the Project represents 6.65% of the portion of the tenure within the LSA and 0.03% of the total tenure, which comprises 2,668,115 ha.

The Project may also result in sensory and habitat disruption to furbearing and game animals due to clearing/construction, operation/maintenance and closure phases. This could potentially affect the use of tenures held by trappers and guide outfitters, as well as recreational hunters. The potential effects and proposed mitigation measures for wildlife species are presented in **Section 6**.

Potential effects related to access along new access roads and reconstruction roads are discussed in **Section 7.7.1.3**.

Table 7.7-8 presents the potential effects and proposed mitigation for the use of land for hunting, the seven traplines and the guide outfitter tenure.

Table 7.7-8: Potential Effects and Proposed Mitigation on Hunting, Trapping and Guide Outfitting

Potential Effect	Project Phase	Proposed Mitigation*
Disruption of land currently used for hunting, guide outfitting and trapping	Clearing/Construction	• Early notification of project activities and schedule will be supplied to affected Trapline and Guide Outfitter tenure holders, First Nations and the local offices of the BC MFLNRO; • Revegetation and restoration of temporary Project areas to a state similar to existing conditions, to the extent practicable.
	Operation/Maintenance	• Ongoing notification of project activities and schedule will be supplied to affected Trapline and Guide Outfitter tenure holders, First Nations and the local offices of the BC MFLNRO;
	Closure	• Revegetation and restoration of Project areas to a state similar to existing conditions, to the extent practicable; • Ongoing notification of project activities and schedule will be supplied to affected Trapline and Guide Outfitter tenure holders, First Nations and the local offices of the BC MFLNRO.
	Post_Closure	• Environmental monitoring as required along the transmission line ROW and access roads during the PC phase would evaluate success of restoration and closure plan, which is yet to be developed; • Ongoing notification of project activities and schedule will be supplied to affected Trapline and Guide Outfitter tenure holders, First Nations and the local offices of the BC MFLNRO.

Notes: *Additional mitigation measures are presented in the Wildlife effects assessment (**Section 6**), and visual resources effects assessment (**Section 8**).

7.7.1.6 Tourism, Parks and Recreation

Project components and activities have the potential to affect lands for recreation and tourism use. A portion of the Project overlaps with part of one regional park, the Kitimat District Regional Park, which includes one recreational hiking trail, the Mount Clague Recreational Trail. Project components also overlap with lands designated as moderate sensitivity / very high significance of recreational features, along the shores of the Lakelse River (**Table 7.7-9**).

A total of 15.04 ha of recreational use land parcels and parks are potentially affected by Project components as follows:

- 11.75 ha of recreational use lands and parks are affected by the transmission line ROW during clearing/construction, operation/maintenance and closure phases;
- 0.16 ha of recreational use lands or parks are affected by new permanent access roads for use during all Project phases;

- No recreational use lands or parks are affected by new temporary access roads; and
- 3.13 ha of recreational use lands and parks are reconstruction roads for use during all Project phases.

The total area potentially affected by the Project represents 7.91% of recreational use lands and parks within the LSA and 1.03% of the total recreational/park land area.

A total of 7.78 ha of moderate sensitivity / very high significance recreational lands, along the shores of the Lakelse River, are potentially affected by Project components as follows:

- 7.55 ha of moderate sensitivity / very high significance recreational lands are affected by the transmission line ROW during clearing/construction, operation/maintenance and closure phases;
- 0.09 ha of moderate sensitivity / very high significance recreational lands are affected by new permanent access roads, which will be required during all Project phases;
- No moderate sensitivity / very high significance recreational lands are affected by new temporary access roads; and
- 0.14 ha of moderate sensitivity / very high significance recreational lands are reconstruction roads for use during all Project phases.

The Project affects 4.60% of lands within the LSA classified as of moderate sensitivity and very high significance for recreation.

Proposed mitigation measures for potential effects on important recreation features such as the Lakelse River and Wedeene River are discussed in other VCs, such as Fish and Aquatic Resources effects assessment (**Section 4**), in the Vegetation effects assessment (**Section 5**) and in the Wildlife effects assessment (**Section 6**).

The Project may also result in sensory disruption of the recreational activities due to clearing/construction, operation/maintenance and closure phases. The effects on visual resources and proposed mitigation are presented in **Section 8**.

Potential effects related to access along new access roads and reconstruction roads are discussed in **Section 7.7.1.3**.

Table 7.7-9 presents the potential effects and proposed mitigation for tourism, parks and recreation.

Table 7.7-9: Potential Effects and Proposed Mitigation on Tourism, Parks and Recreation

Potential Effect	Project Phase	Proposed Mitigation*
Loss of land for recreational use	Clearing/Construction	• Early notification to and ongoing consultation efforts with recreational users and parks management of Kitimat Regional District about the Project schedule and activities; • Re-vegetation and restoration of temporary Project areas to a state similar to existing or desired conditions, to the extent practicable.
	Operation/Maintenance	• Ongoing consultation efforts with recreational users and parks management of Kitimat Regional District about the Project schedule and activities.
	Closure	• Ongoing consultation efforts with recreational users and parks management of Kitimat Regional District about the Project schedule and activities; • Re-vegetation and restoration of Project areas to a state similar to existing conditions, to the extent practicable.
	Post-Closure	• Ongoing consultation efforts with recreational users and parks management of Kitimat Regional District about the Project schedule and activities; • Environmental monitoring as required along the transmission line ROW and access roads would evaluate success of restoration and closure plan, which is yet to be developed.

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7.7.1.7 Fishing

There are no potential effects expected on non-traditional fishing activities in Lakelse Lake, Kitimat River, Williams Creek, Humphrys Creek and Nalbeelah Creek since these waterbodies are located outside of the Non-Traditional Land Use LSA. Potential effects are described for fish species present in the Lakelse River and Wedeene River.

Section 4.6.2.11 presents the potential effects on fish species due to increased or improved access to fishing areas, including increased fishing pressure on coastal cutthroat trout and coho salmon, which are sport fish species present in Lakelse River and Wedeene River. Mitigation measures proposed are presented in **Table 4.6-5** (Summary of Mitigation Measures for Potential Effects).

The Project may also result in sensory disruption of the recreational fishing experience during Project activities related to clearing/construction, operation/maintenance and closure phases. The effects on visual resources and proposed mitigation are presented in **Section 8**.

Table 7.7-10 presents the potential effects and proposed mitigation for fishing.

Table 7.7-10: Potential Effects on and Proposed Mitigation for Fishing

Potential Effect	Project Phase	Proposed Mitigation*
Disruption of fishing experience	Clearing/Construction, Operation/Maintenance and Closure	• Early notification to relevant known fisheries stakeholders (i.e. fishing-related outfitters) and to the BC Fish and Wildlife branches (which can relay the information to recreational fishermen) about Project-related access, schedules and activities.

7.7.1.8 Agriculture

A total of 8.73 ha of ALR 709040 are overlapped by Project components as follows:

- 6.87 ha are affected by the transmission line ROW during clearing/construction, operation/maintenance and closure phases;
- No land of this tenure is affected by new temporary access roads;
- No land of this tenure is affected by new permanent access roads; and
- 1.86 ha of ALR 709040 are reconstruction roads for use during all Project phases.

The total area affected by the Project represents 3.47% of the portion of the ALR within the LSA and 1.48% of the total ALR, which comprises 592 ha.

Potential effects related to access along new access roads and reconstruction roads are discussed in **Section 7.7.1.3**.

A total of 16 ha of ALR 710098 are overlapped by Project components as follows:

- 15.22 ha are affected by the transmission line ROW during clearing/construction, operation/maintenance and closure phases;
- No land of this tenure are affected by new temporary access roads;
- 0.29 ha of land of this tenure is affected by new permanent access roads during all project phases; and
- 0.5 ha of ALR 710098 are reconstruction roads for use during all Project phases.

The total area affected by the Project represents 7.81% of the portion of the ALR within the LSA and 0.36% of the total ALR, which comprises 4,434 ha.

Potential effects related to access along new access roads and reconstruction roads are discussed in **Section 7.7.1.3**.

Table 7.7-11 presents the potential effects and proposed mitigation for land within ALR 709040 and ALR 710098 affected by Project components and/or activities.

Table 7.7-11: Potential Effects and Proposed Mitigation on Agriculture

Potential Effect	Project Phase	Proposed Mitigation
Removal of land from Agricultural Use	Clearing/Construction	• Early notification and consultation to the Agricultural Land Commission of the Project schedule and activities; • Revegetation and restoration of temporary Project areas to a state similar to existing conditions, to the extent practicable.
	Operation/Maintenance	• Consultation to the Agricultural Land Commission of the Project schedule and activities
	Closure	• Consultation to the Agricultural Land Commission of the Project schedule and activities; • Revegetation and restoration of Project areas to a state similar to existing conditions, to the extent practicable
	Post-Closure	• Consultation to the Agricultural Land Commission of the Project schedule and activities; • Environmental monitoring as required along the transmission line ROW and access roads would evaluate success of restoration and closure plan, which is yet to be developed.

7.7.2 Residual Effects

The potential residual effects on Non-Traditional Land Use are presented in **Table 7.7-12**.

Table 7.7-12: Potential Residual Effects on Non-Traditional Land Use

Potential Effect	Valued Component	Residual Effect (yes/no)	Rationale
• Potential conflict with local and regional management strategies and planned land uses	Land Use Planning and Management	Yes	• Mitigation measures are proven to be effective and have already been implemented in the Project design stage; however, the Project cannot completely avoid areas where land use objectives are different from those for utilities use. Thus, there will be residual effects.
• Potential conflict with other crown tenure holders or private owners	Land Ownership	Yes	• BC Hydro will notify and coordinate with land owners to compensate for the loss of land; however, there will be residual effects because land ownership changes when compared with existing conditions.
• Access restrictions to lands available for non-traditional land uses • Increased traffic and additional wear on local roads • Increased access to lands available for non-traditional land uses	Access and Transportation	Yes	• Mitigation measures are proven to be effective; however, residual effects will remain during the clearing/construction, operation/maintenance, closure and post-closure phases because there will be access restrictions and increased traffic after mitigation measures have been applied.

Potential Effect	Valued Component	Residual Effect (yes/no)	Rationale
Direct Effects • Reduction in timber production and yield due to the harvest of existing stands of timber for the transmission line clearing and the lost opportunity to grow timber in areas that are proposed for permanent clearing (i.e. Statutory ROW and roads) • Potential site degradation on areas stripped/grubbed for temporary use during construction Indirect Effects • Potential isolation of adjacent stands of timber and restrictions to conventional logging activities and aerial flight paths	Forestry	Yes	• BC Hydro will notify and coordinate with area-based tenure holders and may develop agreements for loss of merchantable timber; however, there will be residual effects due to the unavoidable loss of some land from areas cleared for the life of the Project.
• Disruption of land for hunting, guide outfitting and trapping	Hunting, Trapping and Guide Outfitting	Yes	• Mitigation measures are proven to be effective for revegetation of the land; however, there will be disruptions of the use of the land for hunting, trapping and guide outfitting during clearing/construction, operation/maintenance and closure phases
• Loss of land for recreational use	Tourism, Parks and Recreation	Yes	• Mitigation measures are proven to be effective for revegetation of the land; however, portions of land will be unavailable for recreational use during clearing/construction, operation/maintenance and closure phases
• Disruption of fishing experience	Fishing	Yes	• Close communication with affected stakeholders is proven to be effective; however, there will be sensory disruptions of the fishing experience during clearing/construction, operation/maintenance and closure phases
• Removal of land from Agricultural Use	Agriculture	Yes	• Mitigation measures are proven to be effective for revegetation of the land; however, portions of the ALR tenures will be unavailable for agricultural use during clearing/construction, operation/maintenance and closure phases

Notes: ALR = agricultural land reserve; VC = valued component

7.7.3 Characterization of Residual Effects

Table 7.7-13 summarizes the characterized residual effects for Non-Traditional Land Use.

For the characterization of the residual effects on the Non-Traditional Land Use VCs, the rating definitions presented in **Table 3.3-3** (**Section 3**) have been applied.

7.7.3.1 Land Use Planning and Management

Residual effects on land use planning and management are expected to be minor and not require further planning, mainly due to low context and a low magnitude rating, which was applied because the affected area identified showed less than 10% change from existing conditions. The frequency of the residual effect is continuous, with a long-term duration (beyond operation). Residual effects have a low context, a site-specific or local geographic extent and are reversible due to the decommissioning and revegetation of the affected areas during the post-closure phase. The direction of the effect is adverse.

The full characterization of residual effects for the land use planning and management VC is described in **Table 7.7-13**. These effects are not anticipated to require further planning, due to the low context, low magnitude, site-specific extent and reversibility.

7.7.3.2 Land Ownership

Residual effects on land ownership have a low magnitude rating. Despite the fact that the area affected by the Project represents between 10% and 20% change from existing conditions, appropriate compensation for land losses is proposed as mitigation, reducing the magnitude of the effect to low. The frequency of the residual effect is continuous, with a long-term duration (beyond operation), and site-specific geographic extent. The context has been determined to be low as the area of the features that is affected by the Project is minimal compared to the overall feature size. The residual effects will be reversible, due to the decommissioning and revegetation of the affected areas during the post-closure phase. The direction of the effect is adverse.

The full characterization of residual effects for the land ownership VC is described in **Table 7.7-13**. These effects are not anticipated to require further planning, due to the low context, low magnitude, site-specific extent and reversibility.

7.7.3.3 Access and Transportation

Residual effects on access and transportation are expected to be negligible and not require further planning, mainly due to a negligible magnitude rating, which was applied because the affected area identified showed less than 1% change from existing conditions. The residual effects have an intermittent frequency and have a low context, a site-specific or local geographic extent and are reversible due to the decommissioning and revegetation of the affected areas during the post-closure phase. The direction of the effect on access and transportation is neutral, because the effect can be positive or adverse on the land use.

The full characterization of residual effects for the access and transportation VC is described in **Table 7.7-13**. These effects are not anticipated to require further planning, due to the low context, low magnitude, site-specific extent and reversibility.

7.7.3.4 Forestry

Residual effects on forestry are expected to be minor and not require further planning, mainly due to low context and a low magnitude rating, which was applied because the affected area identified showed less than 10% change from existing conditions. The frequency of the residual effect is continuous, with a long-term duration (beyond operation). Residual effects have a low context, a site-specific or local geographic extent and are reversible due to the decommissioning and revegetation of the affected areas during the post-closure phase. The direction of the effect is adverse.

The full characterization of residual effects for the forestry VC is described in **Table 7.7-13**. These effects are not anticipated to require further planning, due to the low context, low magnitude, site-specific extent and reversibility.

7.7.3.5 Hunting, Trapping and Guide Outfitting

Residual effects on hunting, trapping and guide outfitting are expected to be minor and not require further planning, mainly due to low context and a low magnitude rating, which was applied because the affected area identified showed less than 10% change from existing conditions. The frequency of the residual effects for hunting, trapping and guide outfitting is intermittent, with a short-term duration at specific locations as the activities move along the entire length of ROW during the clearing/construction phase. The direction of the effect is adverse.

The full characterization of residual effects for the hunting, trapping and guide outfitting VC is described in **Table 7.7-13**. These effects are not anticipated to require further planning, due to the low context, low magnitude, site-specific extent and reversibility.

7.7.3.6 Tourism, Parks and Recreation

Residual effects on tourism, parks and recreation are expected to be minor and not require further planning, mainly due to low context and a low magnitude rating, which was applied because the affected area identified showed less than 10% change from existing conditions. The frequency of the residual effect is continuous, with a long-term duration (beyond operation). Residual effects have a low context, a site-specific or local geographic extent and are reversible due to the decommissioning and revegetation of the affected areas during the post-closure phase. The direction of the effect is adverse.

The full characterization of residual effects for the tourism, parks and recreation VC is described in **Table 7.7-13**. These effects are not anticipated to require further planning, due to the low context, low magnitude, site-specific extent and reversibility.

7.7.3.7 Fishing

Residual effects on fishing are expected to be negligible and not require further planning, mainly due to a negligible magnitude rating, which was applied because the affected area identified showed less than 1% change from existing conditions. The residual effects have an intermittent frequency and have a low context, a site-specific or local geographic extent and are reversible due to the decommissioning and revegetation of the affected areas during the post-closure phase. The direction of the effect on fishing is adverse.

The full characterization of residual effects for the fishing VC is described in **Table 7.7-13**. These effects are not anticipated to require further planning, due to the low context, low magnitude, site-specific extent and reversibility.

7.7.3.8 Agriculture

Residual effects on agriculture are expected to be minor and not require further planning, mainly due to low context and a low magnitude rating, which was applied because the affected area identified showed less than 10% change from existing conditions. The frequency of the residual effect is continuous, with a long-term duration (beyond operation). Residual effects have a low context, a site-specific or local geographic extent and are reversible due to the decommissioning and revegetation of the affected areas during the post-closure phase. The direction of the effect is adverse.

The full characterization of residual effects for the agriculture VC is described in **Table 7.7-13**. These effects are not anticipated to require further planning, due to the low context, low magnitude, site-specific extent and reversibility.

Table 7.7-13: Characterization of Residual Effects on Non-Traditional Land Use

Valued Component	Direction	Context	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
Land Use Planning and Management	Adverse	Low	Low	Site-Specific	Long term	Continuous	Reversible
Land Ownership	Adverse	Low	Low	Site-Specific	Long term	Continuous	Reversible
Access and Transportation	Neutral (Positive and Adverse)	Low	Negligible	Site-Specific	Long term	Intermittent	Reversible
Forestry	Adverse	Low	Low	Site-Specific	Long term	Continuous	Reversible
Hunting, Trapping and Guide Outfitting	Adverse	Low	Low	Site-Specific	Short term	Intermittent	Reversible
Tourism, Parks and Recreation	Adverse	Low	Low	Local	Long term	Continuous	Reversible
Fishing	Adverse	Low	Negligible	Local	Short term	Intermittent	Reversible
Agriculture	Adverse	Low	Low	Site-Specific	Long term	Continuous	Reversible

Notes: **Table 3.3.2** and **3.3.4** provides criteria definitions (**Section 3**).

8 VISUAL RESOURCES

8.1 Introduction

The objective of this section is to assess the potential effects of Project-related disturbances and activities on visual resources. Visual resources are the visible natural features of landscapes such as mountains, skylines, ridges, waterbodies and vegetation cover. Project infrastructure will be located in areas with intrinsic scenic values that support a range of outdoor activities, including recreational pursuits and general appreciation of nature.

8.2 Regulatory Setting

Currently, there are no regulations in BC governing the effects of industrial development on visual resources, nor are there established procedures prescribing how to evaluate the potential effects on visual resources. However, section 150.3 of the *Forest and Range Practices Act* enables the creation of regulations to designate scenic areas with Visual Quality Objectives (VQOs).

Though specific to forest harvesting and not applicable to the Project, the qualitative and quantitative VQOs established through the Forest Planning and Practices Regulation constitute a reasonable, defensible and established basis on which to evaluate existing conditions and potential effects on the study area's visual quality.

8.3 Issues Scoping

Potential issues regarding Visual Resources were selected by consulting the following sources:

- Comments from potentially affected First Nations;
- Kalum LRMP (Government of BC, 2002);
- Kalum SRMP (Government of BC, 2006); and
- Comments from community members and stakeholders.

Issues relating to visual resource values, as listed in the LRMP/SRMP concordance table in **Appendix A1**, guided methodologies, the selection of observation points and evaluation of potential effects.

8.4 Spatial Boundaries

An LSA defines where direct or indirect effects may occur. Effects on Visual Resources may take place over a significant distance, given clear visibility and elevation variances. Consequently, the outer boundary of the LSA is 10 km on each side measured from the provisional route.

The LSA extends along the lower-lying areas of the Kitimat Valley and initial east and west slopes and mountain peaks of the Kitimat Range. Extending from the Skeena River in the north to Lakelse Lake, the LSA encompasses the floodplain of the Kitimat River and its numerous tributaries. In the south, the LSA extends from Mount Clague to Robinson Lake and includes the settlements of Kitimat and Kitamaat Village. The assessment will identify points of congregation within the LSA that may be affected if line-of-sight occurs with the Project. The boundary of the LSA is delimited beyond the northernmost and southernmost observation points.

The LSA is divided into foreground, middle ground and background distance zones to assist with the assessment. Nineteen percent of the LSA is within the foreground zone, with 31% and 50% within the middle ground and background, respectively. **Table 8.4-1** summarizes area calculations and for the Visual Resources LSA. **Figure 8.6-3** shows the spatial distribution of the LSA and distance zones.

Table 8.4-1: Visual Resources Local Study Area

Distance Zones	Distance from Provisional Route (m)	Area (ha)	% of LSA
Foreground	0 – 2,000	22,031	19
Middle ground	2,001 – 5,000	36,348	31
Background	5,001 – 10,000	59,321	50
Total		**117,700**	

Notes: ha = hectares, m = metres; % = percent

8.5 Valued Component Selection

Visual resource values are incorporated in many LRMP objectives and strategies and support various land uses such as tourism, recreation and backcountry activities. First Nations communities and members of the public recognize the value of visual resources and express concern for their responsible management. Visual Resources are present in the Kitimat Valley in the form of parks, recreation sites, and trails, scenic areas with associated recreation viewpoints and natural features of regional importance.

The Project has potential to interact and adversely affect visual resources given its height, width and length. Due to existing effects and the number of future projects planned for the region, this VC is deemed vulnerable to disturbance. Potential effects of the Project on visual resources can be measured and monitored, and the required data are available.

8.6 Visual Resources Studies

8.6.1 Methods

8.6.1.1 Desktop Review

A desktop review was conducted to document existing conditions and compile an inventory of visual resources in the LSA. Data was sourced from the provincial spatial data warehouse GeoBC. Locations and facilities related to recreational activities as identified by the Non-Traditional Land Use Existing Condition section (**Section 7.6.2**) informed the selection of observation points. The provincial Visual Landscape Inventory (VLI) provided delineations of gazetted visually sensitive areas. Sections of the Kalum LRMP relating to visual resources informed issue scoping and provided land use planning guidelines. Previous studies were reviewed to incorporate earlier findings regarding Visual Resources.

Specific layers that were reviewed and incorporated include First Nations reserves, SRMZs, Visual Sensitivity Units (VSUs), recreational viewpoints along travel corridors, parks and recreation sites and trails. Features that influence visibility, such as topography, skylines and vegetation cover, were mapped and analyzed (**Figure 8.6-1**, **Figure 8.6-2** and **Figure 8.6-6**).

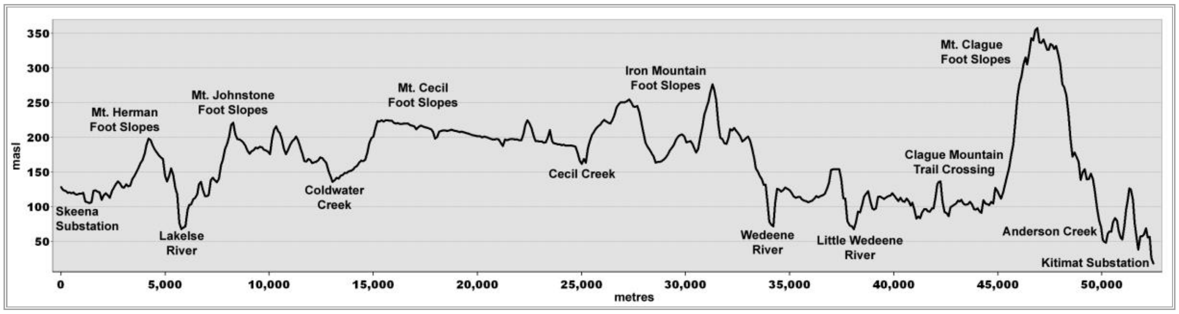

Figure 8.6-1: North – South Profile of the Provisional Route

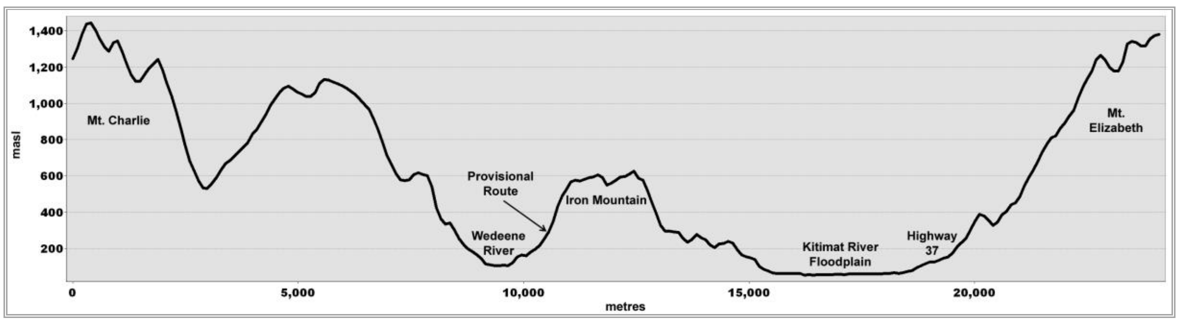

Figure 8.6-2: East – West Profile of the Kitimat Valley

8.6.1.2 Photographic Survey

Fieldwork for this section was conducted by vegetation, wildlife and archaeology specialists during their field visits. Preliminary observations points were selected from where clear views of the Project may be practicable. Field staff used tablets with geo-rectified maps and mobile data collection software (iFormBuilder) to capture images and information on site conditions. Photographs were taken from observation points towards the route alignment to describe viewing conditions and support the assessment. Information was captured on elevation, bearing, distance to the Project and visibility conditions. Photographs taken from selected observation points towards the Project are included in **Appendix F.2**. Not all locations were accessible.

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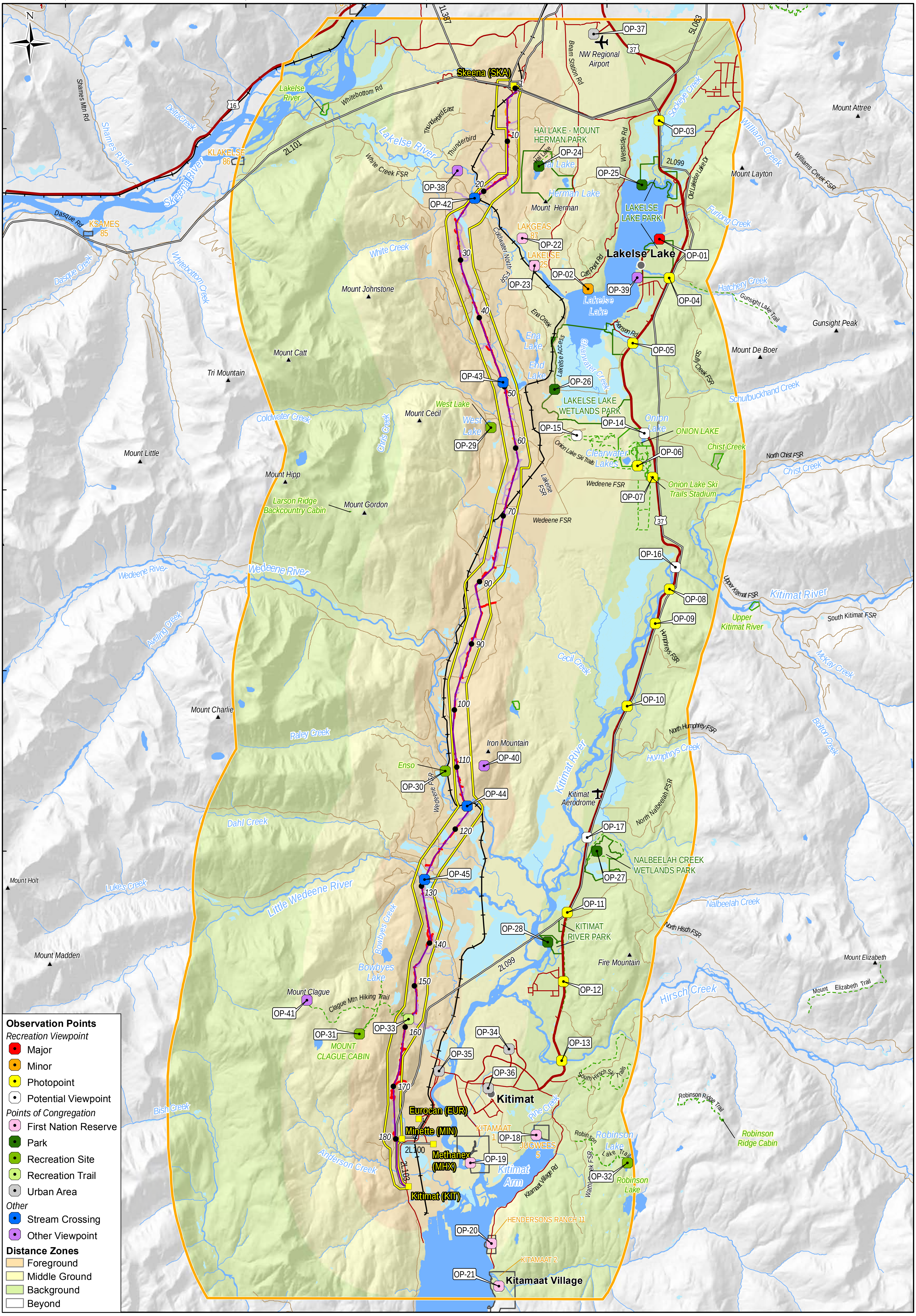

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Last updated by willem.van-riet

Legend

- Populated Place
- Existing Substation
- Existing Transmission Line
- Railway
- Recreation Trail
- Park
- Recreation Site
- First Nation Reserve
- Highway
- Arterial
- Local Road
- Forest Service Road
- Watercourse
- Waterbody
- Wetland

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary
- Visual Resources Local Study Area

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
DataBC Data
Distribution Service
Open Government License
(http://www.data.gov.bc.ca/)

CLIENT: Prepared for BC Hydro

PROJECT: Terrace to Kitimat Transmission Project (TKTP)

TITLE: Visual Resources Local Study Area and Distance Zones

DATE:	ANALYST:	QA/QC:	
September, 2016	WR	CH	**Figure 8.6-3**

GIS FILE: 13-03-001_VisualResourceLSA_v4

JOB No: VE52379

COORDINATE SYSTEM: NAD 1983 UTM Zone 9N

amec foster wheeler

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8.6.2 Existing Condition

General visibility within the LSA is governed by topography. The Kitimat Valley aligns in a generally north–south direction. The elevated area near the junction of the Wedeene FSR with Highway 37 acts as a watershed, with drainage flowing north into Lakelse Lake (76 masl) and along the Lakelse River to the Skeena River (43 masl). Water flows south from this junction along the main floodplain of the Kitimat River (115 masl) to Kitimat Arm at sea level. Incised river valleys flow into the centre of the Kitimat Valley, generally in an east–west direction, forming skylines and ridges that shape wide-ranging visibility. Local outcrops that influence visibility are Iron Mountain, Fire Mountain, Mount Herman and the hills surrounding Ena Lake. **Figure 8.6-1** shows the north-south profile of the provisional route and **Figure 8.6-2** shows the east-west profile of the Kitimat Valley. **Figure 8.6-4** illustrates the topography of the Kitimat Valley.

8.6.2.1 Vegetation Cover

Visibility within the LSA is also affected by vegetation cover. Historical land uses include intensive logging, with numerous retired cutblocks and associated logging roads influencing scenic values throughout the Kitimat Valley. Several existing ROWs of existing transmission lines and pipeline projects route through the valley (**Figure 8.6-6**). Scenic quality is affected by uniform crown heights in previously harvest areas. Photo **OP-40 Iron Mountain** in **Appendix F.2** illustrates the effect of historical logging from a viewpoint near Iron Mountain looking east across the Wedeene River towards the Raley Creek.

8.6.2.2 Scenic Areas

VSUs were reviewed to identify areas managed for their inherent scenic value and measure expectations of scenic quality by residents and visitors. VSUs are graded categories that identify the probability of concern attributable to the alteration of a particular site from a public perspective (BC MOF, 1997). VSUs cover 24% of the LSA and range in sensitivity from High to Low. VSUs with High sensitivity rated important to viewers with a high probability of concern are:

- Lakelse Lake and surroundings;
- Ridgelines adjoining White Creek;
- Highway 37 crossing the Kitimat River;
- Humphrys FSR;
- West-facing slopes south of Humphrys Creek;
- Fire Mountain;
- Robinson Ridge;
- Kitamaat Village Road; and
- East-facing slopes of Mount Clague.

VSUs with Moderate to Low sensitivity are located on other, less prominent slopes and ridges within view of public movement corridors. **Table 8.6-1** shows a summary of VSUs in the LSA, and **Figure 8.6-5** illustrates their spatial distribution. **Table 8.6-2** lists four specific VSUs that are intersected by the provisional route.

Table 8.6-1: Visual Sensitivity Units in the Local Study Area

Sensitivity to Human-Made Visual Alterations	Description	Area (ha)	% of LSA
High	Area very important to viewers; high probability of concern	15,454	8.7
Moderate	Area important to viewers; probability of concern	12,943	7.3
Low	Area somewhat important to viewers; some risk of concern	14,593	8.2
Total		**42,990**	**24.2**

Notes: ha = hectares; LSA = Local Study Area; % = percent

Source: BC MFLNRO Forest Tenures branch. **Obtained from:** GeoBC, 2015.

Table 8.6-2: Visual Sensitivity Units Intersected by the Provisional Route

VLI #	VQO	Visual Sensitivity	Date Conducted	VLI Project Name	Area (ha)	Length of Intersect (m)
441	Partial Retention	High	1993 03 31	Highway 37 / Kitimat	33	827
1,657	Partial Retention		2009 01 31		1,064	6,421
467	Partial Retention	Moderate	1993 03 31		156	536
1,619	n/a		2009 01 31	Highway 37 / Lakelse Lake	221	1,460
Total					**1,474**	**9,244**

Notes: ha = hectares; m = metres; VQO = Visual Quality Objective; VLI = Visual Landscape Inventory; # = number

Within scenic areas, VQOs define management objectives that reflect the desired level of visual quality and threshold for proposed alterations, based on the physical characteristics and social concern for the area. Approximately 12% of the LSA is designated with VQOs ranging from Modification to Preservation. **Table 8.6-3** summarizes the minimum thresholds set to retain the inherent scenic value of each VSU.

Figure 8.7-1 charts VQOs as drivers of visual resource values and LRMP objectives in the LSA. One VSU with a Retention VQO is found near the Beam Station Road. VQOs with a Partial Retention VQO adjoin the east and west shores of Lakelse Lake, the ridges south of the White Creek FSR, east-facing slopes of Mount Clague and the Kitamaat Village road corridor. Modification VQOs delimit the Lakelse Lake Wetland Park, east slopes of Mount Johnstone, hills north and east of Iron Mountain, west-facing slopes adjoining Humphrys Creek, Fire Mountain, areas overlapping the South Hirsch and Robinson Lake Recreation Trails and the Kitimat River inflow into Kitimat Arm.

Table 8.6-3: Visual Quality Objectives

Sensitivity to Human-made Visual Alterations	Desired Level of Visual Quality: "An altered forest landscape in which the alteration, when assessed from a significant public viewpoint" is:	Kalum SRMP Alterations Guidelines for the Visual Unit	Area (ha)	% of LSA
Retention	(i) difficult to see, (ii) small in scale and (iii) natural in appearance	Repeat line, form, colour and texture of the VSU and do not exceed 1%–5% denudation	116	0.1
Partial Retention	(i) easy to see, (ii) small to medium in scale and (iii) natural and not rectilinear in shape	Repeat line, form, colours and texture to ensure a blending with the dominant elements and do not exceed 6%–15% denudation	10,357	5.8
Modification	(i) very easy to see, (ii) large in scale and natural in its appearance, or small to medium in scale but with some angular characteristics	Borrow from natural line and form that are comparable to natural occurrences or events and do not exceed 16%–25% denudation	11,583	6.5
Total			**22,057**	**12.4**

Notes: ha = hectare; SRMP = Sustainable Resource Management Plan; VSU = Visual Sensitivity Unit; % (percent) based on Visual Resources LSA at 117,700 ha

Source: BC MFLNRO Forest Tenures branch. **Obtained from:** GeoBC, 2015.

8.6.2.3 Observation Points

Recreation viewpoints are locations within public movement corridors connected to VSUs along recognized viewlines. Viewpoints are classified as major, minor, potential viewpoints and photopoints. One major viewpoint is located at the mouth of Furlong Creek, with one minor viewpoint at Catt Point on the southwest shore of Lakelse Lake. Eleven photopoints and four potential photopoints are located at roadside stops, stream crossings and road junctions along Highway 37.

Six First Nation reserves, five parks, four recreation sites, one recreation trail, four built-up areas, four stream crossings, two mountain peaks and two other viewpoints complete the 45 points of congregation selected as observation points for the assessment. Selection criteria incorporated numbers of users, viewer sensitivity, proximity and potential for a clear view of the Project. Recreation viewpoints are associated with VSUs along recognized viewlines. **Table 8.6-4** provides the number of viewlines for each recreation viewpoint, and specifies distance, bearing and elevation for all observation points.

Table 8.6-4: Observation Points

OP #	Observation Point	Type	Viewlines	X Coordinate[1]	Y Coordinate[1]	Elevation (m)
OP-01	Lakelse Park (11518)	Major Recreation Viewpoint	4	530,316	6,027,099	77
OP-02	Catt Point Road (11521)		2	527,155	6,024,900	77
OP-03	Highway 37 (11524)	Recreation Photopoint	2	530,301	6,032,342	89
OP-04	Hatchery Creek (11520)		2	530,749	6,025,374	127
OP-05	Highway 37 (11516)		2	529,142	6,022,488	90
OP-06	Clearwater Lake (11511)		3	529,344	6,017,066	189
OP-07	Onion Lake (11508)		2	530,014	6,016,549	216
OP-08	Highway 37 (11504)		3	530,768	6,011,603	107
OP-09	Highway 37 (11503)		2	530,135	6,010,074	95
OP-10	Highway 37 (11501)		1	528,890	6,006,420	70
OP-11	Highway 37 (11489)		0	526,239	5,997,287	49
OP-12	Oolichan Ave (11488)		1	526,068	5,994,222	53
OP-13	Hirsch Creek (11487)		3	525,986	5,990,724	54
OP-14	Onion Lake (11513)	Potential Viewpoint	1	529,652	6,018,506	189
OP-15	Onion Lake Ski Trail (RVP-11515)		5	526,653	6,018,413	186
OP-16	Highway 37 (11505)		4	531,022	6,012,569	113
OP-17	Highway 37 (11491)		6	527,117	6,000,606	46
OP-18	Jugwees 5	First Nations Reserve	0	524,862	5,987,430	4
OP-19	Kitamaat 1		0	521,944	5,986,200	5
OP-20	Henderson's Ranch 11		0	522,878	5,982,627	41
OP-21	Kitamaat 2		0	523,204	5,980,741	11
OP-22	Lakgeas 87		0	524,246	6,027,135	113
OP-23	Lakelse 25		0	524,780	6,025,925	85

OP #	Observation Point	Type	Viewlines	X Coordinate[1]	Y Coordinate[1]	Elevation (m)
OP-24	Hai Lake	Park	0	524,981	6,030,322	225
OP-25	Lakelse Lake		0	529,541	6,029,497	77
OP-26	Lakelse Lake Wetland		0	525,675	6,020,441	83
OP-27	Nalbeelah Creek		0	527,544	6,000,002	43
OP-28	Kitimat River		0	525,373	5,995,975	27
OP-29	West Lake	Recreation Site	0	522,857	6,018,748	221
OP-30	Enso		0	520,831	6,003,551	92
OP-31	Mount Clague Cabin		0	517,023	5,991,909	690
OP-32	Robinson Lake		0	528,897	5,986,201	424
OP-33	Clague Mountain Hiking Trail Crossing	Recreation Trail	0	519,204	5,992,558	103
OP-34	Kitimat (Alexander Ave.)	Urban Area	0	523,655	5,991,240	94
OP-35	Kitimat (Industrial)		0	520,551	5,990,259	20
OP-36	Kitimat (CBD)		0	522,738	5,989,502	24
OP-37	Terrace Airport		0	527,407	6,036,183	213
OP-38	Lakelse River Fishing Spot	Other Viewpoint	0	521,363	6,030,126	68
OP-39	Adele Road		0	529,330	6,025,388	77
OP-40	Iron Mountain		0	522,549	6,003,783	691
OP-41	Mount Clague		0	514,699	5,993,404	1,330
OP-42	Lakelse River	Stream Crossing	0	522,130	6,028,916	67
OP-43	Coldwater Creek		0	523,386	6,020,756	168
OP-44	Wedeene River		0	521,796	6,001,999	73
OP-45	Little Wedeene River		0	519,910	5,998,741	70

Notes: CBD = central business district; m = metre; OP = Observation Point; # = number; RVP = Recreation Viewpoint.
[1]Coordinates in Universal Transverse Mercator 9 projection

Source: Recreation viewpoints and viewlines, recreation sites and trails – BC MFLNRO Resource Practices.

Obtained from: GeoBC, 2015.

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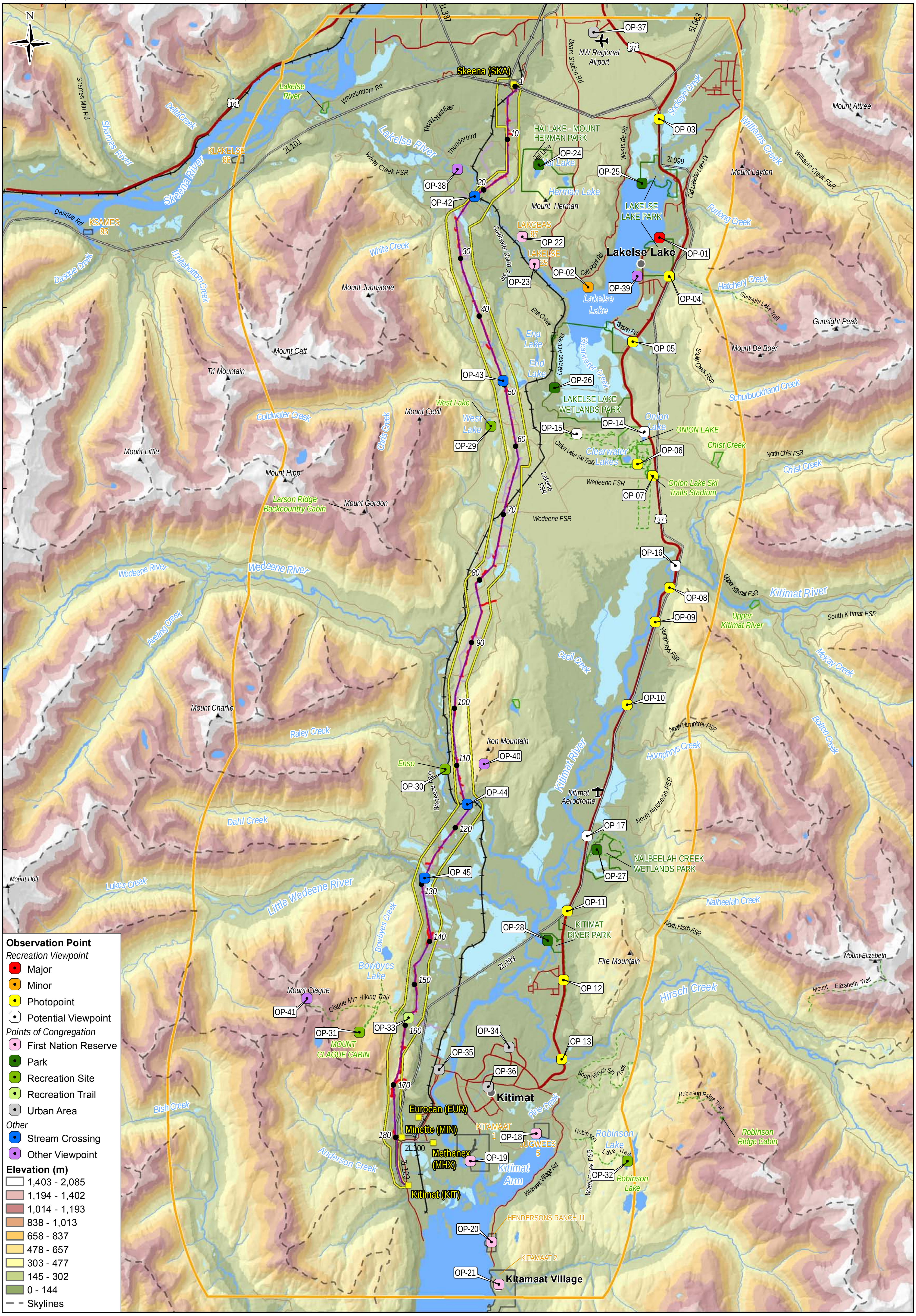

Legend

- Populated Place
- Existing Substation
- Existing Transmission Line
- Railway
- Recreation Trail
- Park
- Recreation Site
- First Nation Reserve
- Highway
- Arterial
- Local Road
- Forest Service Road
- Watercourse
- Waterbody
- Wetland

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary
- Visual Resources Local Study Area

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
DataBC Data
Distribution Service
Open Government License
(http://www.data.gov.bc.ca/)

CLIENT:
Prepared for BC Hydro

PROJECT:
Terrace to Kitimat Transmission Project (TKTP)

TITLE:
Topography of the Kitimat Valley

DATE:	ANALYST:	QA/QC:	
September, 2016	WR	CH	**Figure 8.6-4**

GIS FILE: 13-03-002_Topography_v4

JOB No: VE52379

COORDINATE SYSTEM: NAD 1983 UTM Zone 9N

amec foster wheeler

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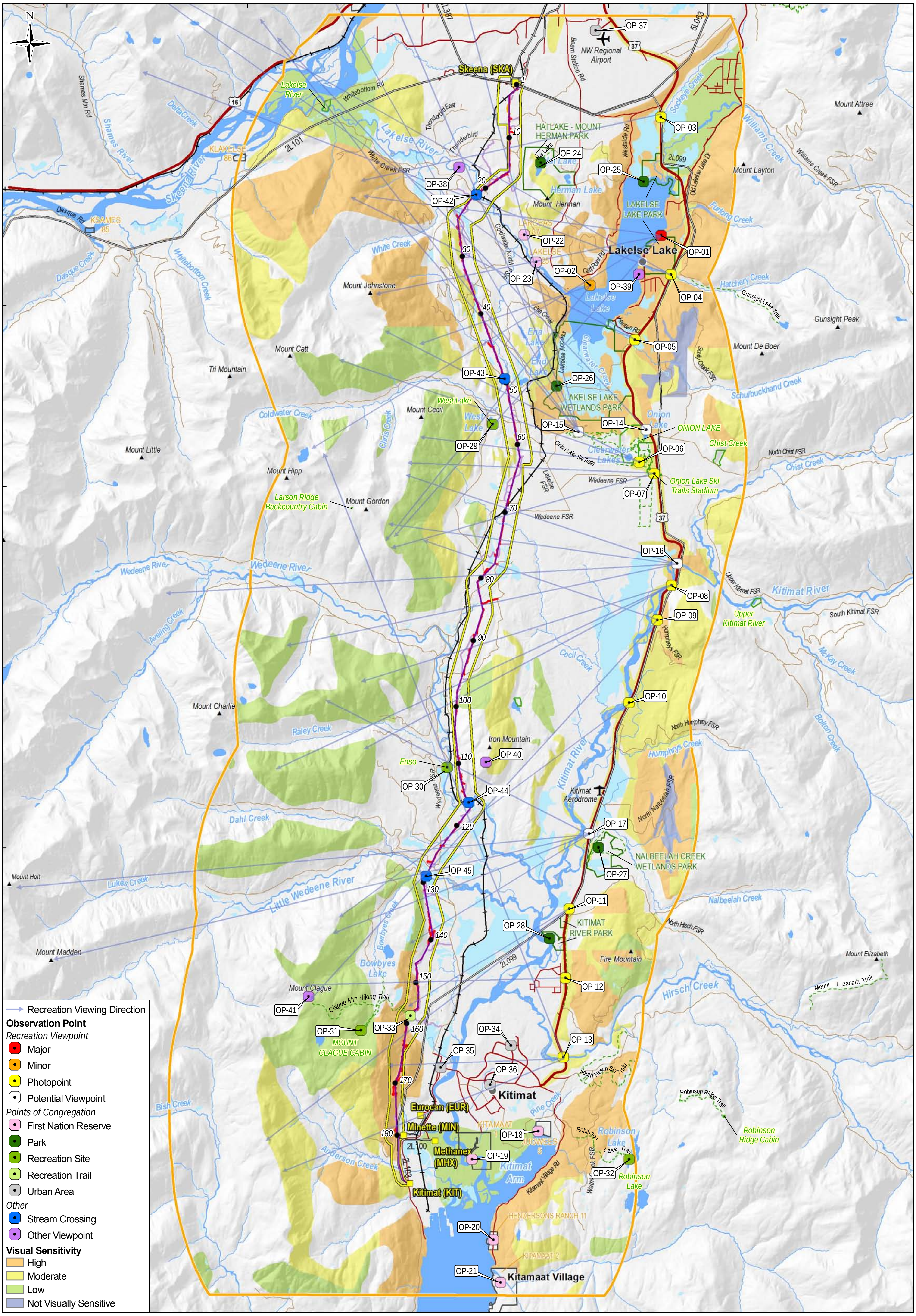

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Last updated by willem.van-riet

Legend

- Populated Place
- Existing Substation
- Existing Transmission Line
- Railway
- Recreation Trail
- Park
- Recreation Site
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- Engineering Boundary
- Visual Resources Local Study Area

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
Visual Landscape Inventory (VLI)
MFLRNO - Resource Practices
VISUAL SENSITIVITY
data.gov.bc.ca/ dataset/ visual-landscape-inventory
RECREATION VIEWING POINTS
data.gov.bc.ca/ dataset/ visual-landscape-inventory-viewing-points
VIEWING DIRECTION
data.gov.bc.ca/ dataset/ visual-landscape-inventory-viewing-direction-lines

CLIENT:	PROJECT:			
Prepared for BC Hydro	Terrace to Kitimat Transmission Project (TKTP)			
TITLE:	DATE: September, 2016	ANALYST: WR	QA/QC: MY	**Figure** 8.6-5
Visual Sensitivity Units and Recreation Viewpoints in the Visual Resources Local Study Area	GIS FILE: 13-03-003_VisualSensitivity_v4			amec foster wheeler
	JOB No: VE52379			
	COORDINATE SYSTEM: NAD 1983 UTM Zone 9N			

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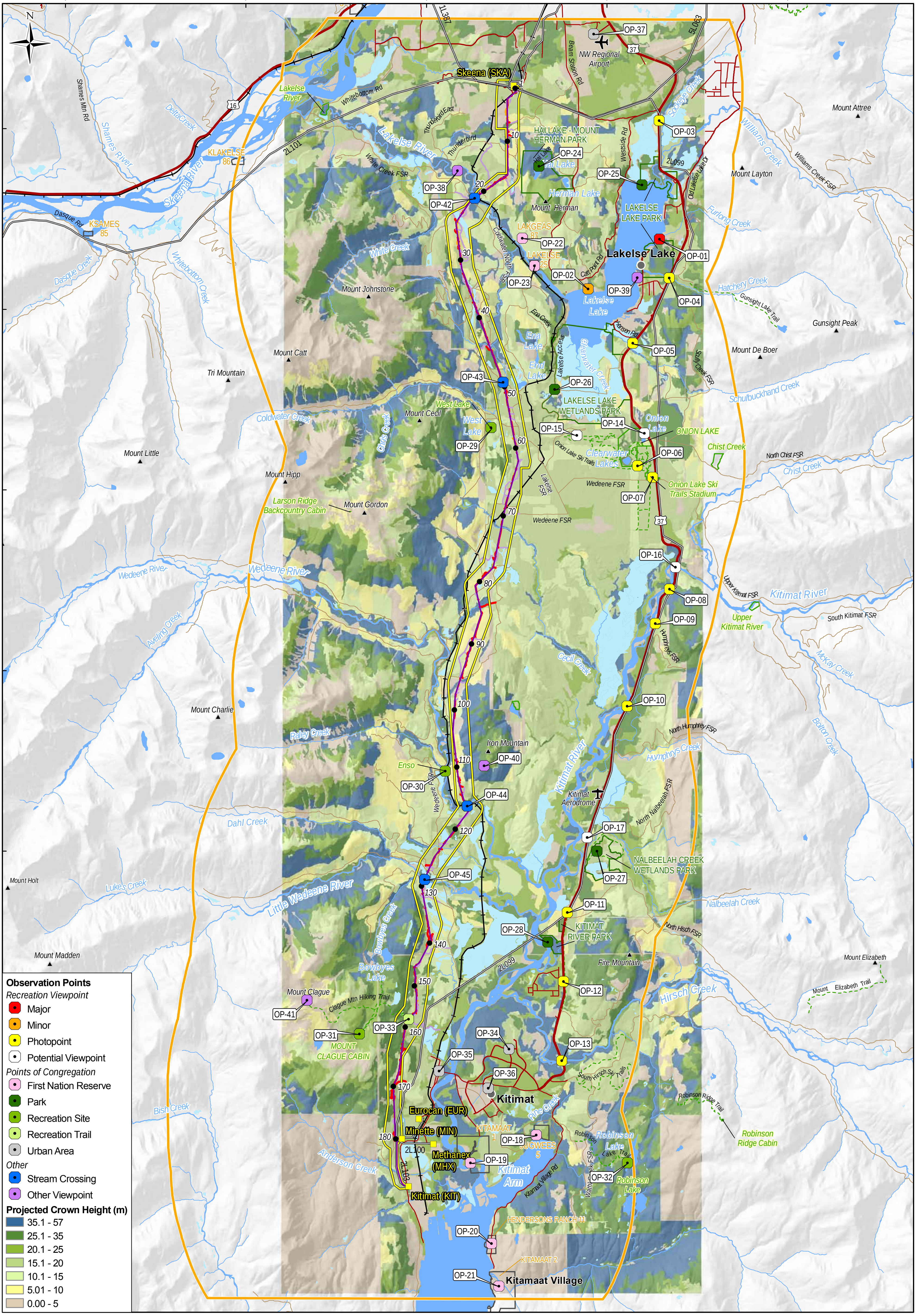

Legend

- Populated Place
- Existing Substation
- Existing Transmission Line
- Railway
- Recreation Trail
- Park
- Recreation Site
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- Visual Resources Local Study Area

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
DataBC Data
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(http://www.data.gov.bc.ca/)

CLIENT: Prepared for BC Hydro	PROJECT: Terrace to Kitimat Transmission Project (TKTP)
TITLE: Vegetation Cover in the Visual Resources Local Study Area	DATE: September, 2016 · ANALYST: WR · QA/QC: CH · **Figure 8.6-6**
	GIS FILE: 13-03-008_VegCrownHeight_v3
	JOB No: VE52379
	COORDINATE SYSTEM: NAD 1983 UTM Zone 9N

amec foster wheeler

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8.7 Visual Resource Assessment

8.7.1 Potential Effects and Proposed Mitigation

8.7.1.1 Assessment Methods

Judgment related to the value of scenery can be subjective. The assessment follows a systematic methodology, using spatial analyses with effective modelling tools, guided by clear land use objectives, to identify consistent qualities to objectively describe and measure potential effects. Viewshed analyses identify lines-of-sight between observation points and the Project as the main indicators of potential effects on visual resources. The type of observation point and length of route visible, combined with contrast and viewer sensitivity, to identify the level of interaction between the Project and the VC, ranging from low to moderate to high.

8.7.1.1.1 Viewshed Analyses

An amalgamated terrain model was constructed to simulate existing and future visibility conditions by adding projected crown heights of vegetation to terrain elevations. **Figure 8.6-6** illustrates crown heights in the LSA, ranging from 0 m to 5 m in the alpine zones and cleared areas adjacent to main FSRs, to >50 m in steep mid-slopes of incised river valleys. Crown heights revert to base elevations along existing ROWs (transmission lines, roads), built-up land (airports, suburbs) and the 120 m maximum clearing area along the provisional route. The heights of proposed transmission line structures, ranging from 21 m to 65 m as specified by design engineers, is added to the model within the clearing area. An average height of 34 m represents transmission line cables between structures. In this way, the analysis incorporates existing and future visibility.

Viewshed analyses are generated with the Spatial Analyst extension of ArcGIS v. 10.2 to identify the presence or absence of theoretical lines-of-sight between the 45 observer points and the Project. Photographs taken during field visits support results. Analyses are focused in the direction of the provisional route using the Azimuth function and are limited to 10 km, as the dimensions of the Project are expected to blend with existing conditions beyond this distance. The observer height is set at 3 m to simulate observers from ground level to an elevated viewing position on an SUV or bus.

Table 8.7-1: Observation Points with Line-of-Sight to the Project

OP #	Observation Point	Type	Distance to the Project (m)	Bearing (°)[1]	Cardinal Direction	Elevation (OP) (masl)	Elevation (Line-of-sight) (masl)	Elevation Differential (masl)	Length of Route Visible[2] (m)	Visible Structures[4]	Stream (Line-of-sight)[3]
OP-11	Highway 37 Viewpoint (RVP-11489)	Recreation Photopoint	8,026	230	Southwest	49	109	60	3,527	145–159, 162–164	N/A
OP-15	Onion Lake Ski Trail (RVP-11515)	Potential Viewpoint	3,086	280	West	186	215	29	3,455	39–47, 51–57	
OP-20	Henderson's Ranch 11	First Nation Reserve	4,473	320	Northeast	41	322	281	4,737	170–181	
OP-21	Kitamaat 2		6,024	330	Northeast	11	322	311	4,737	170–181	
OP-22	Lakgeas 87		2,831	250	West	113	220	107	2,625	28–32, 34–37	
OP-33	Clague Mountain Hiking Trail Crossing	Recreation Trail	0–1,300	N/A	N/A	103	375	272	800	158	
OP-34	Kitimat (Alexander Ave.)	Urban Area	5,184	250	West	94	326	232	828	169–172	
OP-35	Kitimat Industrial		2,129	250	West	20	328	308	2,015	154, 156–159, 170–173	
OP-36	Kitimat CBD		4,186	250	West	24	328	304	2,274	169–177	
OP-41	Mount Clague	Other Viewpoint	7,843	30	Northeast	1,330	241	-1,089	2,122	120–128	
OP-42	Lakelse River	Stream Crossing	0	N/A	N/A	67	67	0	592	21, 22, 23	603
OP-43	Coldwater Creek					168	168		365	49	536
OP-44	Wedeene River					73	73		1,066	116, 117, 118	945
OP-45	Little Wedeene River					70	70		844	127, 128, 131, 132, 133	649

Notes: CBD = central business district; m = metres; masl = metres above sea level; OP = Observation Point; # = number; RVP = Recreation Viewpoint
[1]Bearings in degrees measured clockwise with north = zero
[2]Length of Route Visible = length of the provisional route within line-of-sight of an OP
[3]Stream (Line-of-sight) = length along the Stream within line-of-sight of the Project
[4]Visible structures = numbers provided by design engineers

8.7.1.1.2 Contrast

The level of contrast between views of the Project and surroundings are identified for each observation point by considering proximity to the Project, alignment with the Project and altitude variances between the observer and the Project. The relative size of the Project within views is predominantly influenced by proximity. Alignment with a linear effect, such as a cleared ROW, increases the relative size of effects on visual resources. Significant variance in elevation, whether up or down, intensifies the perspective of an observer. **Table 8.7-2** lists parameters used to classify distance zones, alignments and elevation classes.

Table 8.7-2: Contrast Parameters

Distance on Each Side of the Provisional Route (km)	Distance Zone
0–2	Foreground
2.1–5	Middle ground
5.1–10	Background
General Bearing between OP and the Project (°)[1]	**Alignment**
0 / 180	Aligned
45 / 135 / 225 / 315	Partially Aligned
90 / 270	Perpendicular
Difference in Elevation between OP and the Project (masl)	**Elevation Variance**
>300	Large
115.1–300	Moderate
<115	Slight
Contrast Description	**Contrast**
Contrast demands attention and would not be overlooked by an average observer	Stark
Contrast begins to attract attention and affect landscape characteristics	Moderate
Contrast can be seen but does not attract attention	Vague

Notes: km = kilometres; masl = metres above sea level
[1]Bearings in degrees measured clockwise with north = zero; bearings measured with route alignment between 0 and 180 degrees.

Table 8.7-3 lists considerations for vague, moderate and stark contrast for each of the 10 observation points where theoretical line-of-sight was identified. For example, a view from the background zone, at a low elevation and a perpendicular angle to the Project will result in a weak contrast. A view from the foreground, at high elevation and aligned with the Project, will result in a strong contrast.

Table 8.7-3: Contrast

NR	Name	Distance Zone	Alignment	Elevation Variance	Contrast
OP-11	Highway 37 Viewpoint (RVP-11489)	Background	Partially Aligned	Slight	Vague
OP-15	Onion Lake Recreation Trail (RVP-11515)	Middleground	Perpendicular	Slight	Vague
OP-20	Henderson's Ranch 11	Middleground	Partially Aligned	Moderate	Moderate
OP-21	Kitamaat 2	Background	Partially Aligned	Large	Vague
OP-22	Lakgeas 87	Middleground	Perpendicular	Slight	Vague
OP-33	Clague Mountain Trail Crossing	Foreground	Aligned	Moderate	Stark
OP-34	Kitimat (Alexander Ave.)	Middleground	Perpendicular	Moderate	Vague
OP-35	Kitimat Industrial	Foreground	Perpendicular	Large	Moderate
OP-36	Kitimat CBD	Middleground	Perpendicular	Large	Vague
OP-41	Mount Clague	Middleground	Aligned	Large	Stark
OP-42	Lakelse River	Foreground	Aligned	Slight	Stark
OP-43	Coldwater Creek	Foreground	Aligned	Slight	Stark
OP-44	Wedeene River	Foreground	Aligned	Slight	Stark
OP-45	Little Wedeene River	Foreground	Aligned	Slight	Stark

Notes: CBD = central business district; OP = Observation Point; # = number; RVP = Recreation Viewpoint

8.7.1.1.3 Viewer Sensitivity

Viewer sensitivity is identified for each observation point by analyzing the various indicators of public concern, including existing scenic quality, visual sensitivity designations and expected viewer numbers. Scenic quality is a measure of the visual appeal of a tract of land. Landscapes are rated based on their apparent scenic quality determined by visibility, landforms and waterbodies, influence of man-made facilities and activities. **Table 8.7-4** lists general parameters used to classify existing scenic quality and expected viewer numbers.

Table 8.7-4: Viewer Sensitivity Parameters

General Parameters	Existing Scenic Quality
Natural landforms and waterbodies visible on areas with clear views and few man-made effects	High
Some natural landforms and man-made influences visible in areas with intermittent views	Moderate
Urban, port utility infrastructure and ROWs, major roads, railway lines or logging activities visible in areas with restricted views	Low
General Parameters	**Viewer Numbers**
Large number, frequent use, accessible, urban areas, motorized access or movement corridor	High
Modest number, variable frequency, settlements or recreational facilities	Moderate
Low numbers, infrequent use, unpopulated, remote or no motorized access	Low

Notes: Observations made during the photographic survey inform the ratings of existing scenic quality. ROW = right-of-way.

An assessment is made to determine whether the Project will meet or exceed the VQOs of gazetted scenic areas intersected by the provisional alignment. Potential effects are compared to acceptable levels for each VSU. Anticipated viewer numbers is a reflection of ease of access, frequency of use and presence of recreational facilities. **Table 8.7-4** lists parameters used to summarize indicators of viewer sensitivity. **Table 8.7-5** lists vague, moderate and stark contrast for each of the 14 observation points where theoretical lines-of-sight was identified.

Table 8.7-5: Viewer Sensitivity

NR	Name	Existing Scenic Quality	Visual Sensitivity[1]	Desired Level of Visual Quality[1]	Viewer Numbers	Viewer Sensitivity
OP-11	Highway 37 Viewpoint (RVP-11489)	Low	High	Exceed	Moderate	**Moderate**
OP-15	Onion Lake Recreation Trail (RVP-11515)	Moderate	Low	Meet	Low	**Low**
OP-20	Henderson's Ranch 11	Low	High	Exceed	Low	**Low**
OP-21	Kitamaat 2	Low	High	Exceed	Moderate	**Moderate**
OP-22	Lakgeas 87	Moderate	Moderate	Meet	Low	**Low**
OP-33	Clague Mountain Trail Crossing	Moderate	High	Exceed	Low	**High**
OP-34	Kitimat (Alexander Ave.)	Low	High	Exceed	High	**Moderate**
OP-35	Kitimat Industrial	Low	High	Exceed	Moderate	**Low**
OP-36	Kitimat CBD	Low	High	Exceed	High	**Moderate**
OP-41	Mount Clague	High	High	Exceed	Low	**Moderate**
OP-42	Lakelse River	High	N/A	Meet – VQOs Exceed – Foreground Preservation Buffer	Moderate	**High**
OP-43	Coldwater Creek				Low	**Low**
OP-44	Wedeene River					
OP-45	Little Wedeene River					

Notes: CBD = central business district; OP = Observation Point; # = number; RVP = Recreation Viewpoint; [1]Visual Sensitivity and Desired Level of Visual Quality designations from visual landscape inventory.

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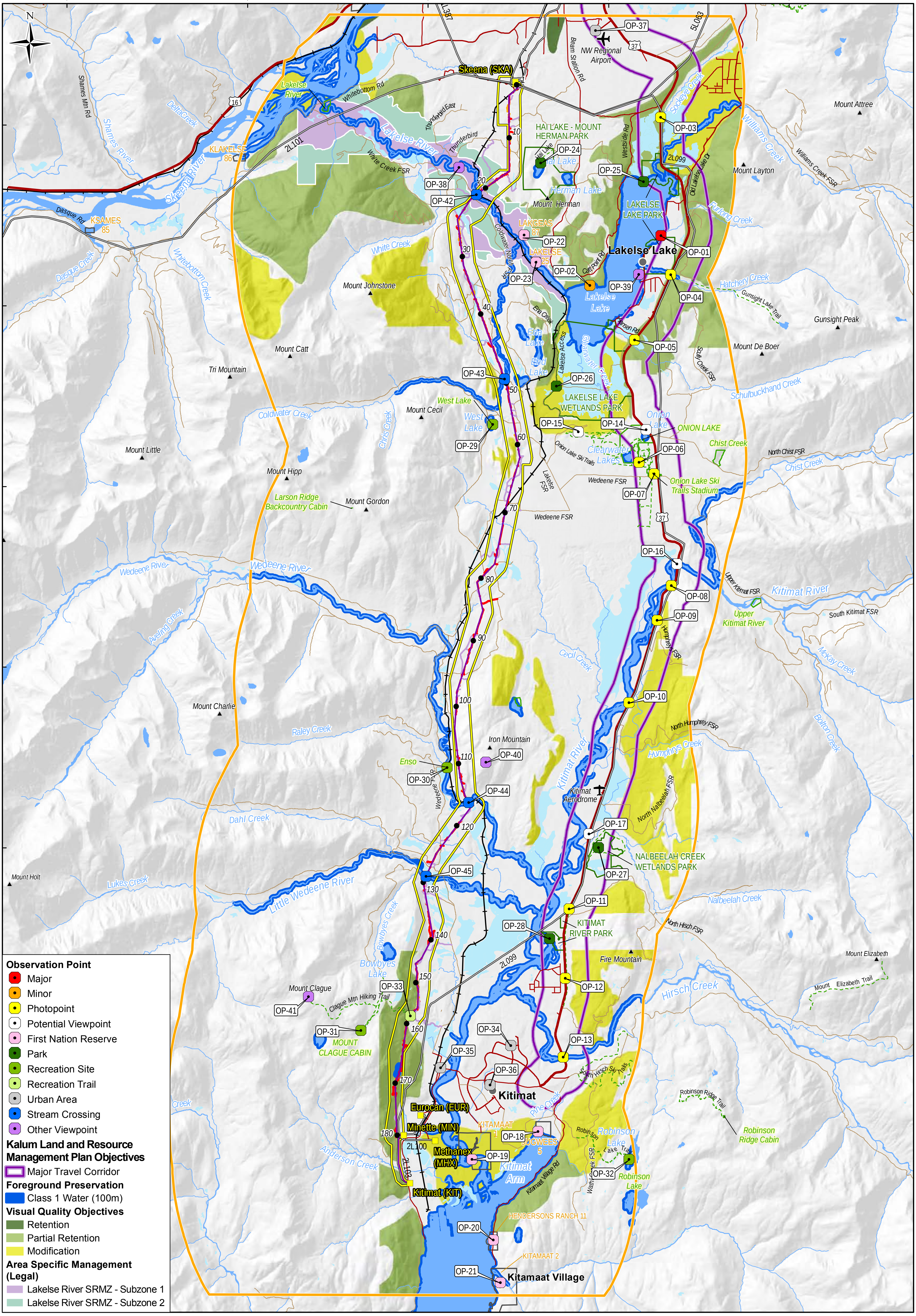

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Last updated by willem.van-riet

Legend

- Populated Place
- Existing Substation
- Existing Transmission Line
- Railway
- Recreation Trail
- Park
- Recreation Site
- First Nation Reserve
- Highway
- Arterial
- Local Road
- Forest Service Road
- Watercourse
- Waterbody
- Wetland

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary
- Visual Resources Local Study Area

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
DataBC Data
Distribution Service
Open Government License
(http://www.data.gov.bc.ca/)

CLIENT: Prepared for BC Hydro	PROJECT: Terrace to Kitimat Transmission Project (TKTP)
TITLE: Visual Resource Values and Land and Resource Management Plan Objectives in the Visual Resources Local Study Area	DATE: September, 2016; ANALYST: WR; QA/QC: MY; **Figure 8.7-1**
	GIS FILE: 13-03-007_VisualResourceVC_v3
	JOB No: VE52379
	COORDINATE SYSTEM: NAD 1983 UTM Zone 9N

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8.7.1.2 Potential Effects

Potential effects are based on contrast and viewer sensitivity for observation points where viewshed analyses indicate line-of-site with the proposed transmission line structures and ROW and new access roads. The length of route visible, contrast and viewer sensitivity informs the predicted level of interaction with the VC. Consideration is also given to specific effects during the various project phases and temporal variations.

Viewshed Analyses: Line-of-sight was modelled at 14 of the 45 identified observation points within the Visual Resource LSA (**Figures 8.7-2**, **8.7-3** and **8.7-4**). Types of observation points include three First Nations Reserves, one recreation photopoint, three urban areas, four stream crossings and three observations points associated with recreation trails. Proximity to the Project is zero at the four stream crossings and the Clague Mountain Hiking Trail Crossing. At other observation points, proximities range from 2,129 m (Kitimat industrial area) to 8,026 m (Highway 37 viewpoint north of the Kitimat River Park). Elevation variances range from 29 m at RVP-11515 on the Onion Lake Ski Trail to 1,089 m at the end of Clague Mountain Hiking Trail. The length of the route within line-of-sight varies from 4,737 m at the Kitamaat First Nation Reserve to 800 m at the crossing of the Mount Clague Trail. Users will have a view of sections of the provisional route and structure number 158 for 800 m of the first 1,330 m of the trail. **Table 8.7-2** lists structures visible from other observation points. **Appendix F.1** lists 31 observation points that are screened from the Project by terrain and/or vegetation cover.

Contrast: A stark contrast is assigned to the four stream crossings and the Clague Mountain Hiking Trail Crossing, as observers will traverse underneath the proposed transmission line when views will align with the ROW. A stark contrast is also predicted for Mount Clague with aligned views from the Middleground at a large elevation variance. Contrast at Henderson Ranch 11 First Nation Reserve, and Kitimat Industrial observation points is moderate due to a combination of attenuated distance, alignment and elevation factors. A large elevation variance and alignment with the Project results in a stark contrast at the Mount Clague peak. **Table 8.7-3** lists moderate and vague contrast for other observation points.

Viewer Sensitivity: The Lakelse River crossing is designated high viewer sensitivity due to its location in a SRMZ and the existence of a foreground preservation buffer (100 m) that manage viewscapes around Class1 water to maintain the visual quality experience of anglers and recreationalists (see **Figure 8.7-4** and **Appendix A** LRMP/SRMP Concordance Tables – Objective 2.2.8/Strategy 5.4). High viewer sensitivity assigned to the Clague Mountain Hiking Trail Crossing as a VSU with high visual sensitivity, and a partial retention VQO will be intersected by the Project in an area with few existing effects. **Table 8.7-5** lists the observation points with moderate and low viewer sensitivity ratings.

New Access Roads: Permanent and temporary new access roads will create additional ROWs in previously vegetated areas that may contrast with existing conditions. The majority of new access roads align with the provisional route where additional effects will not exceed those of the transmission line ROW. This occurs within views from Highway 37 Viewpoint (RVP-11489), Lakgeas 87 First Nation Reserve and the Wedeene and Little Wedeene River crossings. Sections of new access roads outside the transmission line ROW may be visible from the Henderson's Ranch 11, and Kitamaat 2 First Nation Reserves, Clague Mountain Hiking Trail Crossing, Mount

Clague, Kitimat urban area and the Lakelse River and Cold Water Creek crossings. These effects will be less visible than effects of the transmission line and will decrease from views in the middleground and background. New access roads will be visible in the foreground at the Clague Mountain Hiking Trail and Lakelse River Crossing.

Project Phases: Temporary effects may occur within the foreground zone during the clearing/construction phase (2016) when construction equipment and movement, and activities of workers may appear within sight of observation points. These effects are anticipated to be intermittent and short term. Effects of the Project are expected to decrease during the closure phase as structures are removed and ROWs rehabilitated and eventually disappear in the post-closure (decommissioning) phase. Effects anticipated during the operation/maintenance phase are described in the following section.

Temporal Variations: Visual effects may be more evident during winter when clear cuts are at times covered with snow, resulting in a stark contrast with surrounding darker vegetated areas.

Potential Effects: A high level of interaction is identified for the Clague Mountain Hiking Trail Crossing, as a short visible route length is countered by a stark contrast and high viewer sensitivity Line-of-sight is constrained at the Lakelse River crossing by a bend in the river and high vegetation cover. However, the >60 m-high structures on either side of the river and 592 m of the ROW will be visible to kayakers and canoeists along approximately 600 m of the river. Given these parameters and high viewer sensitivity, the level of interaction is considered high.

A moderate level of interaction is predicted for the Mount Clague peak, due to a medium length of visible route, stark contrast and moderate viewer sensitivity. A protracted visible route length is offset by a vague contrast and low to moderate viewer sensitivity at RVP-11489 along Highway 37 viewpoint and the Henderson's Ranch 11 and Kitamaat 2 First Nation Reserve, resulting in low levels of expected interaction. Initial views from these First Nations Reserves are towards the Minette to Kitimat section of the provisional route that aligns closely with effects from the existing route. The short length of visible route, vague contrast and low viewer sensitivity results in a low level of interaction at RVP 11515 along the Onion Lake Ski Trail.A medium visible route length is offset by vague to moderate contrast and low to moderate viewer sensitivity at the Lakgeas 87 First Nation Reserve and three observation points in the Kitimat urban area, resulting in low effects levels of expected interaction. Stream crossings of Coldwater Creek, Wedeene River and Little Wedeene River are also considered low, due to low viewer sensitivity and a short length of the route within line-of-sight of the Project. However, the suggested 100 m foreground preservation buffer for class 1 water will be affected along the width of the ROW at stream crossings.

Table 8.7-6 details length of route visible, contrast, viewer sensitivity and level of interaction for the 14 observation points with theoretical line-of-sight to the Project.

Table 8.7-6: Summary of Potential Effects

OP #	Name	Length of Route Visible	Contrast	Viewer Sensitivity	Level of Interaction
OP-11	Highway 37 Viewpoint (RVP-11489)	Protracted	Vague	Moderate	Low
OP-15	Onion Lake Ski Trail (RVP-11515)	Short	Vague	Low	Low
OP-20	Henderson's Ranch 11	Protracted	Moderate	Low	Low

OP #	Name	Length of Route Visible	Contrast	Viewer Sensitivity	Level of Interaction
OP-21	Kitamaat 2	Protracted	Vague	Moderate	Low
OP-22	Lakgeas 87	Medium	Vague	Low	Low
OP-33	Clague Mountain Hiking Trail Crossing	Short	Stark	High	High
OP-34	Kitimat (Alexander Ave)	Short	Vague	Moderate	Low
OP-35	Kitimat Industrial	Medium	Moderate	Low	Low
OP-36	Kitimat CBD	Medium	Vague	Moderate	Low
OP-41	Mount Clague	Medium	Stark	Moderate	Moderate
OP-42	Lakelse River	Short	Stark	High	High
OP-43	Coldwater Creek	Short	Stark	Low	Low
OP-44	Wedeene River	Short	Stark		Low
OP-45	Little Wedeene River	Short	Stark		Low

Notes: CBD = central business district; OP = Observation Point; # = number; RVP = Recreation Viewpoint; Short: <1.5 km; Medium: 1.51 km to 3 km; Protracted: 3.1 km to 4.7 km.

8.7.1.3 Mitigation

The following technically and economically feasible mitigation measures will lessen the effect of the Project on visual resources. Measure to mitigate effects on visual resources were considered for the selection of the provisional route, therefore no additional planning is considered necessary during clearing/construction phase.

The following mitigation measures will lessen effects of the project during the operation/maintenance.

- Work collaboratively with the Kalum LRMP implementation committee to manage vegetation cover between the Project and visual resources, in a way that supports current recreational activities and is consistent with the safe and reliable operation of the Project;
- Where practicable, apply selective control methods in sections of the provisional route visible from high value observation points to improve aesthetics (noting that this has already been done as mitigation in design);
- Target specific vegetation, based primarily on height and species, so that low-growing species are left intact and encourage shrubs and indigenous plants naturally present on the site to reduce colour/contrast effects; and
- Retain as much vegetation as practicable around bodies of water and focus clearing methods on target vegetation to protect safe working clearances (Integrated Vegetation Management Plan, BC Hydro, 2016).

The following measure will mitigate effects during the closure phase:

- Remove structures and revegetate cleared areas with appropriate vegetation and establish a composition consistent with the surrounding undisturbed landscape as guided by the Restoration and Closure Plan (RCP).

The likelihood of mitigation success was evaluated as part of the effects rating. Mitigation relies on management interventions and ongoing best practices. Measures of success are dependent on feedback from the public and affected stakeholders.

8.7.2 Residual Effects

Adverse residual project effects expected to remain after the application of mitigation measures are identified and characterized for observation points with a high effects rating and listed in **Table 8.7-7** and **Table 8.7-8**.

Table 8.7-7: Residual Effects Table

OP #	Name	Level of Interaction	Residual Effect (Yes/No)	Rationale
OP-33	Clague Mountain Hiking Trail Crossing	High	Yes	Effects remain after application of mitigation measures
OP-42	Lakelse River			
OP-41	Mount Clague	Moderate	No	Level of interaction expected to be reduced from moderate to low by proposed mitigation measures
OP-11	Highway 37 Viewpoint (RVP-11489)	Low	No	Level of interaction expected to be reduced to negligible by proposed mitigation measures
OP-20	Henderson's Ranch 11	Low	No	Level of interaction expected to be reduced to negligible by proposed mitigation measures
OP-21	Kitamaat 2	Low	No	Level of interaction expected to be reduced to negligible by proposed mitigation measures
OP-22	Lakgeas 87	Low	No	Level of interaction expected to be reduced to negligible by proposed mitigation measures
OP-34	Kitimat (Alexander Ave)	Low	No	Level of interaction expected to be reduced to negligible by proposed mitigation measures
OP-35	Kitimat Industrial	Low	No	Level of interaction expected to be reduced to negligible by proposed mitigation measures
OP-36	Kitimat CBD	Low	No	Level of interaction expected to be reduced to negligible by proposed mitigation measures
OP-43	Coldwater Creek	Low	No	Level of interaction expected to be reduced to negligible by proposed mitigation measures
OP-44	Wedeene River	Low	No	Level of interaction expected to be reduced to negligible by proposed mitigation measures
OP-45	Little Wedeene River	Low	No	Level of interaction expected to be reduced to negligible by proposed mitigation measures
OP-15	Onion Lake Ski Trail (RVP-11515)	Low	No	Level of interaction expected to be reduced to negligible by proposed mitigation measures

Notes: CBD = central business district; OP = Observation Point; # = number; RVP = Recreation Viewpoint

8.7.3 Characterization of Residual Effects

Residual effects can be expected at the Lakelse River Crossing and Clague Mountain Hiking Trail observation points after the application of proposed mitigation measures. Residual effects for both observation points are characterized with medium context (moderate resilience to stress) as the Project may contrast with relatively untouched surroundings. Magnitude is high as the Project will be proximate and distinctly visible.

Geographic extent is local as views of the Project are confined to the foreground zone. Duration will be long-term, as effects will last through operations and closure. Effects are reversible once the structure has been removed and the ROW revegetates. Frequency will be continuous within the modelled viewshed, as structures will remain in place during the operational phase. These effects are not anticipated to require further planning at this time.

Table 8.7-8 summarizes the characterization of residual effects on visual resources represented by two observation points designated with a high level of interaction with the VC.

Table 8.7-8: Characterization of Residual Effects on Visual Resources

Observation Point	Direction	Context	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
OP-33 – Clague Mountain Hiking Trail Crossing	Adverse	Medium	High	Local	Long term	Continuous	Reversible
OP-42 – Lakelse River	Adverse	Medium	High	Local	Long term	Continuous	Reversible

Notes: OP = Observation Point; # = number; RVP = Recreation Viewpoint

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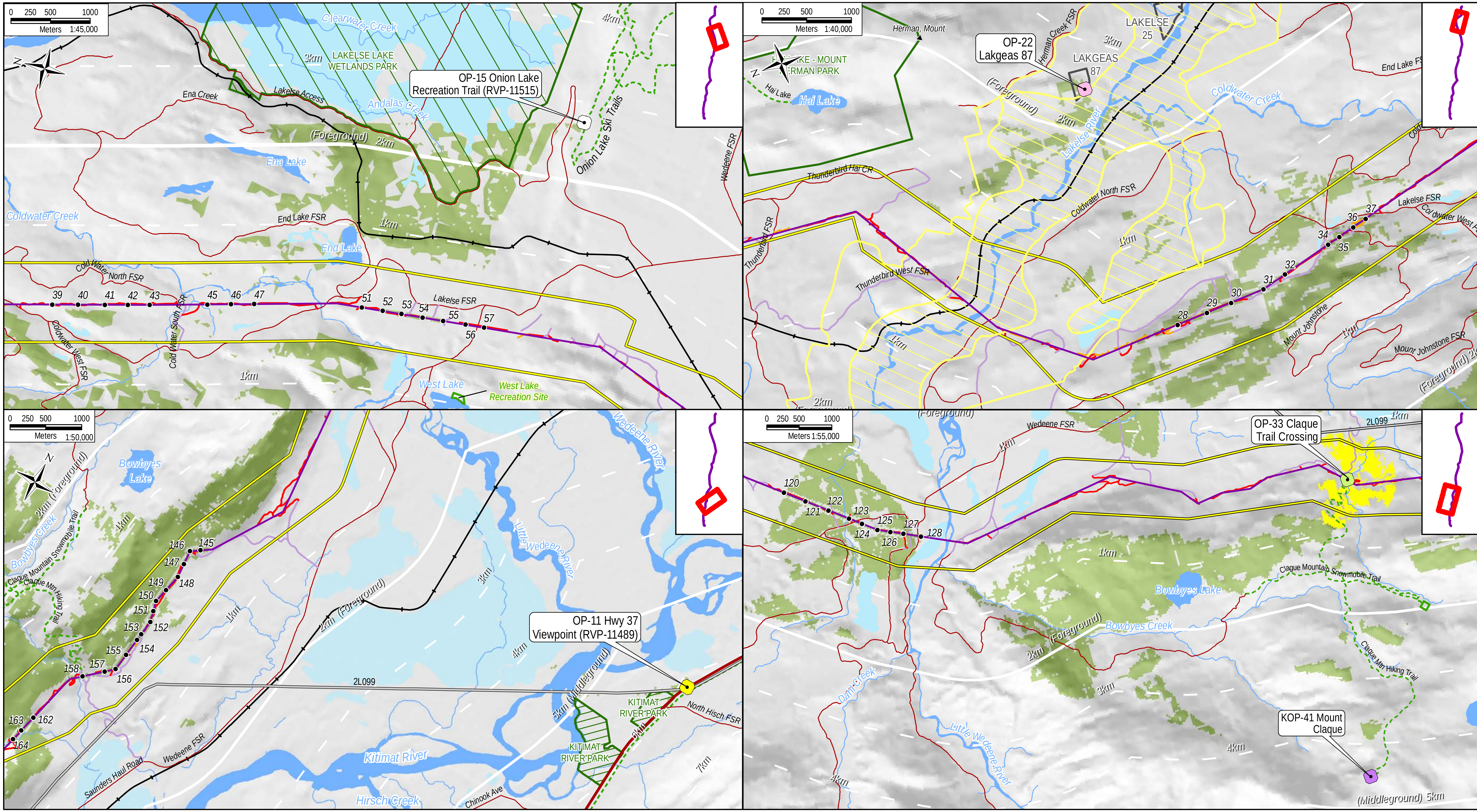

Legend				
Transmission Line	Waterbody	**Project Components**	**Observation Point**	**Viewshed Analyses**
Highway	Wetland	Proposed Structure	*Recreation Viewpoint*	Theoretical Line of Sight
Arterial	First Nation Reserve	Provisional Route	Photopoint	Theoretical Line of Sight (Claque Trail)
Local/ FSR	Park	New Permanent Road	Potential Viewpoint	Distance Zone
Railway	Recreation Site	New Temporary Road	*Points of Congregation*	Proximity Buffer
Recreation Trail	Lakelse Subzone 1	Reconstruction Road	Recreation Trail	
Watercourse	Lakelse Subzone 2	Engineering Boundary	Other	
			Other Viewpoint	

Reference:
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ANALYST: WR
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COORDINATE SYSTEM: NAD 1983 UTM Zone 10N
SCALE:
PAGE SIZE: 11in X 17in

PROJECT:
Terrace to Kitimat Transmission Project (TKTP)

TITLE:
Line of Sight Present Observation Point (OP) 11, 15, 33, 41

PROJECT NO: VE52379
REVISION NO:
DATE: September, 2016
SHEET NO:
Figure 8.7-2

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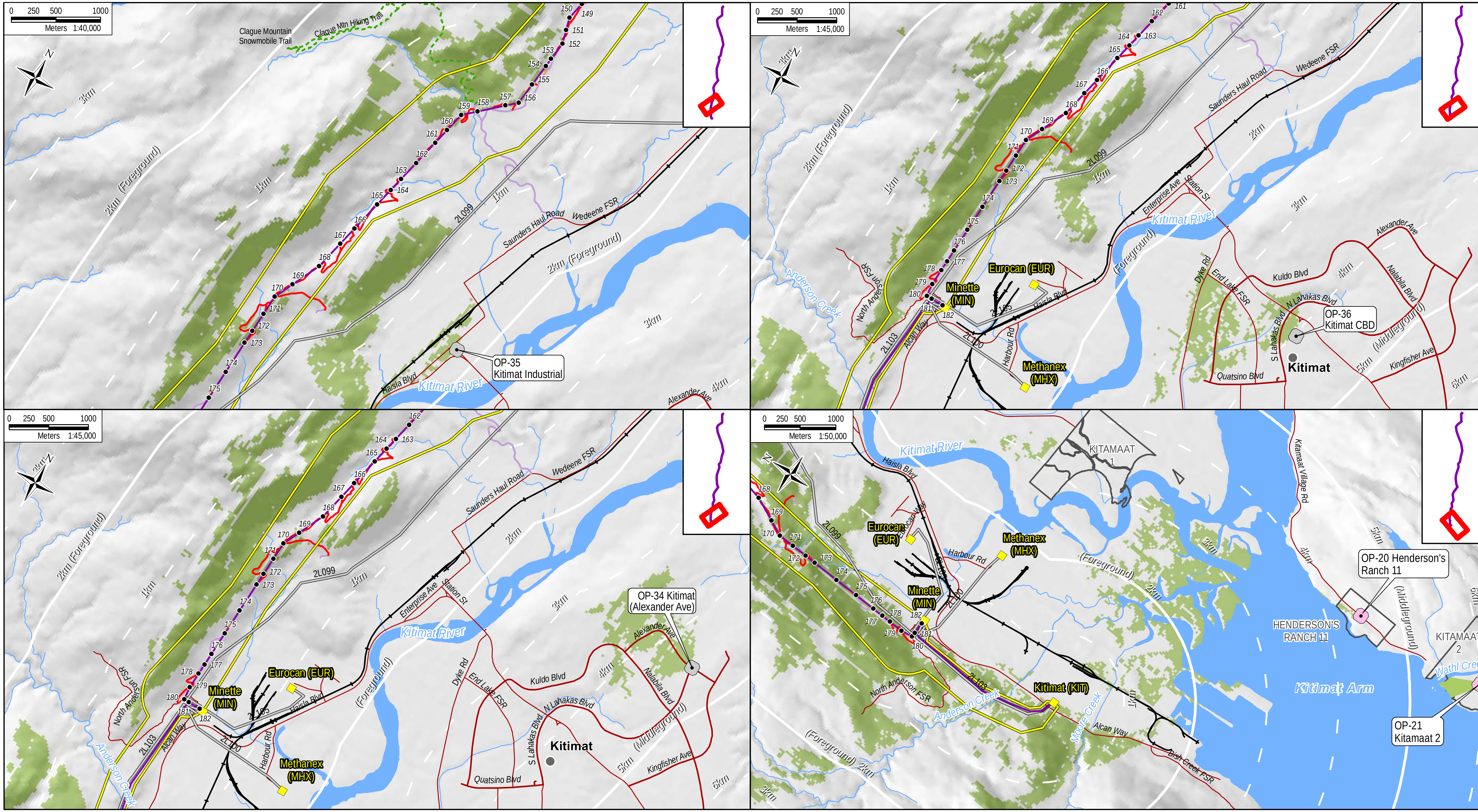

Legend

- Populated Place
- Substation
- Existing Transmission Line
- Railway
- Recreation Trail
- Watercourse
- Waterbody
- First Nation Reserve
- Park

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary

Observation Point

- First Nation Reserve
- Urban Area

Viewshed Analyses

- Theoretical Line of Sight
- Distance Zone
- Proximity Buffer

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PROJECT:
Terrace to Kitimat Transmission Project (TKTP)

TITLE:
Line Of Sight Present Observation Point (OP) 20, 21, 34, 35, 36

PROJECT NO:	VE52379
REVISION NO:	
DATE:	September, 2016
SHEET NO:	

Figure 8.7-3

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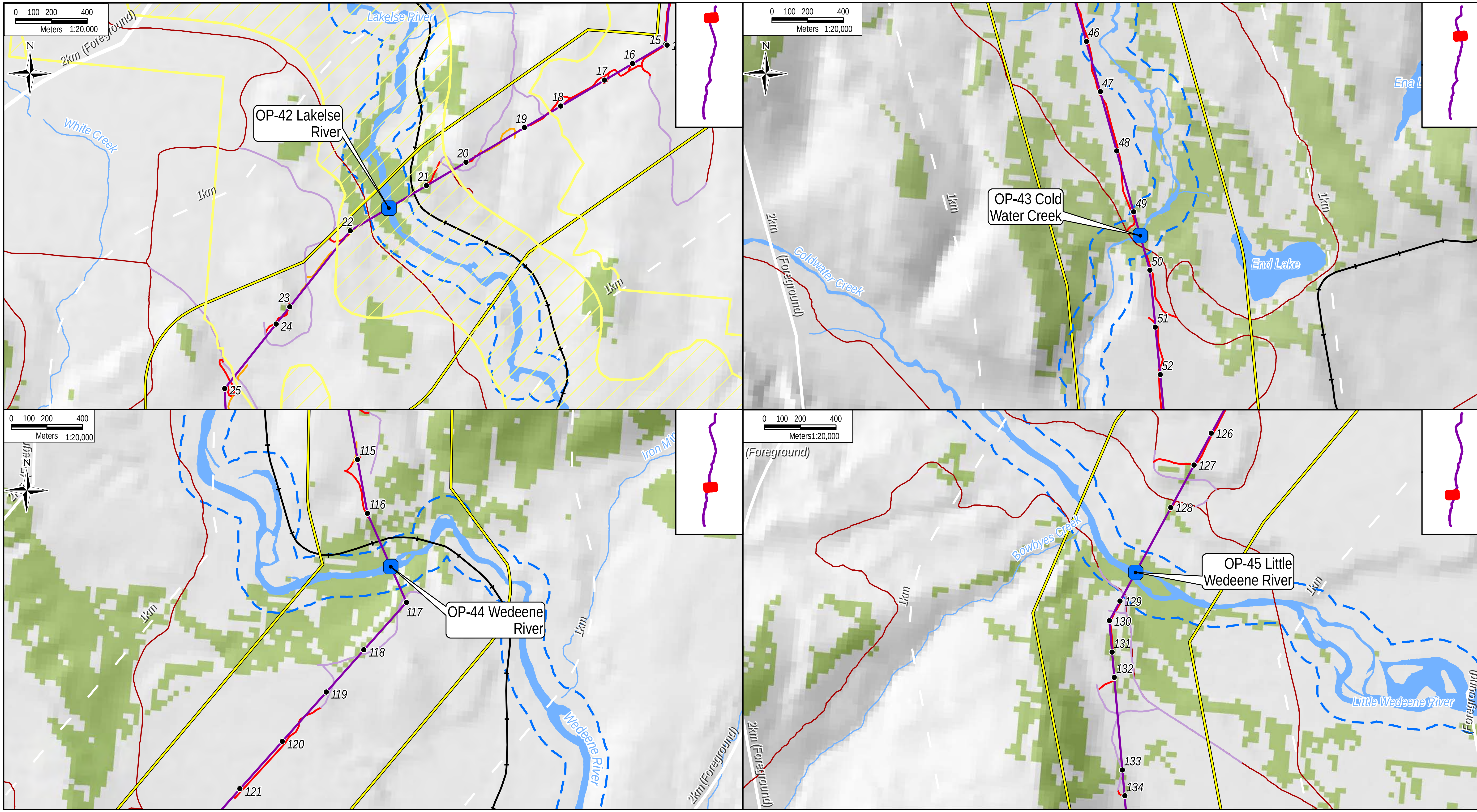

Arterial	**Project Components**	Stream Crossing	Class1 Water (100m buffer)
Local/ FSR	Proposed Structure	**Viewshed Analyses**	
Railway	Provisional Route	Theoretical Line of Sight	
Watercourse	New Permanent Road	Distance Zone	
Waterbody	New Temporary Road	Proximity Buffer	
	Reconstruction Road	**Area Specific Management (Legal)**	
	Engineering Boundary	Lakelse Subzone 1	
		Lakelse Subzone 2	

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COORDINATE SYSTEM:	NAD 1983 UTM Zone 10N
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PROJECT:
Terrace to Kitimat Transmission Project (TKTP)

TITLE:
Line of Sight Present Observation Point (OP) 42, 43, 44, 45

PROJECT NO:	VE52379
REVISION NO:	
DATE:	September, 2016
SHEET NO:	

Figure 8.7-4

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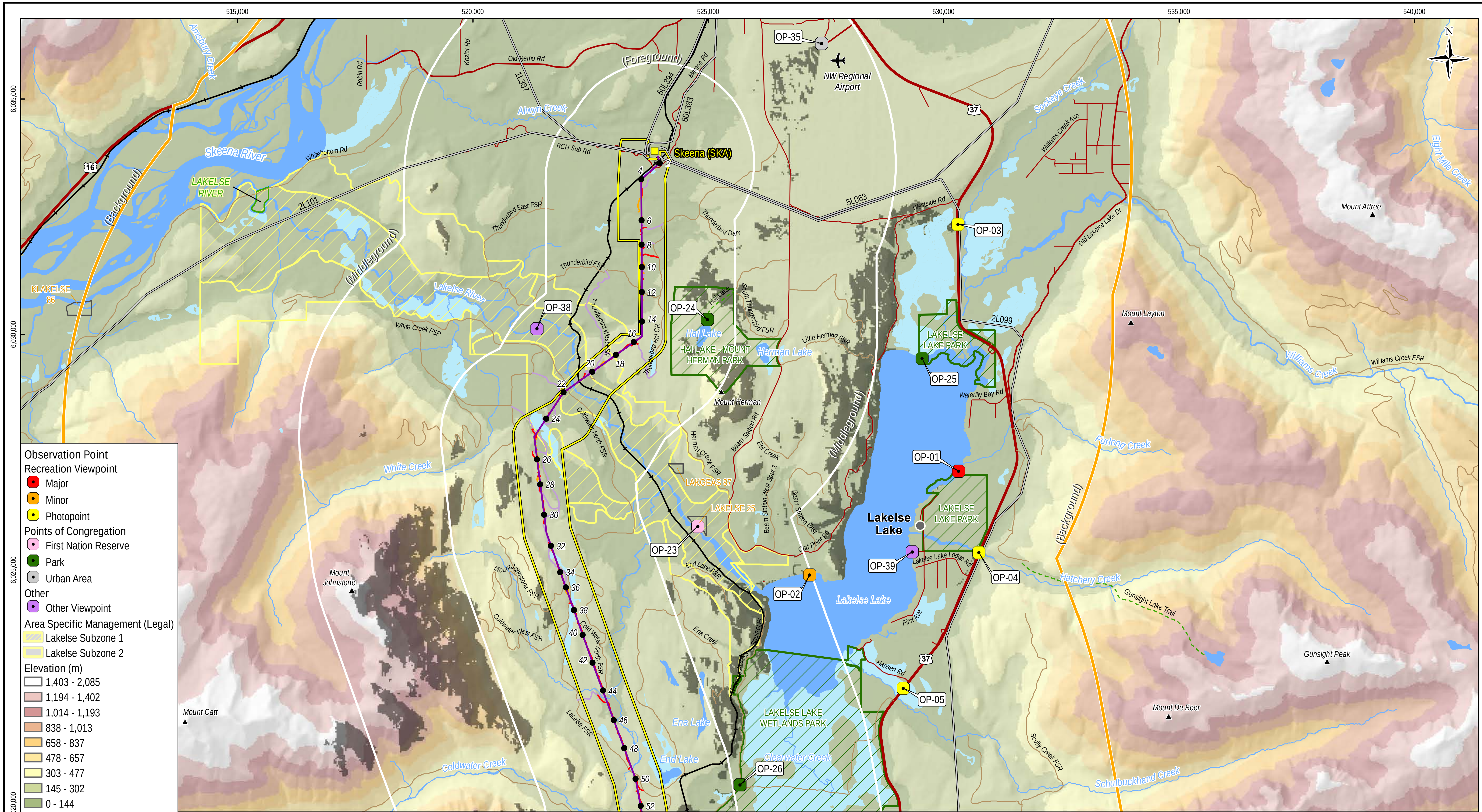

Legend

Populated Place	Highway	**Project Components**	**Viewshed**
Existing Substation	Arterial	Proposed Structure	Theoretical Line of Sight with Selected Observation Points
Existing Transmission Line	Local	Provisional Route	Distance Zone
Recreation Trail	FSR	New Permanent Road	
Recreation Site	Watercourse	New Temporary Road	
First Nation Reserve	Waterbody	Reconstruction Road	
Park	Wetland	Engineering Boundary	
		Visual Resources Local Study Area	

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Kilometers
Scale: 1:75,000

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QA/QC: MY
COORDINATE SYSTEM: NAD 1983 UTM Zone 9N
SCALE: 1:75,000
PAGE SIZE: 11in X 17in

PROJECT: Terrace to Kitimat Transmission Project (TKTP)

TITLE: Line Of Sight Absent - Lakelse Lake Region

PROJECT NO: VE52379
REVISION NO:
DATE: September, 2016
SHEET NO:

Figure 8.7-5

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9 SOCIO-ECONOMIC

9.1 Introduction

This section discusses the potential effects of the Project on the socio-economic conditions of the local communities most likely to be affected by the Project.

The Project is located in the Kitimat-Stikine Regional District Electoral Area (RDEA) C of the Kitimat-Stikine Regional District. The Project involves the construction of a 50 km 287 kV transmission line from the SKA substation near the City of Terrace to the MIN substation near the District of Kitimat to replace the existing transmission line that has reached the end of its serviceable life.

Transmission line construction and operation may affect socio-economic conditions primarily through demand for labour force and procurement of goods and services. This would result in increased employment and business opportunities in the local communities. Labour demands could also stimulate some temporal population increases in the local area, which could create additional pressure on local accommodation, services and infrastructure. In addition, the Project will use certain local infrastructure directly, such as roads, which could affect traffic congestion and road safety.

Considering this interaction, the assessment focuses on the potential effects on employment and business opportunities in the study area, as well as on effects on local infrastructure and services, including availability of temporary accommodation, emergency, health and policing services and traffic and transportation.

The section begins with an overview of existing conditions. It then describes the methodology used for the assessment. This is followed by a discussion of potential effects on socio-economic components, as well as mitigation measures and design criteria to minimize temporary and permanent adverse effects. Finally, it discusses the residual effects that would remain after mitigation using characterization criteria described in **Section 3**: **Methods**.

Community benefits of increased power supply and the potential for new industrial, commercial, or residential development are addressed elsewhere.

9.2 Regulatory Setting

There is no specific legislative requirement for considering the effects of the Project on socio-economic conditions. However, it is common practice to evaluate potential socio-economic changes because these changes directly affect the quality of life in a region and the findings assist public and private agencies in planning for future capacity requirements for various services.

Local and regional services are subject to relevant issue-specific legislation and/or regulation. Any Project-related increased demand for services will be addressed within the context of existing regulatory requirements as a matter of normal business practice.

Project transportation activities will be subject to provincial and federal regulations and legislations including the BC *Transportation Act,* BC *Transport of Dangerous Goods Act,* Canadian

Transportation of Dangerous Goods Act and BC *Motor Vehicle Act*. Other relevant provincial permit requirements may include, but not be limited to:

- Access Permit under the Transportation Act and Motor Vehicles Act;
- Approvals for oversize/overweight loads or bulk hauling under the *Motor Vehicles Act*; and
- Road Use Permit under the Forest and Range Practice Act.

9.3 Issues Scoping

The purpose of issues scoping is to focus the assessment on key issues that have the potential to affect the socio-economic environment of communities and populations in proximity to the Project. These key issues were determined through the identification of the potential interactions of the Project components and activities with the socio-economic environment, from the outcomes of consultation with First Nations and other stakeholders and from the use of professional judgement and scientific and regulatory considerations.

The main socio-economic issue that arose during consultation with First Nations and stakeholders was the desire for employment and business opportunities for residents in local communities. The area has considerable industrial and natural resource experience and local residents have expressed strong interest in work opportunities in these industries. A concern expressed during consultation was the potential increase in traffic during construction activities.

Local residents were also concerned about the potential cumulative effects from multiple developments occurring in the local area, in particular pipelines and LNG projects, which could increase pressures on local infrastructure and services.

Comments received from stakeholders during consultation were documented and considered in this assessment. Detailed information on consultation and engagement activities is included elsewhere.

9.4 Spatial Boundaries

The spatial boundaries for the assessment of socio-economic effects are shown on **Figure 9.5-1**. The socio-economic study area is defined as the particular communities most likely to be affected by the construction and implementation of the Project. The study area consists of two municipalities, rural settlements and First Nations reserves located nearest to the Project route. These areas represent the closest, most accessible sources of labour and goods and services for the Project and reflect the statistical reporting units used by Statistics Canada and the Government of BC.

The following populated rural and urban communities are located within the socio-economic study area:

- City of Terrace;
- District Municipality of Kitimat;
- Kitimat-Stikine RDEA E (Thornhill);

- Kitimat-Stikine RDEA C (Terrace rural);
- Kitselas Indian Reserve 1 (Kitselas First Nation);
- Kulspai Indian Reserve 6 (Kitselas First Nation);
- Kitamaat Indian Reserve 2 (Haisla First Nation); and
- Kitsumkaylum Indian Reserve 1 (Kitsumkalum First Nation[6]).

9.5 Valued Component Selection

The Project could adversely affect the socio-economic conditions of the communities in the study area, both directly and indirectly. A number of socio-economic VCs were selected as a focus for the effects assessment based on their expected interaction with the Project. The VC selection was informed by issues and concerns identified during consultation, literature review (including review of previous assessments) and previous experience in assessing potential resource development project effects on local communities.

Table 9.5-1 presents the socio-economic VCs identified and the rationale for their inclusion.

Table 9.5-1: Valued Components and Rationale

Valued Components	Rationale
Employment and procurement	The Project is expected to provide employment and procurement opportunities for local workers and businesses. It is important to assess potential effects on employment and procurement as it is a prominent factor in determining community benefits arising from the Project. In addition, the proportion of the workforce expected to be drawn from outside of the study communities may influence potential Project effects in other VCs such as availability of temporary accommodation and health services. During consultation activities, local stakeholders and First Nations expressed the desire for employment and business opportunities with the Project.
Temporary accommodation	Construction workers hired from outside the study area would require local availability of temporary accommodation while working on the Project.
Transportation and traffic	Transportation of workers, equipment and materials could create additional vehicular traffic on highways, local roads and FSRs and increase the potential for motor vehicle accidents. Increase in traffic during construction activities was raised as a concern by local stakeholders and First Nations.
Emergency, health and policing services	Project-related arrival of non-local workers may place additional demands on local services including emergency, health and policing services. Increased Project-related traffic could increase the risk of accidents and could place strain on local emergency and policing services.

Notes: FSR = forest service road; VC = Valued Component.

[6] BC Hydro is consulting with all First Nations potentially affected by the Project. This section specifically deals with communities within the study area, not all First Nations that are being consulted.

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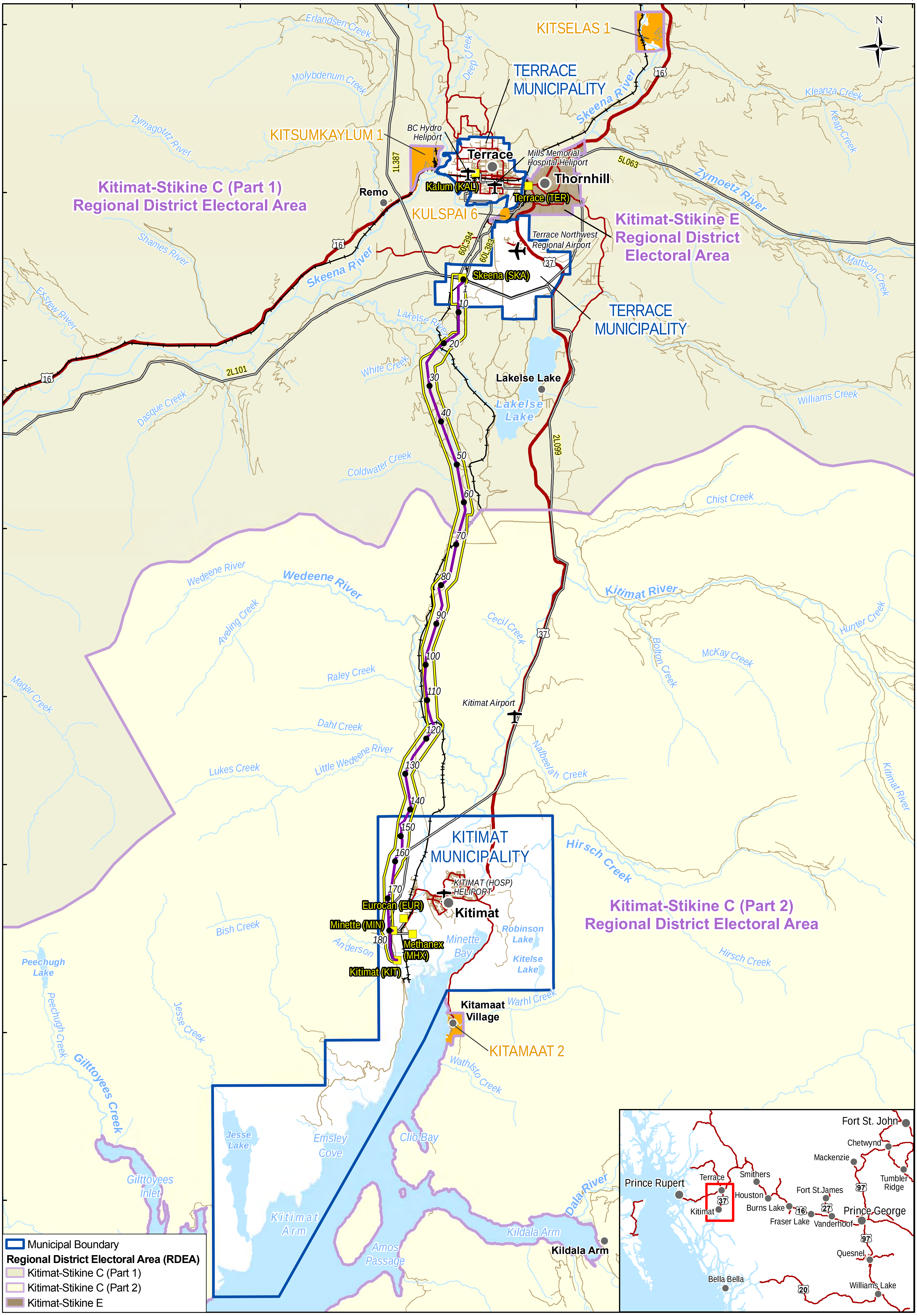

Legend

- Populated Place
- Airport
- Aerodrome/Heliport
- Existing Substation
- Existing Transmission Line
- Railway
- First Nation Reserve
- Waterbody
- Highway
- Collector / Arterial
- Other Road
- Watercourse

Project Components

- Proposed Structure
- Provisional Route
- Engineering Boundary

0 2.5 5 10
Kilometers
Scale: 1:250,000

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CLIENT: Prepared for BC Hydro

PROJECT: Terrace to Kitimat Transmission Project (TKTP)

TITLE: Socio-economic Local Study Area

DATE: September, 2016 | ANALYST: WR | QA/QC: CH | **Figure 9.5-1**

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JOB No: VE52379

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9.6 Socio-Economic Studies

9.6.1 Methods

Existing conditions were characterized to understand the nature and capacity of the local labour force and local infrastructure and services most likely to be affected by the Project. The intent of the socio-economic studies was to gather baseline information to inform the assessment of potential Project effects.

Since Terrace and Kitimat are the closest communities to the Project and the largest communities in the study area, it is expected that the infrastructure and services in these communities are more likely to experience direct and indirect Project effects than other communities in the study area. Therefore, the characterization of existing conditions will focus primarily on Terrace and Kitimat, with some discussion of the other rural communities and First Nations reserves.

Information to describe baseline conditions in the study area was collected via desktop research and supplemented with interviews with key informants. The quantitative data were obtained from the 2011 census (Statistics Canada, 2012) and the 2006 census (Statistics Canada, 2007). Results of the 2011 National Household Survey (Statistics Canada, 2013a; 2013b), which replaced the long-form census, were also used, although for some indicators the 2006 census is the most comprehensive data source.

Social statistical information was also collected from BC Stats (the central statistics agency for BC), BC ministries and local municipalities. Recent community and regional reports from government agencies, community profiles produced by municipalities and community and regional websites were also used.

In some cases, statistical data are only reported for regional districts or administrative service delivery areas that represent areas and populations larger than the individual communities in the LSA. In these instances, the baseline information is reported for those larger areas, and the communities lying within them are clearly indicated.

The qualitative data were gathered through phone interviews with key informants in the study area.

9.6.2 Existing Condition

The Project is located in the Kitimat-Stikine RDEA C. The City of Terrace and the District of Kitimat are the largest population centres in the vicinity of the Project.

The City of Terrace is an important service centre for northwest BC and is expected to have a central role for the Project as an access point and labour and service centre. Terrace is located along the freight transportation corridor, with highway connections to the ports of Kitimat (65 km south) and Prince Rupert (140 km west) and trans-continental rail service. The city is the location for many of the region's business, retail, medical and government services. Terrace's role as a service centre is supported by excellent transportation links and infrastructure such as Northwest Regional Airport, Northwest Community College, University of Northern BC and Mills Memorial Hospital.

Historically, Terrace was a resource community focusing on forestry, fishing and mining, but Terrace's economy has diversified and become more service oriented (Terrace Economic Development Authority (TEDA), 2015b). TEDA has been actively pursuing economic development initiatives to promote growth and diversification of the Terrace economy. Terrace encourages investment and industrial development and is preparing to take advantage of investment in major developments occurring in mining, green energy and LNG (TEDA, 2015a).

The Kitselas First Nation has two communities in close proximity to Terrace. The four other potentially affected First Nations—Haisla, Kitsumkalum, Metlakatla and Lax Kw'alaams—also have communities in the local study area, as described in **Table 9.6-1**. First Nation community members from surrounding communities access health care, education, retail and other services in their communities as well as in the city of Terrace..

The District of Kitimat is a port and large-scale manufacturing centre, occupying a strategic location in Canada's Asia Pacific Gateway and Corridor Initiative (District of Kitimat, 2015b). The district has substantial existing infrastructure, including multi-modal transportation infrastructure, shipping logistic capabilities and a specialized industrial service sector.

Kitimat's economy is primary driven by the Rio Tinto Alcan aluminum smelter. Other smaller economic contributors are tourism, port development, international trade investments and small businesses (District of Kitimat, 2015a). Growth is expected in energy exports, including LNG and petroleum, driven by the number of major proposed Projects underway.

The Kitimat-Stikine Regional District addresses issues of shared interest to communities across a region (e.g. land use planning, emergency services) and is the primary level of government for unincorporated communities. First Nations communities access services on-reserve and also in Terrace and Kitimat.

9.6.2.1 Population

According to the latest census data (Statistics Canada, 2013a; 2013b), the population of the study area was 27,636 residents in 2011 (**Table 9.6-1**). This represented a 10% decrease (over 3,000 residents) from 2001. Terrace, with a population of 11,486, is the largest community in the study area and the second largest in northwest BC, next to Prince Rupert (12,508 residents) (Statistics Canada, 2012). In general, Terrace's population has fluctuated since the 1980s, experiencing a high of 13,417 in 1997. The population has declined since this time, although there was a slight increase between 2006 and 2011 (1.5%).

Kitimat is the second largest community in the study area, with an estimated population of 8,335 residents. This represents a 7% decrease from 2006 and a 19% decrease from 10,285 residents in 2001 (**Table 9.6-1**). The peak population in Kitimat was approximately 13,000 during the late 1970s and early 1980s (District of Kitimat, 2015a).

In contrast to the main population centres, population in First Nations communities in the study area has increased in recent years, with the majority of the growth occurring in Kitselas 1 and Kitsumkaylum 1, (182.1% and 20.3%, respectively, between 2006 and 2011).

As shown in **Table 9.6-1**, in 2011 approximately 19% of the population in the study area was First Nations, with the majority of them living in Terrace (50.7%) and Kitimat (18.2%). First Nations residents represented approximately 23% and 11% of the total populations of Terrace and Kitimat, respectively.

Table 9.6-1: Summary of Population in Local Study Area

Community	2011	2006	2001	% Change from 2001 to 2011	% First Nations Population 2011
Terrace	11,486	11,320	12,109	-5.1	22.6
Kitimat-Stikine RDEA E (Thornhill)	3,988	4,002	4,475	-10.9	14.8
Kitimat-Stikine RDEA C (Terrace rural)	2,696	2,822	2,998	-10.1	6.9
Kulspai 6	95	98	75	26.7	100.0
Kitsumkaylum 1	302	251	265	14.0	-
Kitselas 1	220	78	-	-	97.7
Kitimat	8,335	8,987	10,285	-19.0	11.0
Kitamaat 2	514	514	511	0.6	99.0
Total Study Area	**27,636**	**28,072**	**30,718**	**-10.0**	**18.7**

Note: RDEA = Regional District Electoral Area; % = percent; - indicates no data.

Source: Statistics Canada, 2002; 2007; 2012; 2013b.

More recent population estimates by BC Stats indicate further decreases in population between 2011 and 2014 for the two municipalities in the LSA where data are available. As indicated in **Table 9.6-2**, population in Terrace was estimated at 11,265 in 2014, which is approximately 4% lower than in 2011. Similarly, Kitimat population was estimated at 8,452 in 2014, which represents approximately 1% decrease compared with 2011 levels.

Table 9.6-2: Population Projections for Municipalities in Socio-economic Local Study Area

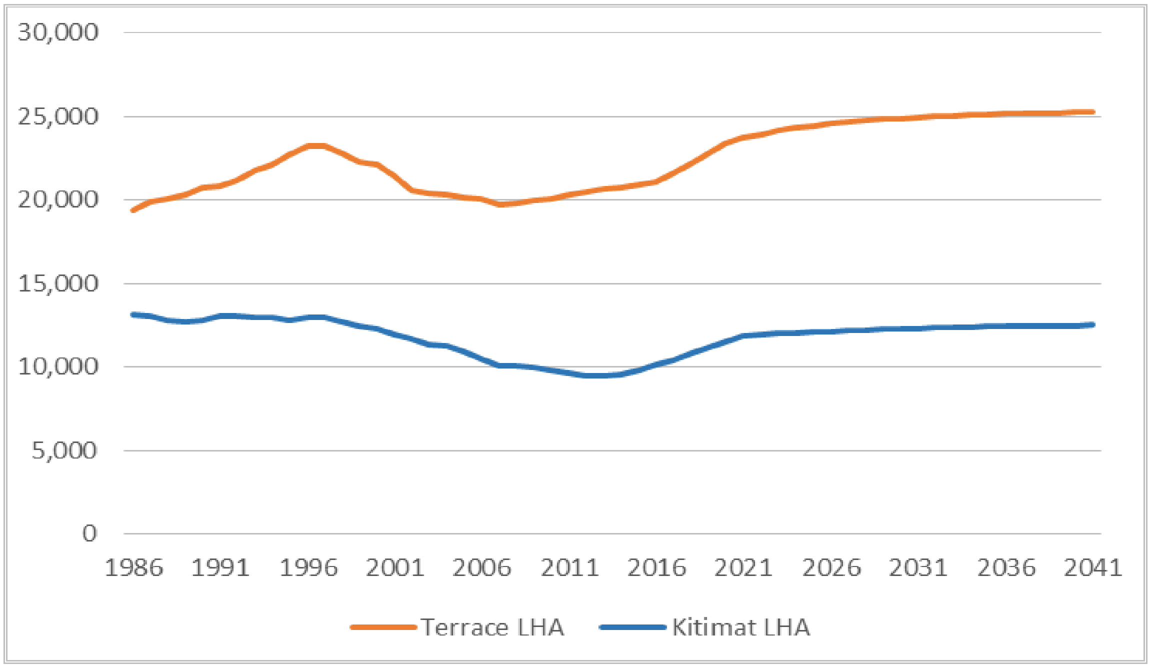
Community	2011	2012	2013	2014	2011–12 Change (%)	2012–13 Change (%)	2013–14 Change (%)
City of Terrace	11,688	11,445	11,458	11,265	-2.1	0.1	-1.7
District Municipality of Kitimat	8,538	8,329	8,367	8,452	-2.4	0.5	1.0

Note: All figures are as of July 1st of the year stated.
% = percent

Sources: BC Stats 2015a

Population projections for the next 25 years for the Terrace and Kitimat local health areas (LHAs), which when combined, roughly coincide with the study area, indicate anticipated population increases in both Terrace and Kitimat areas (**Table 9.6-1**). Current populations in both areas have declined compared with 1996 but are anticipated to grow considerably over the coming years. By

2034, populations in Terrace and Kitimat areas are forecasted to grow by 21% and 29%, respectively, compared with 2014 levels.



Note: LHA = local health area

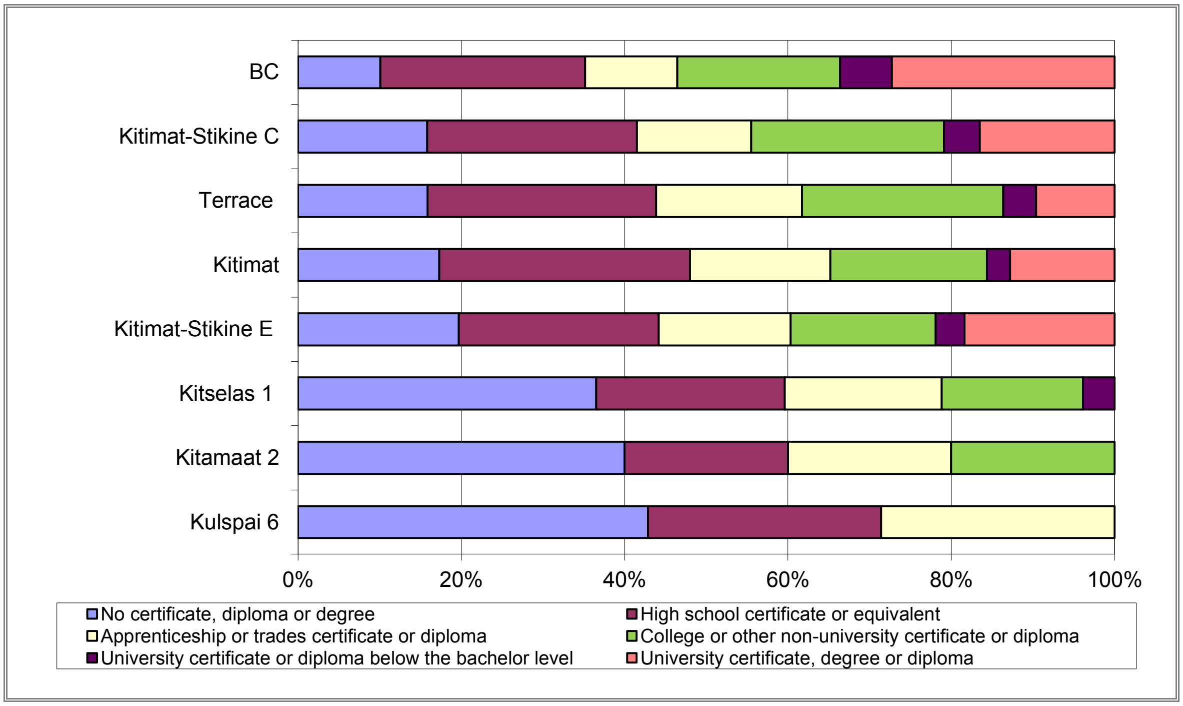
Source: BC Stats, 2015a, 2015b

Figure 9.6-1: Annual Population Estimates and Projections – Terrace and Kitimat Local Health Areas

9.6.2.2 Education

Educational characteristics of the adult population of the study area (people aged 15 years and older) are shown on **Figure 9.6-2**. Relative to the province, residents of the study area were more likely to have incomplete high school education (24.2% compared with 16.7% in BC as a whole) and are less likely to have university degrees. However, trades and college programs are more commonly pursued. Common fields of post-secondary studies included architecture, engineering and related trades (34%); business, management and public administration (20%); health and related fields (15%) and education (10%) (Statistics Canada, 2013a).

The percentage of the adult population with no certificate, diploma or degree ranged from 46.2% for adults on the Kulspai 6 community to 18.8% of adults in the Kitimat-Stikine RDEA C. College or other non-university certificate or diploma was the most common type of post-secondary education attained in all the communities, ranging from 11.8% in Kitamaat 2 to 20.5% in Terrace. The percentage of adults who had obtained an apprenticeship or trades certificate or diploma ranged from 10.7% in Kitselas 1 to 16.4% in Kitimat-Stikine RDEA E.



Note: % = percent; BC = British Columbia**.** Data for Kitsumkaylum 1 were suppressed due to confidentiality requirements.

Source: Statistics Canada, 2013a

Figure 9.6-2: Educational Attainment of Residents Aged 15+ in the Study Area, 2011

9.6.2.3 Labour Force

In 2011, there were approximately 14,180 people in the labour force in the study area, of whom 1,350 were unemployed, demonstrating an unemployment rate of 9.5% compared with 7.8% for the entire province.

In general, unemployment rates in the study area have decreased since 2001, in particular in Terrace and surrounding communities (RDEA E and C). Unemployment rates in Kitimat also slightly decreased in 2011 compared with 2006 but were similar to 2001 levels, at 11.8%. Among the study area communities, Kitimat-Stikine RDEA C and Terrace had the lowest unemployment rates at 7.3% and 7.8%, respectively. These rates were comparable to the provincial average of 7.8%.

First Nations reserves had lower participation rates and significantly higher unemployment rates than the rest of the communities (greater than 30%). Unemployment rates among First Nations population living off-reserve (in Terrace, Kitimat and Thornhill) were also high (23.3%) but were less than the unemployment rates reported on reserves (Statistics Canada, 2013b).

Table 9.6-3 summarizes participation and unemployment rates for the study area communities.

Table 9.6-3: Labour Force Indicators for the Study Area Communities, 2011, 2006, 2001

Location	Labour Force 2011	Participation Rate[1] (%)			Unemployment Rate[2] (%)		
		2011	2006	2001	2011	2006	2001
Terrace	5,890	65.4	68.6	70.5	7.8	9.3	13.5
Kitimat-Stikine RDEA E (Thornhill)	2,220	68.2	70.8	71.1	8.1	12.3	16.7
Kitimat-Stikine RDEA C (Terrace rural)	1,500	68.6	61.6	70.7	7.3	10.8	13
Kulspai 6	30	50	33.3	54.5	33.3	50	33.3
Kitsumkaylum 1	-	-	55.6	-	-	28	-
Kitselas 1	70	45.2	-	-	35.7	-	-
Kitimat	4,270	61.3	65.2	68	11.8	9.5	11.8
Kitamaat 2	200	47.6	-	53	30	-	18.2
Total Study Area	**14,180**	**64.3**	**66.8**	**-**	**9.5**	**10.2**	**-**
BC	**2,354,245**	**64.6**	**65.6**	**65.2**	**7.8**	**6**	**8.5**

Notes: (1) "Participation Rate" refers to the number of people in the labour force in the week prior to Census Day, as a percentage of the population 15 years and over
(2) "Unemployment Rate" refers to the number of people unemployed in the week prior to Census Day expressed as a percentage of the labour force.
BC = British Columbia; RDEA = Regional District Electoral Area; % = percent.

Source: Statistics Canada, 2002; 2007; 2013a.

Over 50% of the labour force in the study area was distributed among five industries—retail trade, manufacturing, health services, educational services and accommodation and food services. Retail trade represented the major industry in Terrace, accounting for 15.6% of the labour force. Other important industries in Terrace included health services (13.5%) and educational services (11%). Overall, service industries accounted for more than 60% of total employment in Terrace, which is consistent with the city's role as a primary service centre in the area.

In Kitimat over a quarter of the labour force (29.4%) was employed in manufacturing industry. This industry was also important in the nearby Kitamaat 2 reserve, where 11.8% of the labour force was employed in the manufacturing industry. This is reflective of Kitimat's status as a manufacturing centre.

Employment in construction was relatively large for most communities, in particular in Kitimat and in Kitamaat 2. Employment in this sector ranges from 4.4% in Terrace to 10.2% in Kitimat.

Among First Nations communities, public administration was typically a major employer, accounting for 42.9% in Kitselas 1 and 23.5% in Kitamaat 2. Residents of First Nations communities were also involved in health care and social services. The cultural industry was also important in Kitselas 1. **Table 9.6-4** shows the labour force distribution by industry for the study area communities.

Table 9.6-4: Labour Force by Industry, 2011

Industry	Terrace (%)	Kitimat-Stikine E (%)	Kitimat-Stikine C (%)	Kitselas 1 (%)	Kitimat (%)	Kitamaat 2 (%)
Total Labour Force	**5,890**	**2,220**	**1,500**	**70**	**4,270**	**200**
Forestry, mining and other resource-based	5.1	10.1	8.8	0.0	2.1	5.9
Construction	4.4	7.8	8.4	0.0	10.2	8.8
Manufacturing	4.4	5.3	3.4	0.0	29.4	11.8
Wholesale trade	3.4	3.2	1.7	0.0	1.9	0.0
Retail trade	15.6	14.7	10.8	0.0	8.4	8.8
Transportation and warehousing	4.7	6.9	10.4	0.0	4.9	0.0
Finance and real estate	3.6	4.1	2.7	0.0	3.4	0.0
Professional, scientific and technical services	4.8	4.1	3.0	0.0	2.9	5.9
Administrative and support; waste management and remediation services	2.9	3.7	5.7	0.0	3.8	8.8
Educational services	11.0	7.1	11.4	0.0	5.8	8.8
Health care and social assistance	13.5	12.4	13.8	28.6	8.2	11.8
Cultural industries, arts, entertainment and recreation	3.7	1.8	3.7	28.6	3.2	0.0
Accommodation and food services	9.0	8.8	4.4	0.0	6.2	5.9
Public administration	9.8	4.6	5.4	42.9	5.4	23.5
Other services	4.3	5.1	6.4	0.0	4.3	0.0

Notes: % = percent.
Data for Kitsumkaylum 1 and Kulspai 6 were suppressed due to confidentiality requirements.

Source: Statistics Canada, 2013a

With respect to occupational classifications (**Table 9.6-5**), sales and service occupations (23.9%) combined with trades, transport and equipment operators (and related occupations) (19.3%) comprise approximately 44% of the labour force in the study area. Other notable occupations include business, finance and administration occupations (12.2%) and education, law and social services and community and government services (14.2%).

Trades, transport and equipment operation were important occupations in all communities. This was the main occupational area in Kitselas 1 (44%), Kitimat-Stikine C (28.6%), Kitamaat 2 (26.5%) and Kitimat (24.5%). Sales and services occupations were also important in all the communities. This was the main occupational area in Terrace and Kitimat-Stikine E, accounting for more than a quarter of the labour force in each community.

Overall, almost 50% of Kitimat's labour force was directly employed in manufacturing, transportation, trade and industrial supply and service, while Terrace has a more service-oriented economy.

Table 9.6-5: Labour Force by Occupation, 2011

Occupation	Terrace (%)	Kitimat-Stikine E (%)	Kitimat-Stikine C (%)	Kitselas 1 (%)	Kitimat (%)	Kitamaat 2 (%)
Total Labour Force	**5,890**	**2,220**	**1,500**	**70**	**4,270**	**200**
Management	9.5	6.0	3.4	0.0	8.1	11.8
Business, finance and administration	12.8	13.8	8.1	22.2	12.0	11.8
Natural and applied sciences	6.8	5.5	3.4	0.0	4.7	0.0
Health	5.7	6.4	8.1	0.0	5.1	0.0
Education, law and social and community and government services	18.4	10.3	15.5	0.0	10.0	14.7
Art, culture, recreation and sport	2.1	1.1	2.4	0.0	2.1	0.0
Sales and services	26.3	27.5	21.5	33.3	19.4	20.6
Trades, transport and equipment operations	12.5	22.5	28.6	44.4	24.5	26.5
Natural resources, agriculture and related production	3.1	4.4	6.1	0.0	1.1	8.8
Manufacturing and utilities	2.8	2.5	3.0	0.0	13.1	5.9

Note: % = percent.

Source: Statistics Canada, 2013a.

9.6.2.4 Large Employers

Table 9.6-6 lists the largest employers in Terrace and Kitimat. The largest employers in Terrace are the School District and Northern Health Authority, while the largest employer in Kitimat is Rio Tinto Alcan (manufacturing).

Table 9.6-6: Large Employers by Community

Community	Employer	Industry/Sector	No. of Employees
Terrace	School District 82	Public Education	721
	Northern Health Authority	Health	650
	Bear Creek Contracting	Construction	225
	Northwest Community College	Education	218
	Walmart	Retail	160
	Safeway	Retail	145
	Hawkair	Aviation	135
	City of Terrace	Public Services	140
	Skeena Sawmills	Manufacturing	100
Kitimat	Rio Tinto Alcan	Manufacturing	1,384
	School District 82	Public Education	265
	Health Council	Health Care	140
	District of Kitimat	Public Services	135
	Overwaitea Foods	Retail	90
	101 Industries	Metal Fabrication	50
	Zanron Fabrication	Metal Fabrication	33
	Iron & Metal Works	Metal Fabrication	30

Source: Terrace Economic Development Authority, 2015a; District of Kitimat, 2015b.

9.6.2.5 Current Main Projects

During 2015 there has been considerable construction activity in the study area, with three major projects valued at $5.3 billion being constructed (**Table 9.6-7**). The largest of these projects was Rio Tinto Alcan's Smelter Modernization Project, which was recently completed and had an estimated value of $4.8 billion.

In terms of possible future development, 14 major projects have been proposed in the area. As of September 2015, the estimated total cost of 11 of these projects was $68.2 billion. The largest of these proposed projects include the Kitimat Clean Oil Refinery and Pipeline ($32 billion), the LNG Canada facility ($25 billion), the Kitimat LNG Terminal and Pacific Trails Pipeline ($5.8 billion), and the Northern Gateway Condensate Pipeline ($2.5 billion) and Crude Oil Pipeline ($1.9 billion). If commencement of any of these projects overlap with the Project, they may interact with Project effects.

Table 9.6-7: List of Major Projects Proposed and Under Construction, 2015

Location	Name	Type	Developer	Description	Estimated Jobs	Start Date/Expected Start date*	Expected Completion Date*
Projects Under Construction							
Kitimat	Kemano Tunnel Project	Utilities	Rio Tinto Alcan	Project will include construction of a back-up tunnel connecting to existing Kemano tunnel and penstocks and an intake for the second tunnel at West Tahtsa Lake. The Kemano hydroelectric plant supplies power to the aluminum smelter in Kitimat (see below). Phase 1 of the project completed in 2014; phase 2 is awaiting final decision.	500 (110 jobs during construction)	Summer 2012	-
Kitimat	Smelter Modernization Project	Metal Manufacturing	Rio Tinto Alcan	Expansion of the aluminum smelter to increase production by 420,000 tonnes/year and convert the existing smelter to new technological systems.	4,800	Early 2012	2015 (completed)
Terrace	Dasque-Middle Hydro Project	Utilities	Verasen Inc.	20 MW hydroelectric project consisting of two locations at Dasque Creek and Middle Creek 20 km west of Terrace and near the SKA substation. Project has been approved for a BC Hydro energy purchase agreement in March 2010.	75	Sep 2011	2015
Proposed Projects							
Kitimat	Cedar LNG	Oil and Gas Extraction	Cedar LNG Export Development Ltd.	Proposed LNG processing facility to be developed at three sites in the Douglas Channel, Haisla project lands. Cedar 1, Cedar 2 and Cedar 3 will have a capacity of 14.5 million tonnes/year. An application for an export licence has been submitted to the National Energy Board.		2017	2020
Kitimat	Terminal A Extension Project	Port and Harbour Facilities	Rio Tinto Alcan	Proposed extension of Terminal A includes replacement of barge ramp, tug dock and laydown facility. The berth will be dredged to a depth of 13.5 m to accommodate Handymax vessels. The project received an environmental assessment certificate in December 2015.	250	-	2017
Kitimat	Kitimat Clean Oil Refinery and Pipeline	Petrochemical Manufacturing	Kitimat Clean Ltd.	Proposed refinery for the Dubose Industrial site located 25 km north of Kitimat. An estimated 550,000 barrels/day of condensate diluent and Alberta oil sands bitumen (dilbit) will be refined to produce 240,000 barrels of diesel/day, 100,000 barrels of gasoline/day and 50,000 barrels of aviation fuel/day. Part of the project is a 40 km pipeline ($11 billion) to transport refined fuel, a marine terminal on the Douglas Channel and a fleet of tankers. The project includes a natural cogeneration facility to provide steam and electric power on site. The project has not formally entered the regulatory process.	32,000 (6,000 jobs during construction; 3,000 jobs during operation)	2017	2022

Location	Name	Type	Developer	Description	Estimated Jobs	Start Date/Expected Start date*	Expected Completion Date*
Kitimat	LNG Canada Facility	Oil and Gas Extraction	Shell, PetroChina, Korea Gas and Mitsubishi	Proposed LNG terminal plan located on the former Methanex facility site. The project will include a gas liquefaction plant, storage and natural gas transport capacity of up to 2 billion cubic feet/day. CFSW LNG Constructors, a partnership of Chiyoda, Foster Wheeler, SAIPEM and WorleyParsons will be the main construction contractor. An agreement is in place to connect to the BC Hydro power grid. The Project has been approved under the *Environmental Assessment Act and the CEA Act*.	25,000 (7,500 jobs during construction; 400 jobs during operation)	2017	2022
Kitimat	BC LNG (Douglas Channel) Energy Project	Oil and Gas Extraction	Douglas Channel LNG Consortium	Proposed natural gas liquefaction plant with a targeted production of about 0.55 million tonnes/year. Export would be carried out by transport vessels and through an option to tie in to the Pacific Northern Gas pipeline with a 10 km connecting pipeline. Douglas Channel LNG Consortium includes AltaGas, Idemitsu Kosan Co., EDF Trading Ltd. and shipper EXMAR NV. An agreement is in place with Haisla First Nation for land and water use and Pacific Northern Gas Ltd. to supply gas. A 20-year export licence has been issued by the National Energy Board for approval to export liquefied natural gas.	600 (750 jobs during construction; 25 jobs during operation)	2016	2018
Kitimat	Northern Gateway Pipeline Condensate Pipeline	Natural Gas Pipeline	Enbridge Pipelines Inc.	Proposed pipeline from Kitimat to Edmonton, Alberta, to deliver 150,000 barrels/day of an ultra-light condensate (a mixture of petroleum by-products and chemicals) for blending with oil sands crude oil. The condensate line will be 20 inches in diameter and be laid at the same time as a crude oil pipeline from Edmonton to Kitimat. Regulatory review with the National Energy Board and the Canadian Environmental Assessment Agency concluded in June 2014 with conditional approval from the National Energy Board Joint Review Panel. Due to a recent court ruling, further regulatory requirements will need to be satisfied before the project can proceed. Project cost is estimated for BC portion.	2,500 (2,500 jobs during construction; 35 jobs during operation)	-	-
Kitimat	Kitimat LNG Terminal and Pacific Trails Pipeline	Natural Gas Pipeline	Chevron Canada and Woodside Energy International Limited .	A liquid natural gas terminal ($4.5 billion) at Bish Cove, 18 km south of Kitimat, to include facilities for marine offloading, LNG storage, natural gas liquids recovery and re-gasification. Chevron Canada Ltd. will construct the 463 km Pacific Trail Pipeline ($1.3 billion) to transport natural gas from Summit Lake to Kitimat LNG. TransCanada Corp. will construct connecting pipeline from Dawson Creek to Summit Lake. Project has received approval under the BC *Environmental Assessment Act*. Federal approval has been received. Front-end engineering and design study has been completed. The National Energy Board has approved a 20-year	5,800 (3,000 jobs during construction; 100 jobs during operation	-	-

Location	Name	Type	Developer	Description	Estimated Jobs	Start Date/Expected Start date*	Expected Completion Date*
				licence to export natural gas. An Engineering, Procurement and Construction Contract has been awarded to a joint venture of Fluor Canada and JGC Corp. of Japan. Site preparation of access roads and worker accommodation are taking place while awaiting final investment decision.			
Kitimat	Northern Gateway Pipeline Project - Crude Oil Pipeline	Crude Oil Pipeline	Enbridge Pipelines Inc.	Proposed 36 in/525 kbpd (thousand barrels per day), 1,177 km bitumen export pipeline from Bruderheim, Alberta, to deliver crude oil to the deepwater port at Kitimat. Engineering and environmental overviews are completed. A second, parallel 20 in/193 kbpd, 1,200 km import pipeline will be built to ship condensate to the oil sands. Regulatory review by the National Energy Board and the Canadian Environmental Assessment Agency concluded with conditional approval from the National Energy Board Joint Review Panel. Due to a recent court ruling, further regulatory requirements will need to be satisfied before the project can proceed. Project cost is estimated for BC portion.	1,900 (2,000 jobs during construction; 165 jobs during operation)	-	-
Kitimat Area	Triton LNG Facility	Oil and Gas Extraction	AltaGas Ltd. / Idemitsu Canada Corp.	Proposed floating LNG export facility is expected to process about 2.3 million tonnes of LNG/year. A 20-year transportation reservation agreement has been made with Pacific Northern Gas for 325 million cubic feet/day. Project has been granted a 25-year export licence by the National Energy Board. An Environmental Assessment will be required for the project.		-	2019
Kitimat to Summit Lake	Pacific Northern Gas Pipeline Looping Project	Natural Gas Pipeline	Pacific Northern Gas Ltd.	Project consists of construction of a new 525 km, 24-inch natural gas pipeline between Summit Lake and Kitimat, primarily along current pipeline ROWs. Project also includes a new compressor station as well as upgrades to existing stations. Pre-application phase under the *Environmental Assessment Act* has commenced.	130 (2,100 jobs during construction)	-	-
Terrace	Northwest Regional Airport Expansion	Transportation	Northwest Regional Airport	Phased airport improvements include expansion of the main terminal building by 40%, airfield upgrades and parking capacity increase to an 800-vehicle gravel lot. The project is in the prefeasibility/feasibility stage.	15	-	-
Terrace	Geothermal Power Plant	Utilities	Enbridge / Borealis Inc. / Kitselas First Nation	Proposed 15 MW geothermal power plant south of Lakelse Lake near Terrace. The plant would generate power for 10,000 homes. The project is in the consultation/approvals stage.	30	-	-

Location	Name	Type	Developer	Description	Estimated Jobs	Start Date/Expected Start date*	Expected Completion Date*
Terrace	Industrial Development Park	Commercial	City of Terrace	Proposed 20 acre serviced industrial development site is located near Highway 16 and railway. Potential for forestry-based manufacturing and services, site is zoned for heavy industrial use. The project is in the prefeasibility/feasibility stage.	15	-	-
Terrace	Skeena Industrial Development Park	Commercial	City of Terrace	A 971 ha heavy industrial greenfield development site with potential for bioenergy manufacturing. Project is located on Kitselas First Nation lands south of the Northwest Regional Airport. Taisheng International Investment Services has purchased 480 ha, an alfalfa protein extract plant is planned for a 13 ha parcel. The project is in the prefeasibility/ feasibility stage.	-	2017	-

Notes: BC = British Columbia; ha = hectares; km = kilometre; kbpd = thousand barrels per day; LNG = liquefied natural gas; m = metre; MW = MegaWatt; ROW = right-of-way; SKA = Skeena substation; % = percent; "-" = Information was not available at the time of writing.
*****Most of the information has been obtained from the BC Major Projects Inventory (September 2015). While efforts have been made to update this information and include the most up to date changes post September 2015, is important to note that projects are constantly re-evaluated by industry and not all information is published by reasons of confidentiality. Start and completion dates are provided as per sources available and are referential only.

Source: BC Ministry of Jobs, Tourism and Skills Training, 2015; Northern Development Initiative Trust, 2011-2015b.

9.6.2.6 Temporary Accommodation and Rental Market

Terrace has 15 properties listed as hotels and motels, with over 418 rooms (excluding bed and breakfast and lodges) (Rescan Environmental Services Ltd. (Rescan), 2009; Visit Terrace, 2015). In addition, there are three new 100-room hotels proposed in Terrace. At the time of writing this report one hotel was under construction, and the other two hotels were expected to begin construction in late 2015 (TEDA, 2015b).

In terms of rental accommodation, Greater Terrace (including Thornhill and surrounding areas) has 412 privately owned rental units of various sizes. **Table 9.6-8** presents the number of privately owned apartments, availability rates, vacancy rates and average rent.

The Greater Terrace's vacancy rates reached historical lows of 0.8% in 2014 (**Figure 9.6-3**). This was explained by the high level of economic activity occurring in the region. This situation has eased during 2015 as supply of rental accommodation has expanded and project-related activities have eased. Between April 2014 and April 2015, the apartment vacancy rate increased from 0.8% to 4.1% (or 17 vacant units). This increase was mainly due to construction of purpose-built housing that resulted in a net increase of 16 units, mostly two-bedroom apartments (**Table 9.6-8**). The availability rate, which measures occupied and unoccupied apartments that are available for rent, was higher than the vacancy rate at 4.6% in April 2015.

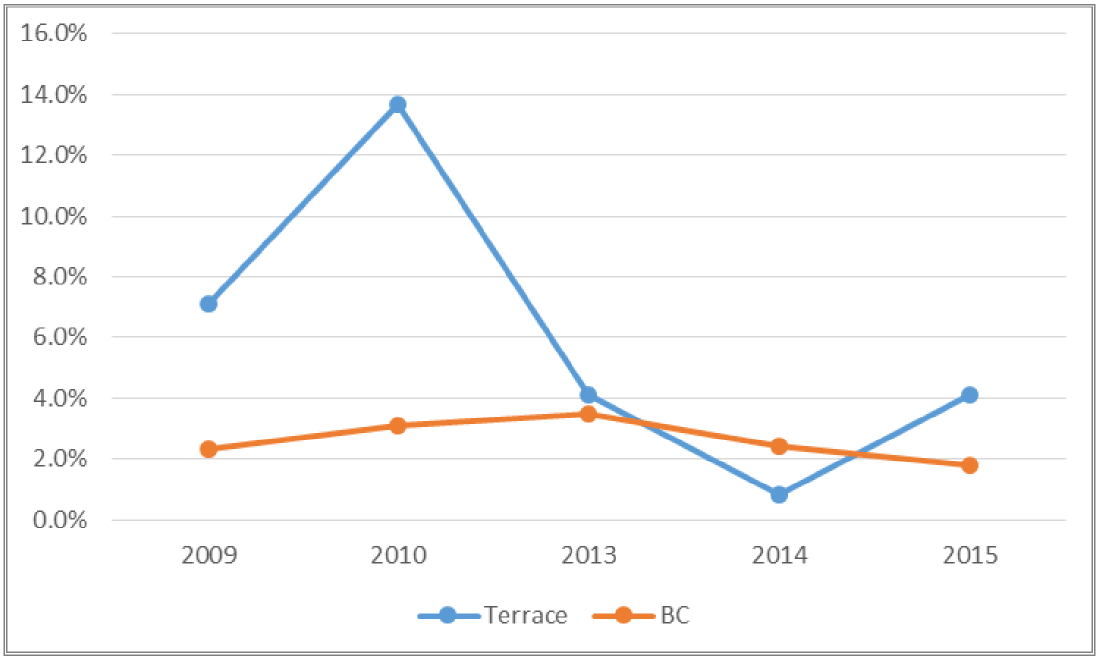
Canada Mortgage and Housing Corporation (CMHC) statistics also show that the average rental price has increased in each type of unit, with the biggest increase being in the two-bedroom apartment category. Overall, the average private apartment rent in Terrace rose from $703 in April 2014 to $778 in April 2015 (**Table 9.6-8**).

Table 9.6-8: Greater Terrace Rental Market Indicators – April 2014 and April 2015

	Bachelor		1 Bedroom		2 Bedroom		3 Bedroom		Total	
Indicator	**2014**	**2015**	**2014**	**2015**	**2014**	**2015**	**2014**	**2015**	**2014**	**2015**
Number of private apartment units	30	31	123	123	198	213	45	45	396	412
Vacancy Rate[1] (%)	0	3.2	0.8	4.9	0.5	4.2	2.2	2.2	0.8	4.1
Availability Rate[2]	0	3.2	0.8	6.5	0.5	4.2	2.2	2.2	0.8	4.6
Average rent ($)	520	566	606	656	751	845	895	949	703	778

Notes: [1] Vacancy rate includes those units that are vacant at the time of the survey and ready for rental
[2] Availability rate is defined as a vacant property ready for rental, a property where the tenant gave notice of departure, or was given notice to leave by the landlord, and where a new tenant has not yet signed a lease for the property.

Source: Canada Mortgage and Housing Corporation, 2015



Notes: % = percent; BC = British Columbia. Values are for April each year.

Source: Canada Mortgage and Housing Corporation, 2010; 2014; 2015.

Figure 9.6-3: Vacancy Rates Percentage for Terrace and British Columbia, 2009 to 2015

Kitimat has 14 properties listed as hotels, motels, lodges, inns and bed and breakfast with over 250 rooms. In addition, there are various campsites available in the study area (Tourism Kitimat, 2013).

9.6.2.7 Health Services and Facilities

The Mills Memorial Hospital is located in Terrace and serves as the primary medical facility in northwestern BC. Patients from rural communities in the region, as far away as Dease Lake, are often transferred to Mills Memorial for moderate to serious health issues. The hospital has 52 beds, including 10 beds in the emergency room (**Table 9.6-9**). The hospital operates at capacity, although there have been some periods when capacity has been exceeded and emergency room beds have been used for regular patients (Mills Memorial Hospital, pers. comm., 2015.). In addition, the Intensive Care Unit was noted to operate over capacity on a regular basis. Hospital management expects to build a new facility or undertake extensive renovations commencing in 2017 (Mills Memorial Hospital, pers. comm., 2015). The emergency room offers a full range of emergency services, including trauma care. It is open 24 hours, 7 days a week and receives an average of 24,700 visits per year (Northern Health, 2015b).

The hospital provides acute, education, prevention and community-based programs. Terrace has the largest concentration of physicians and services north of Prince George and is the largest diagnostic and specialist centre west of Prince George. There are 16 family physicians and 21 specialists, including obstetrics/gynecology, psychiatry, general surgery, urology, ophthalmology, otolaryngology, anaesthetics, radiology, nuclear medicine, pathology, ear/nose/throat, general surgeons, podiatrists, pediatricians and internal medicine (Northern Health, 2015b).

Table 9.6-9: Main Health Centres by Community

Community	Name of Health Care Facility	No. of Beds	Services
Terrace	Mills Memorial Hospital	52	Emergency room, surgery, laboratory, x-ray, intensive care, psychiatric service, extensive day care services. Education, prevention and community-based programs.
	Terraceview Lodge	75	Long-term care
	Seven Sisters	20	Mental health
Kitimat	Kitimat General Hospital and Health Centre	36 multi-level care 22 acute care	Emergency room, laboratory, rehabilitation, X-ray, surgery. Also clinics for public health, home and community care, support and mental health services.

Source: Terrace Economic Development Authority, 2015a; City of Terrace, 2015; District of Kitimat, 2015a; 2015b.

Other health facilities located in Terrace include the Terraceview Lodge, a 75-bed facility that provides long-term care services (Rescan, 2009). The Terrace Adult Sunshine Centre provides services for seniors and adults with disability. The Seven Sisters Residence is a 20-bed psychiatric outpatient centre. In addition, Adult Mental Health (governed by Northern Health Authority) operates group homes for people with mental illnesses.

Kitselas communities are located in close proximity to Terrace and reserve residents access primary and urgent health care in Terrace. An on-reserve health centre offers disease prevention and health promotion. Funding for health services flows through both Northern Health and the First Nations Health Authority. Kitselas is funded for delivery of health services to registered members only; nevertheless, services are provided to all community members living on-reserve (Kitselas Administration, 2015).

The Kitimat General Hospital and Health Centre provide health services in Kitimat. The health complex includes 58 beds, two operating rooms and complete laboratory, rehabilitation diagnostic imaging and emergency departments. It also comprises clinics for diabetes outreach, public health, home care, home support and mental health services, as well as offices for physicians and visiting specialists (District of Kitimat, 2015b). In 2014, the Kitimat General Hospital's emergency room completed renovations, including the addition of an observation room, a clinical workstation, a medical and storage room and a new walk-in patient area (Northern Sentinel, 2014).

Hospitals in Terrace and Kitimat are expected to be able to handle small increases in demand for services but would not be able to absorb large changes in demand. Main concerns with respect to temporary workers relate to unscheduled visits to clinics and the emergency department for non-emergency services such as sick notes, medication refills and doctor appointments for flu, colds and other non-emergency services that could increase pressure on services (Northern Health, pers. comm., 2015a).

9.6.2.8 Protection Services and Facilities

9.6.2.8.1 Policing

Policing services in the study area are provided by the Terrace and Kitimat detachments of the Royal Canadian Mounted Police (RCMP).

The Terrace detachment serves Terrace and the surrounding rural and unincorporated areas (RDEA E and C and First Nations reserves). The detachment currently employs 45 regular members, 10 municipal employees, five public service employees and two victim assistance contractors. The Terrace RCMP detachment also has a well-trained, fully equipped emergency response team, which services the broader northwest region. Regular monthly training is provided (City of Terrace, 2015b).

The Kitimat RCMP detachment serves communities in Kitimat and surrounding area. The detachment has a total personnel of 24 (including 18 regular members, four municipal staff and two auxiliary officers). It also has eight vehicles and a patrol vessel to carry out its duties (District of Kitimat, 2015a). On average, the detachment receives approximately 350 monthly calls. The total number of annual calls has continuously increased during the last five years (RCMP, 2015).

9.6.2.8.2 Fire Protection

Terrace Fire Department serves the City of Terrace and surrounding areas, extending 40 km south towards Kitimat. The department consists of one fire chief, four lieutenants, three full-time firefighters, approximately 25 volunteer firefighters and two fire engines (Rescan, 2009; City of Terrace, 2015). The department is responsible for fire suppression and prevention, first response, highway and technical rescues, hazardous material situation response, public fire safety education and fire extinguisher training.

Fire protection services in Kitimat are delivered by the District Fire and Rescue Services Department. The department consist of 14 firefighters and four fire captains, a clerk dispatcher, a deputy chief of prevention, a deputy chief of operations and a fire chief. The department has seven fire vehicles and two ambulances and performs a number of functions, including fire prevention, public education, fire suppression, pre-hospital emergency care, hazard mitigation, high angle and confined space rescue, hazmat services and auto extrication (District of Kitimat, 2015c).

9.6.2.8.3 Ambulance

Terrace and surrounding area is serviced by one full-time ambulance and two part-time ambulances (on a call-out basis during the day). The detachment comprises four full-time staff and 18 part-time members, all of whom are trained as primary care paramedics (Rescan, 2009).

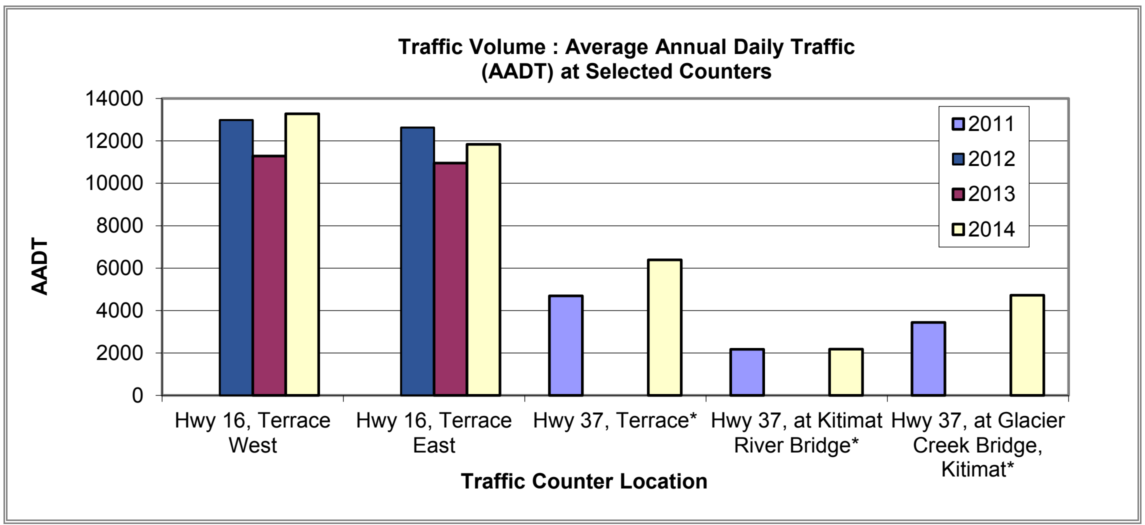
Ambulance service in Kitimat is delivered by Kitimat Fire and Rescue Services Department. All members of the department are trained as firefighters and primary care paramedics. The Kitimat station has one of the fastest response times in the province (District of Kitimat, 2015c).

9.6.2.9 Transportation

9.6.2.9.1 Highways

Highway 16 is the primary east–west highway and trucking route to and through the study area, while Highway 37 provides north–south access. Highway 37 begins at Kitimat and continues to the north to the Yukon Territory border. Highway 16, also known as the Yellowhead Highway, is the second-busiest east–west highway and truck route in Western Canada after Highway 1 (TransCanada Highway). Highway 16 provides linkages to the Port of Prince Rupert, to Prince George, to Alberta and to other eastern provinces.

Figure 9.6-4 shows the average annual daily traffic (AADT) volumes at five traffic counter locations in the study area, including two along Highway 16 at Terrace and three locations on Highway 37 between Terrace and Kitimat. The data indicate that traffic volumes on Highway 16 at the two Terrace locations decreased between 2012 and 2013, but they increased again in 2014. Traffic volumes increased between 2013 and 2014 by 1,995 (18%) and 883 (8%) vehicles per day at the west and east locations, respectively. On Highway 37, traffic volumes at all locations, including one in Terrace and one in Kitimat, have increased since 2011. The AADT at Terrace increased by 1,701 vehicles per day (36%) between 2011 and 2014, while the AADT in Kitimat increased by 1,279 vehicles per day (37%) during the same period.



Source: British Columbia Ministry of Transportation and Infrastructure, 2015

Notes: 48-009EW Terrace West: Highway 16, 0.2 km west of Highway 37, Terrace
48-005EW Terrace East: Highway 16, 0.2 km east of Highway 37, Terrace
48-007NS Terrace: Highway 37, 0.3 km south of Highway 16, Terrace
48-010NS Kitimat River Bridge: Highway 37, 34 km south of Highway 16, south of Terrace
48-016NS Glacier Creek Bridge: Highway 37, 0.5 km north of the Kitimat Indian Village Road, Kitimat
**Data for 2013 were unavailable from the Highway 37 traffic counters*

Figure 9.6-4 Traffic Volumes at Five Locations in Study Area in 2011, 2013 and 2014

Motor vehicle accident data at intersections compiled by Insurance Corporation of British Columbia (ICBC) for Terrace and Kitimat during the five-year period from 2009 through 2013 are presented in **Table 9.6-10** and **Table 9.6-11**.

During the period of record, an annual average of 131 collisions at intersections was recorded in Terrace, with approximately 18% (23) accidents occurring at intersections with Highway 16. Over the complete five-year period, a total of 655 collisions were reported in Terrace. Of these, 180 (27%) resulted in casualties (injury or fatality) and 475 (73%) in only property damage. The total number of collisions decreased in 2013 by 37% after a sustained increase from 2010.

During the same five-year period, an annual average of 39 collisions at intersections were recorded in Kitimat; of these, approximately 6% (2) occurred at intersections with Highway 37. Twenty-six (13%) of the 197 collisions for the five-year period resulted in injury or fatality and 171 (87%) in only property damage. The total number of accidents has decreased for the last two years recorded, from a peak of 62 in 2011.

Table 9.6-10: Crashes at Intersections for Terrace and Highway 16 (2009 to 2013)

Year	Total Terrace			Highway 16 Only		
	Type of Collision		Total	Type of Collision		Total
	Casualty	Property Damage Only		Casualty	Property Damage Only	
2009	41	89	130	6	16	22
2010	28	88	116	5	12	17
2011	42	102	144	13	17	30
2012	40	123	163	11	22	33
2013	29	73	102	6	9	15

Source: Insurance Corporation of British Columbia, 2014.

Notes: Figures only include crashes where sufficient location information was available; therefore, it may underestimate the total number of crashes. Figures also exclude crashes in parking lots and incidents involving parked vehicles.

Table 9.6-11: Motor Vehicle Accident Data for Kitimat and Highway 37 (2009 to 2013)

Year	Total Kitimat			Highway 37 Only		
	Type of Collision		Total	Type of Collision		Total
	Casualty	Property Damage Only		Casualty	Property Damage Only	
2009	4	20	24	0	0	0
2010	6	27	33	2	1	3
2011	4	58	62	0	4	4
2012	6	35	41	0	2	2
2013	6	31	37	1	2	3

Source: Insurance Corporation of British Columbia, 2014.

Notes: Figures only include crashes where sufficient location information was available; therefore, it may underestimate the total number of crashes. Figures also exclude crashes in parking lots and incidents involving parked vehicles.

An area of high frequency of accidents on Highway 37 is between the Northwest Regional Airport and Williams Creek. In winter, driving can be hazardous due to icy and snowy conditions (RCMP, pers. comm., 2015).

Dangerous goods can be transported on all highways in BC, including Highways 16 and 37 and local FSRs, provided that the dangerous goods and the vehicles transporting them are in compliance with the applicable international, federal and provincial guidelines, acts and regulations. These include but are not limited to the Canadian *Transportation of Dangerous Goods Act* and Regulations and BC *Transport of Dangerous Goods Act* and Regulations. It is anticipated that materials transported to the Project site will fall under some dangerous goods classifications, possibly including reagents such as fuel and lubricants and blasting agents.

9.6.2.9.2 Air Transportation

The Northwest Regional Terrace-Kitimat Airport is located 10 km west of the city of Terrace and is considered a regional hub for air traffic. The airport has two runways and opens 365 days per year. It offers daily direct flights to Vancouver, Kelowna, Victoria, Prince George, Prince Rupert and Calgary via Air Canada, Hawkair, Central Mountain Air and WestJet.

In 2013, the Northwest Regional Airport handled 177,600 passengers, a 28% increase from the previous year (Northwest Regional Airport, 2014). By 2014, the total number of passengers reached a peak of 253,368 passengers (excluding charter passengers), representing a 43% increase with respect to 2013. This increase was driven by a number of industrial projects undertaken in the region and was within the forecasted demand anticipated by the airport authority. Passenger traffic is anticipated to decrease in 2015 given the completion of Rio Tinto Alcan's Aluminum smelter in Kitimat, but is expected to remain within the 235,000 airport annual target (Terrace Standard, 2015a, 2015b).

The airport is implementing a five-phase master expansion plan for the next 20 years to ensure it is positioned to service the expected long-term economic growth in the region. The first phase of the project includes the expansion of the terminal facility and parking. The completion of this project is expected in spring 2016 (Northern Development Initiative Trust, 2011-2015a).

9.6.2.9.3 Rail

The CN Rail mainline runs between Prince Rupert and Edmonton through Terrace. A branch line for freight only operates between Terrace and Kitimat. Available information indicates that the branch line between Terrace and Kitimat is intersected by the proposed Project in four locations.

CN Rail has shipping agreements in place with major United States rail carriers and has made significant investments in the Northern Corridor rail line, including extended sidings, upgrading signal systems and increasing bridge and tunnel clearances (District of Kitimat, 2015b).

9.6.2.9.4 Port Facilities

The LSA is serviced by two port facilities: the Port of Prince Rupert—located 155 km from Terrace—and the Port of Kitimat. Kitimat is BC's largest private port and the deepest inland outlet for goods moving along the Northwest Transportation and Trade Corridor (District of Kitimat, 2015b). The Port of Kitimat facilities are located approximately 5 km south of the proposed Project site. Both ports are serviced by the CN Rail and main highways.

9.7 Socio-Economics Effects Assessment

9.7.1 Potential Effects and Proposed Mitigation

This subsection identifies and analyses potential effects of Project on the socio-economic condition of the study area communities and proposes measures to mitigate adverse effects.

Potential Project effects on socio-economic conditions are related to:

- Employment and procurement opportunities for local labour force and businesses;
- Potential temporary increase in demand for temporary accommodation by incoming construction workers from outside the study area;
- Temporary increase in vehicular traffic on highways and local roads and related motor vehicle safety; and
- Potential temporary increase in the demand for health services, emergency services and protective services in the study area.

The Project construction and operation will generate employment and procurement opportunities for local workers and businesses but will also require some workers from outside the study area, which would create temporary population increases in the local communities. This potential population increase may, in turn, increase the pressure on local services and infrastructure, such as availability of temporary accommodation, health services and policing and emergency services. In addition, Project transportation activities will create additional vehicle traffic and additional demand on regional transportation infrastructure, mostly during the construction phase. Project-related hazards may also increase pressure on local emergency services, including fire, ambulance and police if accidents occur.

A quantitative assessment of capital and operating expenditures in the study area and elsewhere in the province and associated indirect and induced effects is not practicable because detailed Project costing information was not available at this definition stage. This information is not presented in this report.

9.7.1.1 Construction Phase

9.7.1.1.1 Employment and Procurement Opportunities

Construction of the Project will create employment and procurement opportunities for local First Nations and non–First Nations residents and businesses but will also bring some workers from outside the study area. The assessment of potential effects on employment and procurement examines labour availability in the study communities and its ability to meet Project labour demands. The assessment considers BC Hydro workforce needs and hiring policies, the capacity of the local labour force and the competing demands from other anticipated projects. It is important to assess potential effects on employment and procurement as it is a prominent factor in determining community benefits arising from the Project. In addition, the proportion of the workforce expected to be drawn from outside of the study communities would influence potential Project effects in other VCs such as availability of temporary accommodation and health services.

The construction phase of the Project is anticipated to commence the second quarter of 2017 and to last approximately three years. Construction activities will involve vegetation clearing, access road and bridge construction (temporary and permanent), upgrades to existing forestry roads and bridges, foundation works, installation of support structures, stringing of conductors and final testing and commissioning. Further details are provided in **Section 2.4**. The type and degree of specialization of skills required vary across Project activities. Clearing activities do not require very specialized workforces, but structure erection and stringing of conductors and cable and final testing and commissioning require more specialized personnel.

At this definition stage, detailed labour and cost information was not available for all Project activities. Labour information was only available for clearing and access road construction and was provided by Chartwell Consultants Ltd. Labour requirements for structure foundation and structure erection and stringing were estimated using information obtained from a similar transmission line project recently completed. **Table 9.7-1** outlines the estimated labour requirements for each of the main activities involved in the construction of the Project, as well as the type of skills required for each activity.

Table 9.7-1: Estimated Workforce for the Project Clearing/Construction Phase

Project Activity	Type of Skills Required	Expected Timing	Total Man-Hours	Person-Years[1]
Clearing and road building[2]	• Forestry operators • Equipment operators • Truck drivers • Labourers	2017–2018	133,719	38
Structure Foundation[3]	• Linemen • Equipment operators • Truck drivers • Inspectors • Labourers	2018	77,289	22
Structure erection and stringing[3]	• Steel erectors • Equipment operators • General tradesmen • Truck drivers • Linemen • Equipment testers	2018–2019	247,220	71

Notes: 1. Assumes 10-hour work day, 7 days a week, 50 weeks a year.
2. Labour requirements for clearing activities and access road building are based on estimates provided by Chartwell Consultants Ltd.
3. Labour requirements for foundation works and structure erection and stringing are estimated based on workforce statistics for the 60 km transmission line component of the Dawson Creek / Chetwynd Area Transmission (DCAT) Project in northeastern BC.

Source: Chartwell Consultants, pers. comm.; Dawson Creek / Chetwynd Area Transmission, 2015; BC Hydro, 1990.

It is estimated that clearing/construction of the Project would require an average direct[7] workforce of 44 person-years (PYs) for each year of construction, although specific workforce requirements will vary throughout the construction phase. Direct employment during clearing and road building is estimated at 38 PYs, employment during foundations works is estimated at 22 PYs, while labour requirements for structure erection and stringing is anticipated at 71 PYs. The actual number of workers employed at the Project at any given time may vary according to location along the transmission corridor, time of the year and specific Project activity. Construction projects typically involve numerous tradespeople working sequentially and for short time periods, such that 1 PY of construction could translate into up to four different people working for three months. At peak construction periods, it is estimated that there will be a maximum of 140 people working at the Project, although this peak workforce requirement will last for short time periods while labour intensive activities are undertaken.

In addition to direct jobs, other indirect and induced jobs would be created in local supplier industries (e.g. equipment rentals, fuel suppliers, transportation services, accommodation, etc.) and as a result of increased consumer spending. Indirect and induced employment will not be quantified for the purpose of this assessment.

BC Hydro is in the early stages of development of the procurement strategy for the Project, which will be designed and managed directly by BC Hydro. BC Hydro has heard the requests of potentially affected First Nations and will endeavour to provide meaningful work and/or contracting opportunities to these groups through this procurement strategy. It is anticipated that BC Hydro will contract out much of the work during the clearing/construction phase. The contracting opportunities will be posted on the BC Bid website and contracts will be awarded via a public tendering process (BC Hydro, 2015a). Fair opportunities will be provided to qualified contractors and service companies from the study area and across the province in accordance with BC Hydro procurement practices. Personnel hiring decisions would ultimately rest with the selected contractors; however, BC Hydro would encourage the contractors to hire qualified local residents and First Nations employees whenever practicable.

BC Hydro will make best efforts to increase the participation of First Nations businesses in providing goods and services to the Project in accordance with BC Hydro's First Nations Contract and Procurement Policy (BC Hydro, 2015b). Further discussion about contracting and capacity-building opportunities for First Nations will be held during BC Hydro's consultation with First Nations.

Employment opportunities within the study area are anticipated to include ROW clearing and restoration, access road construction and upgrading, excavation and site preparation. It is anticipated that 80% of the workforce required for clearing and access-related activities would consist of certified and experienced forestry operators, while 20% would be general labourers. In addition, the Project will also require some supporting and managing positions, including project managers, first aid supervisor, safety inspector, project administrator, security etc. Specialized activities associated with foundation and anchor installation and stringing of conductors would

[7] Direct employment refers to workers who would be directly employed in activities related to construction of the Project. This does not imply the workers would be directly hired by BC Hydro.

require more specialized trades and technicians that would likely be procured from outside the study area.

First Nations groups and local residents have expressed interest in benefiting from employment and business opportunities created by the Project. The labour force in the study area has a relatively high level of expertise in industrial activities and trades (including forestry, construction and related activities, as indicated in **Table 9.7-2**), and it is expected that the local labour force would have adequate skills and experience to fill at least a portion of the Project labour demands. In addition, a number of contractors with forestry, logging and silviculture experience relevant to the Project construction activities are located in the Terrace–Kitimat area. There are also heavy equipment firms, trucking contractors, electrical contractors and general construction firms located in Terrace that may be able to participate in various activities of the Project construction (Terrace and District Chamber of Commerce, 2015).

It is uncertain whether construction of the Project will be undertaken in competition for resources from other projects. A number of LNG and other industrial projects have been proposed in the study area (**Table 9.6-7**), some of which have already received environmental approvals and permits (e.g. Kitimat LNG, Pacific Trail Pipeline, Douglas Channel LNG and LNG Canada). The fall in commodity prices is expected to delay major projects as financing becomes difficult to attain, so it is uncertain how many projects, if any, will advance over the medium term and compete with the Project for labour and services. In light of the potential competing demands of other projects and the workforce requirements for the Project, it is estimated that 45% of positions (average 20, peak 42) will be filled locally, while the remainder will be from communities outside the study area. This represents between 3% and 6% of the forestry labour force or between 2% and 4% of the construction labour force in the study area.

The overall net effects of the Project on local employment and businesses are positive and do not require mitigation. While Project construction will occur at a time when several other large projects are also underway, possibly resulting in competition for available labour, the local labour force is large enough that it should be capable of providing 45% of the Project workforce requirements. Most jobs would be temporary and short-term over the three-year clearing/construction period.

Table 9.7-2: Estimated Local and Non-Local Workforce for the Project Clearing/ Construction Phase

Project Activity	Expected Timing	Person-Years[1]	Percentage of Local Workforce	Local	Non-Local
Clearing and road building	2017–2018	38	70	27	11
Structure foundation	2018	22	50	11	11
Structure erection and stringing	2018–2019	71	30	21	49
Average	2017–2019	44	45	20	24
Peak (structure erection and stringing)	2019	140[2]	30	42	98

Notes: [1]Assumes 10-hour work day, 7 days a week, 50 weeks a year.
[2]This refers to the maximum number of workers at peak construction (not person-years).
Columns may not add due to rounding.

9.7.1.1.2 Temporary Accommodation

During clearing/construction a portion of the workers are anticipated to be sourced from communities outside the study area and therefore will require local accommodation while working on the Project. Given the short duration of the clearing/construction activities and the rotation schedules, it is not anticipated that workers would bring their families or relocate to the study area permanently. Instead, non-local contractors are expected to use temporary accommodations (e.g. hotels, motels, guesthouses, campgrounds) and rental accommodations (e.g. apartments) in the study area. The demand for accommodation would likely focus in Terrace and Kitimat as they are the closest population centres to the Project. Terrace is the closest community to the northern portion of the Project, while Kitimat is closest to the southern part. Construction crews will be able to commute easily from either community to work sites along the transmission line corridor.

As estimated in **Section 9.7.1.1.1,** the Project may resource up to 55% of its total workforce from outside the study area. The greatest demand for accommodation would occur during structure erection and stringing activities, when the largest workforce and more specialized skills are required (**Table 9.7-2**). Demand for accommodation will be less significant during other construction activities, in particular clearing, when most of the workforce is expected to be hired locally. As shown in **Table 9.7-2**, the maximum number of workers from outside the study area who will require accommodation would average 24 people and peak at 98 people for short periods of time.

BC Hydro encourages the use of local facilities to accommodate workers. Construction camps are only provided if local accommodation is insufficient or not conveniently located. It is not anticipated that construction camps will be required to accommodate workforces for this Project. Terrace currently has more than 400 rooms (of at least double occupancy) available in hotels and motels and there are at least another 250 rooms available in Kitimat. One hotel is under construction in Terrace and two others are in advanced planning stages. At least an additional 100 hotel rooms are expected to be available in Terrace when the Project starts construction in 2017. In addition, apartments and houses are also available for rent in both communities (e.g. 17 vacant apartments in Terrace).

Given the limited number of workers who will require accommodation, increased demand is not expected to result in considerable strain on existing vacancy and availability of short-term accommodation in the study area. The arrival of an average of 24 workers will create a minor increase in the demand for temporary accommodation that is within the existing capacity of local businesses. At peak periods, there could be a maximum of 98 people requiring accommodation. This is still within the capacity of local accommodations, although some pressure on local accommodation would result if the need coincides with peak tourist season.

Contractors will be responsible for finding accommodations for their non-local employees, which will entail reserving in advance blocks of hotel/motel rooms and potentially apartments/rental houses according to work schedules.

9.7.1.1.3 Traffic and Transportation

The Project will use main highways and secondary roads for the transport of equipment, materials and workers to and from the Project construction sites, which could increase road traffic and the risk of motor vehicle accidents.

Road access to the Project corridor is possible via Highway 37 and Beam Station Road south of Terrace and a network of existing FSRs extending from these main roads. In addition, new temporary and permanent access roads will be built to access and service the proposed transmission line. The existing main access roads to the Project include:

- Highway 37 (from Highway 16 to Kitimat), which connects Terrace to Kitimat and runs parallel to the Project corridor;
- Beam Station Road;
- Thunderbird FSR;
- Wedeene FSR; and
- Lakelse FSR.

Access to the north portion of the Project will be through the Bean Station Road and the Thunderbird FSR. The middle and south portions will be accessed through Highway 37, connecting to the Wedeene FSR and to Lakelse FSR to the north or continuing along Wedeene FSR to the south. It is expected that Project-related traffic volume would vary at different points along the corridor as construction progresses. Most of the daily traffic would be on temporary access roads adjacent to the ROW, while peak traffic volumes on main access roads are expected to be in the morning at the beginning of the work day and in the evening at the end of the work day.

Highway 37 is the main access route from Kitimat to Terrace. The highway is hard-surfaced and its conditions vary depending on the weather and season. Maintenance works are undertaken throughout the year by the BC Ministry of Transport and Infrastructure, including sanding and snow ploughing during the winter.

According to BC Ministry of Transport and Infrastructure, the latest AADT volume on Highway 37 was 6,391 vehicles per day at Terrace Junction (i.e. 0.3 km south of Highway 16 in Terrace) and 2,180 at the Kitimat River Bridge (34 km south of Highway 16, approximately 6 km south of the Wedeene FSR junction). In general, traffic at these counters has increased compared with 2011 levels, although historical information shows that traffic at these locations remains at similar or lower levels than in 1995. Specifically, the traffic counter at Kitimat River Bridge measured 2,461 vehicles per day in 1995 compared with 2,180 in 2014 (BC Ministry of Transportation and Infrastructure, no date).

During the construction phase, there would be a temporary increase in highway and secondary road traffic delivering materials and personnel to and from the construction sites along the Project corridor. Transportation will be a combination of light trucks for personnel and heavy trucks for equipment, materials and transmission line structures.

Traffic volume on Highway 37 is anticipated to remain within baseline traffic levels experienced in the past 20 years, although at peak times some Project-related traffic delays may be experienced along Highway 37 and Beam Station Road. The total AADT on Highway 37 is below its design capabilities and the highway would not require any upgrades or increased maintenance to accommodate the additional Project-related traffic. In addition, the incremental traffic is not anticipated to represent a noticeable increased risk to other users of this highway.

Traffic on FSRs will also temporarily increase during the construction phase, but it is expected to be within baseline levels experienced when active logging took place. BC Hydro will obtain appropriate Road Use Permits for industrial use of FSRs and will meet road safety restrictions (e.g. maximum vehicle weight) and ongoing maintenance obligations stipulated in the permit. In anticipation of heavy truck traffic, the FSRs will be surveyed prior to construction and upgrades will be provided as necessary. The Project will upgrade approximately 44.1 km of existing access and will construct approximately 23.8 km of new temporary and permanent access roads (**Table 2.4-2**). Roads will be maintained as required to provide safe road conditions.

BC Hydro will develop a CEMP, outlining BMPs for traffic management and vehicle and equipment management and servicing to ensure the safe movement of traffic. In addition, pursuant to the CEMP, contractors will develop site-specific EPPs giving consideration to the safe movement of all Project traffic to and from the Project construction sites. These site-specific plans will be reviewed and approved by BC Hydro prior to commencement of construction activities. Contractors will be required to implement BMPs for traffic management and comply with road safety restrictions, including adhering to posted speed limits, adjusting speed in accordance with weather and road conditions and radio calling procedures on all vehicles using FSRs and access roads. To minimize Project-related traffic, contractors will be encouraged to use crew cabs.

To minimize the risk of accidents and risk to public safety, appropriate traffic control measures and signage would be implemented according to WorkSafeBC's Operational Health and Safety Regulation and BC Hydro Safety Management Policies. The CEMP will also consider plans for incident management (e.g. spill contingency plan, spill response plan, environmental incident reporting) to provide guidance when an incident occurs. This could include any vehicle malfunction, spill, or event that impedes the normal flow of traffic and threatens the safety of the driver, other road users, or the environment.

BC Hydro will require that all employees and contractors read and follow the CEMP at all times. Environmental monitors will ensure compliance with the CEMP and approved EPPs.

9.7.1.1.4 Railway

The proposed Project route crosses the CN Rail branch line between Terrace and Kitimat at four locations. BC Hydro will obtain the necessary Rail Crossing Agreement with CN Rail for construction and maintenance of the transmission line and ROW pursuant to section 377 of the *Railway Act*. BC Hydro would construct and maintain the crossing such that it would comply with the Crossing Agreement; as such, no potential effects are predicted to the existing railway and therefore are not considered further in the assessment.

9.7.1.1.5 Emergency, Health and Policing Services

Potential Project effects on emergency, health and policing services will be driven by changes in population as well as changes in public safety. Specifically, potential Project effects will be associated with:

- Changes in population – the presence of a temporary, non-local workforce may place strain on emergency departments if non-local workers need access to medical services during their stay in the local communities and choose to visit the emergency room. There could also be an increase in demand for policing services if the temporary workforce engages in socially disrupting activities or there is an increase in crime in the local communities.
- Changes in traffic on local roads could result in higher demands for emergency and policing services if accidents occur; and
- Potential accidents at the construction sites could increase demands for emergency services.

There will be a limited increase in the demand for regional services associated with non-resident workers arriving to the study area. As discussed earlier, the maximum potential increase in population during Project construction would average 24 people and peak at 98 people for short periods. This temporary increase to the population base in the study area is not expected to result in a noticeable increase in demand for emergency, health and policing services. At peak, this temporary population increase would represent 0.4% of the existing population in the study area and is well within the anticipated population growth rates for the area, which are used for service planning and budgeting. Both the Mill Memorial Hospital in Terrace and the Kitimat General Hospital and Health Centre emergency departments have the capacity to accommodate small temporary increases in demands for health services (Northern Health, pers. comm., 2015). In addition, BC Hydro will implement policies and guidelines to promote a respectful and safe workplace, including a no harassment policy and providing First Nations/cultural awareness training as required, as well as implement a zero tolerance policy with respect to drug and alcohol at the Project sites for employees and contractors.

Increased Project-related traffic volumes could increase the risk of traffic accidents. If accidents occur, RCMP and emergency services would be required to respond in a coordinated effort. However, given the traffic control procedures and mitigation described in **Section 9.7.1.1.3**, Traffic and Transportation, the risk for Project-related traffic accidents would be minimized. The type of adverse event that would require a coordinated effort is not expected to occur.

In addition, in accordance with BC Occupational Health and Safety guidelines, an emergency medical team and medical transport vehicle will be located at or near the work site to provide medical services to the construction crew and to transport injured or ill workers requiring additional medical attention to the nearest medical facility for assessment and treatment.

9.7.1.1.6 Operation / Maintenance Phase

Operation/maintenance of the Project will be provided by existing BC Hydro's operation/ maintenance staff, who will perform routine inspection and maintenance, including vegetation maintenance and equipment repairs. Therefore, no additional employment is anticipated during the operation phase.

The ROW will be inspected annually and maintained as necessary. Operation activities will be limited and will result in negligible adverse effects on traffic and on emergency, health and policing services, which will be undetectable from baseline conditions. No effects are anticipated on employment and procurement or availability of temporary accommodation.

9.7.1.2 Closure Phase

At closure the transmission line will be removed and the ROW restored to resemble its original condition. Typical activities include removing structures, aggregate from roads and crane pads; breaking up concrete foundations; re-contouring the ground surface; and revegetating.

During this phase, the Project is anticipated to generate socio-economic effects similar to those identified for the clearing/construction phase, although at a smaller scale. Closure activities would create employment and procurement opportunities for local residents and businesses and increase demand for availability of temporary accommodation if workers from outside the study area are employed. There could also be a Project-related potential increase in vehicular traffic and a potential increase in demand for health, emergency and protective services.

Given that no specific information for the closure phase is available at this definition stage and that current socio-economic conditions could change by the time closure occurs (i.e. more than 40 years in the future), specific socio-economic effects for the closure phase are not quantified. Effects during closure are anticipated to be similar but of a smaller magnitude, than the effects discussed in **Section 9.7.1**.

9.7.1.3 Post-closure Phase

No socio-economic effects are anticipated during the post-closure phase because there will be no associated workforce requirements that would increase the population or demand on local services and infrastructure.

Table 9.7-3 presents a summary of potential socio-economic effects and relevant mitigation.

Table 9.7-3: Summary of Potential Socio-Economic Effects and Mitigation or Enhancement

Potential Effects	Valued Component	Mitigation or Enhancement Measures	Likelihood of Mitigation Success
Increased employment and procurement opportunities for local residents and businesses	Employment and Procurement Opportunities	• Provide opportunities to qualified contractors and service companies from the study area whenever practicable • Encourage contractors to hire local residents and First Nations members to the extent practicable • Make best efforts to increase the participation of First Nations businesses in providing goods and services to the Project in	N/A – positive effect

Potential Effects	Valued Component	Mitigation or Enhancement Measures	Likelihood of Mitigation Success
		accordance with BC Hydro's First Nations Contract and Procurement Policy	
Temporary increase in the demand for availability of temporary accommodation	Temporary Accommodation	• Encourage contactors to make reservations for temporary accommodation in advance whenever practicable • Encourage contractors to hire local residents and First Nations members to the extent practicable	Moderate
Additional vehicle traffic, increased potential for motor vehicle accidents and increased road wear and maintenance	Traffic and Transportation	• Use of crew cabs by contractors to reduce traffic volume wherever practicable • Require adherence of Project-related traffic to terms and conditions of Road Use Permits and CEMP • Require contractors to develop and implement EPPs, considering traffic safety management • Make upgrades, as appropriate and required for the Project, to existing access roads to enhance transportation safety • Implement appropriate traffic control measures and signage according to WorkSafeBC's Operational Health and Safety Regulation and BC Hydro Safety Management Policies • Combine use of rail and trucks whenever practicable to transport transmission line structures	High
Increased stress on emergency, health and policing services due to temporary non-local workforce	Emergency, Health and Policing Services	• Encourage contractors to hire qualified local residents and First Nations members to the extent practicable • Require an emergency medical team and medical transport vehicle to be made available at the work sites • Implement or require no tolerance policy for improper behaviour of workers on and off the work sites	High
Increased stress on emergency, health and policing services due to potential increase for motor vehicle accidents	Emergency, Health and Policing Services	• Use of crew cabs by contractors to reduce traffic volume wherever practicable • Require adherence of Project-related traffic to terms and conditions of Road Use Permits and CEMP	High

Potential Effects	Valued Component	Mitigation or Enhancement Measures	Likelihood of Mitigation Success
		• Require contractors to develop and implement EPPs, considering traffic safety management • Make upgrades, as appropriate and required for the Project, to existing access roads to enhance transportation safety • Implement appropriate traffic control measures and signage according to WorkSafeBC's Operational Health and Safety Regulation and BC Hydro Safety Management Policies • Combine use of rail and trucks whenever practicable to transport transmission line structures	
Increased stress on emergency, health and policing services due to potential accidents at the work sites	Emergency, Health and Policing Services	• Require an emergency medical team and medical transport vehicle to be made available at the work sites • Implement applicable BC Hydro Safety Management Policies	High

Notes: BMP = best management practice; EMP = Environmental Management Plan; EPP = Environmental Protection Plan; FSR = forest service road; N/A = not applicable; ROW = right-of-way.

9.7.2 Residual Effects

Potential effects and their related mitigations were evaluated to determine if the Project has the potential for any residual effects to socio-economic conditions in the study area (**Table 9.7-4**). As described above, given the capacity of the local communities to accommodate Project demands and the implementation of mitigation measures, the likelihood of occurrence of residual effects and their magnitude are reduced. Residual effects that remain after mitigation for each of the socio-economic VCs are described below using criteria described in **Section 3.3**.

9.7.2.1 Employment and Procurement Opportunities

Residual Project effects on employment and procurement will be positive but relatively small. While the Project would employ between 2% and 6% of the study area construction labour force, direct Project employment would only represent a small proportion of the existing labour force in the study area (approximately 0.4% at peak construction).

Residual effects are considered positive, low in magnitude, regional since employment will extend beyond the local area, short-term, continuous and reversible. These effects are not anticipated to require further planning.

9.7.2.2 Availability of Temporary Accommodation

In general, it is anticipated that there is sufficient temporary accommodation capacity to serve Project demand. However, at peak periods there could be some increased pressure on local accommodation if demand coincides with other demands such as from summer visitors or other Projects. This residual effect is considered adverse, but low in magnitude, short-term, local, reversible and intermittent (since increased pressure would only occur during peak periods). Therefore, this residual effect is not anticipated to require further planning. In addition, there will be positive residual effects for local accommodation businesses who will benefit from additional demand for their services.

9.7.2.3 Traffic and Transportation

Following mitigation, there will be a residual effect on local transportation related to increased vehicle volume on Highway 37, Beam Station Road and FSRs during the construction phase of the Project. The residual effect would be low in magnitude, as the traffic patterns would be similar to those caused by past logging activities in the Project area. The effect would be local in extent (i.e. the largest increase in volume would be at access points), short-term and reversible. The frequency of the effect would be intermittent as it occurs during peak periods. Because of these ratings, the residual effect is not anticipated to require further planning.

9.7.2.4 Emergency, Health and Policing Services

A slightly increased demand for emergency, policing and health services is anticipated if accidents occur or if non-local workforce uses local services or engages in socially disruptive activities. These effects are expected to be minimized by the implementation of mitigation measures and transportation management plans. Residual Project effects on emergency, health and policing services are characterized as low in magnitude, regional in extent (regional medical services could be needed if accidents occur), short term, intermittent and reversible. They are therefore not anticipated to require further planning.

Table 9.7-4: Identification of Potential Residual Effects

Potential Effect	Valued Component	Residual Effect (yes/no)	Rationale
Increased employment and procurement opportunities for local residents and businesses	Employment and Procurement	Yes	The Project will create a small positive effect on employment and procurement opportunities in the local communities
Temporary increase in the demand for temporary accommodation	Temporary Accommodation	Yes	At peak period, there could be some increased pressure on local accommodation if demand coincides with other demands from summer visitors or other projects.
Increased vehicle volume and increased delays on Highway 37, Beam Station Road and FSRs	Traffic and Transportation	Yes	It is anticipated that mitigation measures will limit the potential Project effects. However, some temporary traffic delays may be experienced at peak times in some local roads and FSRs.
Increased potential for motor vehicle accidents	Traffic and Transportation Emergency, Health and Policing Services	No	Risk of motor vehicle accidents will remain within normal range for Highway 37 and FSRs. Mitigation measures are expected to be highly effective; no residual effects are anticipated.

Potential Effect	Valued Component	Residual Effect (yes/no)	Rationale
Increased road wear and maintenance	Traffic and Transportation	No	Road wear will remain within normal range for Highway 37 and local roads. BC Hydro will provide ongoing maintenance to access roads and FSRs as per permits conditions; no residual effects are anticipated.
Increased stress on emergency, health and policing services due to temporary non-local workforce	Emergency, Health and Policing Services	Yes	There will be a limited increase in the demand for regional services associated with non-resident workers arriving to the study area that is within the capacity of local services.
Increased stress on emergency, health and policing services due to a potential increase on traffic-related accidents and accidents at work sites.	Emergency, Health and Policing Services	No	Risk of motor vehicle accidents will remain within normal range for Highway 37 and FSRs. Traffic control procedures and mitigation measures and safety policies will minimize the risk for Project-related accidents.

Notes: FSR = forest service road.

9.7.3 Characterization of Residual Effects

Table 9.7-5 presents a summary of the characterization of residual effects.

Table 9.7-5: Characterization of Residual Effects on Socio-economic Conditions

Valued Component	Direction	Context	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
Employment and Procurement Opportunities	Positive	Low	Low	Regional	Short term	Continuous	Reversible
Temporary Accommodation	Positive and Adverse	Low	Low	Local	Short term	Intermittent	Reversible
Transportation and Traffic	Adverse	Low	Low	Local	Short term	Intermittent	Reversible
Emergency Health and Policing Services	Adverse	Low	Low	Regional	Short term	Intermittent	Reversible

10 CONTAMINANTS

10.1 Introduction

The objective of this section is to describe the potential for the Project to cause or to be potentially affected by contaminated environmental media. The construction and maintenance of a transmission line involve several activities that have the potential either to encounter existing contaminated environmental media or to cause contamination. Contaminated media have the potential to affect various other VCs either directly or through altered habitat. This section considers what these effects might be and describes conceptual mitigation measures.

10.2 Regulatory Setting

In the Province of British Columbia, environmental contamination is governed by the *Environmental Management Act* and enabling regulations. The Contaminated Sites Regulation (CSR) is the primary regulation applicable to the investigation, remediation and management of contaminated sites. Under the CSR, numerical standards are provided for soil, soil vapour, sediment, surface water and groundwater that apply to an individual site taking into consideration site-specific factors including land use, resource use and human and ecological receptors. The CSR standards are risk-based and are considered to be protective of human health and the environment. The CSR also contains environmental quality standards that govern the translocation of potentially contaminated soils from one property to another. These relocation standards restrict the translocation of soils taking into consideration whether a receiving property is classified as agricultural or non-agricultural land.

The principal regulations applicable to the release of substances to the environment, and thus that would govern any Project-related activities during the clearing/construction, operation/ maintenance, and closure phases include the Spill Reporting Regulation, Waste Discharge Regulation and Hazardous Waste Regulation. Together, these three regulations establish the requirements for reporting, preventing, or managing the effects of a release of a hazardous substance or environmental contaminant that may occur during construction and maintenance activities.

10.3 Issues Scoping

Issues scoping for contaminants and contaminated sites issues was completed by reviewing the following information:

- Provincial legislation and regulations that may apply;
- Readily available mapping products and aerial imagery;
- Initial desktop review (AMEC, 2014);
- In-house information regarding conditions at existing BC Hydro substations along the provisional route; and
- Project scope documents for TKTP.

Based on review of the above documents, it was determined that contamination may be relevant to the Project under two scenarios: (1) contamination can be pre-existing, in which case the Project has the potential to encounter contamination; and (2) contamination can also result from releases during execution of the Project, either as spillages of hazardous substances or from waste management activities (e.g. surplus soils disposal or excavation water management).

These two scenarios provide the context for the following discussion.

10.4 Valued Component Selection

VCs for contaminated sites include environmental media with the potential for the media itself to be contaminated or to function as an intermediary having potential effects on other VCs. The VCs assessed below consist of environmental media that biologically support other organisms (flora, fauna and humans) that constitute VCs addressed elsewhere in this report. For TKTP, these media/VCs comprise:

- Soil;
- Groundwater; and
- Surface water.

Wherever construction will occur, some soil disturbance and excavation within the physical footprint of the works is anticipated. If contaminated soil is excavated and relocated, it has the potential to contaminate additional locations. If previously buried contamination is exposed or discharged, the exposure pathways for potential receptors could be altered to potentially be affected by the contaminated media.

There is the potential that groundwater will be encountered during excavation for construction, requiring its removal and management. Any contamination present in the groundwater could thus be introduced to the surface and affect surface soils or surface waters.

Surface water is an environmental medium susceptible to contamination during construction and maintenance activities. It is expected that physical works will be designed and constructed to avoid the disturbance of surface waterbodies or incorporate mitigation measures to avoid or minimize effects.

Soil vapour can represent a risk to humans when it accumulates in enclosed spaces. It is understood that no enclosed spaces will be constructed or modified by the Project. Most of the area within the LSA are defined as wildlands for the application of the CSR. The MOE has not established soil vapour guidelines applicable to wildlands or ecological receptors. Consequently, soil vapour was not an environmental medium considered to be a VC.

Sediment is regulated by the CSR. While it is expected that Project activities will avoid watercourses where practicable, some parts of the Project (transmission line or access roads) will have to cross some streams, so Project activities will occur in proximity to watercourses and may therefore potentially affect stream sediments. This could occur directly through introduction of a substance to a watercourse or indirectly through erosion and overland transport of a substance to a watercourse. Sediment as a receptor is considered a VC for the Project.

10.5 Spatial Boundaries

The contaminants LSA is defined by the engineering boundary. The potential for the presence of contaminated environmental media exists within the LSA at locations of anthropogenic activity. Naturally occurring conditions that may be technically defined as contamination were excluded from the discussion as these were considered to be baseline conditions. Contaminated soil and groundwater, if present, will only be directly encountered at the locations of clearing/construction, including those for structure and access road construction. However, significant groundwater contamination may migrate and be intercepted by construction where the actual construction sites are situated sufficiently near to be within the zone of migration. Similarly, contaminated soil located away from the construction area has the potential to cause groundwater contamination, which then may migrate to a Project construction location. As such, the spatial boundaries were defined as the extent of the provisional route and the areas to be cleared for construction and access, with consideration given to the lateral offset from the provisional route where contaminant migration to the Project is possible. This total area is contained within the LSA.

10.6 Contaminated Sites

10.6.1 Methods

No field studies were conducted as part of this assessment, as the level of effort that would be required to obtain useful information was not considered practicable, and because the desktop review was deemed adequate. A desktop review of current and historical information contained in the resources identified in Section 10.3 was used to determine likely existing conditions. Sources accessed and reviewed include:

- Publicly accessible commercial electronic mapping products (e.g. Google Earth);
- Electronic mapping tools created by the province (iMap) including access to numerous provincially maintained databases;
- Mineral Exploration Reports (Ministry of Energy and Mines "Minfile" database);
- BC MOE Site Registry of registered contaminated sites;
- National Topographic System mapping of Project area;
- Amec Foster Wheeler and BC Hydro reports and resources from previous work in the Project area for the SKA and MIN substations;
- Reports provided by BC Hydro generated during route selection for the existing transmission line;
- Historical aerial photography; and
- Interviews and discussions with field staff who conducted other VC field surveys of the LSA.

10.6.2 Existing Condition

Table 10.6-1 shows a summary of the conditions that represent potential existing contamination.

The majority of the proposed Project footprint will be on currently undeveloped natural resource lands. The Kitimat Valley has been extensively logged since at least the 1970s and mining exploration has been conducted in the area. Several access roads and clearings are visible within and near the Project footprint. It is assumed that temporary logging camps, including equipment servicing, and fuel depots, have existed temporarily near and potentially within the Project area. There is the potential for localized effects resulting from operation of such camps, including distributed disposal of wastes. There is also a potential for localized effects from the use of fuels to ignite slash piles. Such conditions may exist at the locations of provisional structures and access roads.

Table 10.6-1: Summary of Findings

Structure	Finding	Information Source(s)
1	SKA substation – Potential for historical release of insulating oils, imported fill of unknown origin	Aerial photography, mapping products, Amec Foster Wheeler and BC Hydro resources.
1, 2, 3, 4 21, 69, 116	Railroad – Potential for soil and groundwater effects due to operation/maintenance of railway, imported fill of unknown origin for rail and ballast, leaching of wood preservative from railway ties.	Mapping resources
174–178	Historical industrial landfill associated with Eurocan pulp and paper mill facility	Amec Foster Wheeler and BC Hydro resources, BC MOE Site Registry
182	MIN substation – Potential for historical release of insulating oils, imported fill of unknown origin	Aerial photography, mapping products, Amec Foster Wheeler and BC Hydro resources
~120-182	Industrial air emissions from historical Kitimat-area smelting operations	Mapping products, internal resources

Notes: BC MOE = British Columbia Ministry of Environment, MIN = Minette, SKA = Skeena

One provisional structure (structure 1) is located within the current boundary of the SKA substation at the northern terminus of the Project. There is a potential that contaminated soil is present within the substation, either imported during construction or resulting from leakage of oil from electrical equipment during operation of the substation. The provisional structure location is over 50 m from the nearest piece of major oil-filled electrical equipment and no records of major releases of insulating oil are on record for the substation. As a result, the likelihood of releases of insulating oil-affecting soils at the provisional tower location is low. The possibility that contaminated fill was imported to the substation during development remains but is also low.

A railroad crosses or parallels the provisional route alignment at several locations, near provisional structures 1, 2, 3, 4, 21, 69 and 116. Treated wood railway ties, ballast materials, and incidental releases of fuels and lubricants from routine rail operations can affect soils within railroad corridors. However, these effects are typically very limited in their distance from the rail centre line. It is expected that no structures will be constructed sufficiently near to the railroad for the railroad to constitute a source of contamination at Project locations.

A historical industrial landfill is located adjacent to and west of the Eurocan pulp and paper mill facility in Kitimat, approximately 400 m north of the MIN substation. Also, the mill is identified as a contaminated site with documented off-site migration of contamination in the BC MOE Site Registry. This landfill is near provisional structures 174 through 178. The construction and containment of this landfill and the nature of the site contamination and migration are not known.

Five of the provisional structures would be located within approximately 200 m of the boundary of the landfill, and a portion of this landfill is within approximately 250 m of the proposed ROW centre line. Leachate from a landfill could affect groundwater and soil within that distance. However, the Project is located in an inferred upgradient direction from the landfill with respect to regional groundwater flow. As such, any leachate or other effects associated with this landfill are not expected to migrate towards the Project footprint.

The southern terminus of the transmission line (provisional structure 182) is the MIN substation. Previous projects undertaken at that substation have documented the presence of existing soil and groundwater contamination at that site. However, the scope of the Project does not include any works within or immediately adjacent to the substation. Further, the Project works will occur in the inferred upgradient groundwater direction from the MIN substation, such that any potential migration of existing contamination at the substation will be directed away from the Project.

Aluminum smelting, particularly that which occurred prior to present day emission control equipment, can release metal fumes and other airborne emissions. Aluminum smelting has been a major industrial activity in Kitimat since the development of the Rio Tinto Alcan plant in the 1950s. Deposition from airborne emissions from historical smelting operations may have resulted in a generalized effect to surficial soils in the vicinity of Kitimat, including at the locations of provisional structures within the industrialized portions of the Kitimat Valley. However, if any soils encountered by construction are thusly contaminated, these conditions will be local anthropogenic background conditions typical of surrounding lands.

10.7 Contaminants Effects Assessment

10.7.1 Potential Effects and Proposed Mitigation

All VCs for contaminants (i.e. soil, groundwater, surface water, and sediment) have the potential to be affected during the clearing/construction, operation/maintenance and closure phases of the Project. Potential effects can result from encountering pre-existing contaminated soil or groundwater during clearing/construction. Potential effects include:

- Translocation of contaminated soil during disposal (on-site or off-site) of excavated soil;
- Exposure of previously buried contaminated soil to potential biological receptors; and
- Distribution of contaminated soil over a larger area than that in which it currently occurs.

Other potential effects can result from clearing/construction activities themselves. Specifically, the release of substances such as fuels and lubricants from clearing/construction equipment can contaminate soil and groundwater. These residual effects could affect soil and potentially surface water, depending on the location and scale of the release and the nature of the response.

Project activities that could potentially affect the VCs include:

- Excavation for structure foundations and road grading;
- Clearing and grubbing ROW and access roads;
- Importing and placing soils for culvert installation, road surfacing and other structural needs;

- Dewatering foundation excavations;
- Construction equipment operation and servicing (primarily during construction and closure phases);
- Application of any coatings to structural steel or generation of metal or abrasive dusts during construction of structures; and
- Transmission line maintenance (operation/maintenance phase), including vegetation control, structure coating and repair and access road maintenance.

10.7.1.1 Mitigation

Considering the low likelihood and limited degree of anticipated effects, it is not considered practicable to assess actual soil and groundwater conditions in advance at provisional structure and access road locations. An appropriate degree of care can be achieved by implementing soil and groundwater management methods in the CEMP, including handling, storage, and disposal/discharge requirements. Similar measures can be specified in an EMP generated for closure activities to mitigate potential effects during that phase of the Project.

In the event that an existing contaminated site is encountered during construction, mitigation of that contamination will be limited to the construction footprint. The mitigation will be effected by the removal or management of soil and groundwater to the extent necessary and practicable, to allow construction and the proper management or off-site disposal of that material resulting in incidental remediation. In the event of such material being encountered at the location of a proposed access road cut, the design of that section of road could be altered to bypass or grade above the contaminated material, eliminating the need to excavate and manage soil.

Further to the recommended mitigation measures discussed in previous sections of the ESER, the following mitigation measures are proposed to prevent mobilization/migration of existing contamination:

- Develop and incorporate into the CEMP a component addressing contaminated material management procedures to be implemented during clearing/construction work. This component should provide procedures for testing, evaluation and management or remediation of potential contaminated media that may be encountered during clearing/construction, both pre-existing contamination and that incidental to clearing/construction. This component should be developed in accordance with the requirements and BC MOE guidance under the CSR.
- Develop and incorporate a spill prevention and emergency response plan into the CEMP.
- Construct the transmission line in accordance with BC Hydro's internal environmental policy and standards (including drainage management).
- Modify the existing spill contingency plans and site management plans as appropriate to include the transmission line ingress/egress for implementation by BC Hydro operation/maintenance personnel.

Mitigation measures are not expected to vary with work location throughout the Project area.

10.7.2 Residual Effects

All of the identified potential effects can be effectively addressed through implementation of the appropriate mitigation measures in the CEMP. Any release during construction is expected to be handled at the time of release under the spill response measures and BMPs in the CEMP. It is assumed that through the implementation of an appropriate CEMP, no residual effects will result from the Project.

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11 ARCHAEOLOGY AND HISTORICAL HERITAGE

11.1 Introduction

This report describes the findings of an archaeological and historical cultural heritage assessment and evaluates existing conditions for heritage resources that could be affected by the Project. This study was based on an archaeological impact assessment (AIA) of the TKTP provisional route, conducted in 2015 and 2016 in accordance with the conditions of Section 14 (Heritage Inspection) Permit 2015-0075. The AIA was informed by an environmental overview report (AMEC, 2014; **Appendix G-1**) that included a desktop review of archaeological resource concerns for various Project route options (i.e. an archaeological overview assessment (AOA)). The objective of the overview was to inform the selection of the provisional alignment by identifying key environmental considerations and constraints for the alternatives, including issues related to archaeology and heritage.

11.2 Regulatory Setting

Heritage sites in BC are protected by the BC *Heritage Conservation Act* (*HCA*), which is administered by the Archaeology Branch (BC MFLNRO). This protection applies to sites located on public or private lands and applies whether the sites are recorded in the Provincial Heritage Register or are undocumented/not yet discovered. Heritage sites are protected if they have been designated as “provincial heritage sites” by Ministerial Order in accordance with Section 9 of the *HCA* or through automatic protection under Section 13 by virtue of particular historical or archaeological values. Sites automatically protected in BC include:

- Archaeological sites occupied or used before AD 1846;
- First Nations rock art with historical or archaeological value;
- Burial places with historical or archaeological value;
- Heritage ship and aircraft wrecks; and
- Sites of unknown attribution, which could have been occupied prior to AD 1846.

Protected archaeological/heritage sites may not be altered or disturbed in any manner without a Permit issued under Sections 12 or 14 of the *HCA*.

11.3 Issues Scoping

To assist in the management of archaeological resources, the Province has issued the *British Columbia Archaeological Impact Assessment Guidelines* (Archaeology Branch, 1998). These Guidelines identify different classes of assessments that are undertaken in response to developments that could affect heritage resources. The appropriate type of assessment is contingent on the stage of development design and the types of information that are required. The information that is described in this report essentially presents the results of the AIA referenced above.

Based on the provincial Guidelines, the objectives of the AIA were to:

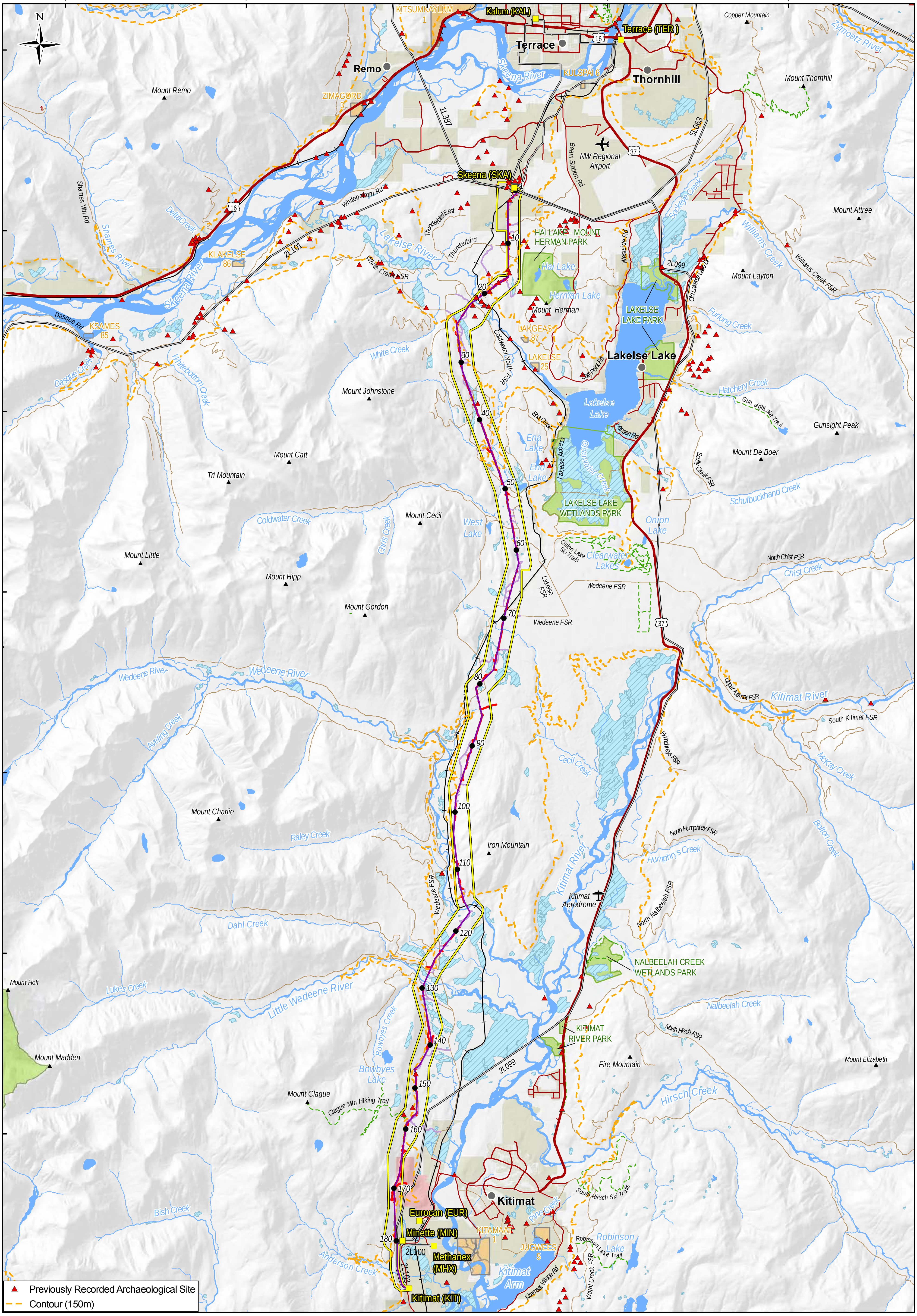
- Identify and evaluate the significance of archaeological and other heritage resources within the lands that will be affected by the Project;
- Assess potential effects to heritage sites that may result from the Project; and
- Recommend management actions to mitigate adverse Project effects (e.g. avoidance, minimize effects by data recovery).

11.4 Spatial Boundaries

To ensure that any archaeological sites or cultural heritage resources that could be affected by the Project, the study area for the AIA was defined by the transmission line ROW—a 42 m wide corridor off the centre line upon which provisional structure locations were placed—plus a 200 m wide buffer (100 m on either side of the centre line; 1,055.55 ha). The study area is larger than the expected Project footprint, defined for the clearing area—a 120 m wide, 632.81 ha corridor from which trees that may pose a risk to the transmission structures and conductors will be removed. Access roads outside the corridor defined above represent a special case; where such access roads were proposed for reconstruction or new construction, the typical footprint for the archaeological assessment was set at 20 m on either side of the route to ensure that any sites in these settings were captured by the field survey.

The LSA for the archaeological assessment effectively conforms to the unbuffered engineering boundary as plotted on the heritage resource map-set. Nearly all potential effects arising from TKTP will occur within the LSA, aside from work on new or reconstruction roads. As used here, the LSA covers an area of 4,569.72 ha.

A Regional Study Area was not defined for the TKTP archaeological study. Where reference to previously documented archaeological resources in a wider area than that covered by the LSA was needed, the area portrayed in the heritage resource overview map (**Figure 11.4-1**) was used.



Legend

- Populated Place
- Existing Substation
- Existing Transmission Line
- Highway
- Arterial
- Local Road
- Forest Service Road
- Railway
- Recreation Trail
- Watercourse
- Waterbody
- Wetland
- Park
- First Nation Reserve
- Private Parcel
- Sandhill Private Parcel

Project Components

- Proposed Structure
- Provisional Route
- New Permanent Road
- New Temporary Road
- Reconstruction Road
- Engineering Boundary

0 0.5 1 2 3
Kilometers
Scale: 1:155,000

Reference:
DataBC Data Distribution Service (http://www.data.gov.bc.ca/)
Archaeological Sites: MFLNRO, Archaeology Branch

CLIENT:
Prepared for BC Hydro

PROJECT:
Terrace to Kitimat Transmission Project (TKTP)

TITLE:
Previously Recorded Archaeological Sites

DATE:	ANALYST:	QA/QC:	
September, 2016	MY	RB	Figure 11.4-1

GIS FILE: 14-03-037_Fig1_Arch_Site_Overview_v4
JOB No: VE52379
COORDINATE SYSTEM: NAD 1983 UTM Zone 9N

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11.5 Valued Component Selection

The approach of selecting VCs is described in Sections **3.3.4** and **3.3.5**. Project-specific issues are generally indicative of local and regional values held by the public, First Nations and other stakeholders. Issues concordance tables that document issues and concerns raised during the preparation of this study are presented in **Appendix A** of this document.

Table 11.5-1 includes the rationale for identifying each candidate VC as a result of the issue scoping, including details on the interactions of Project components with Project activities.

The evaluation resulted in the following selected heritage resource VCs for the effects assessment (**Table 11.5-2**):

- Archaeological Sites;
- Cultural Heritage Sites; and
- Historical Heritage Sites.

Indicators are identified as required to further focus the analysis of interactions between the Project and the selected VC. Indicators are aspects of the VC used to understand, evaluate and/or quantify the potential effect on the VC. To be effective and useful, indicators should have the attributes from the Guideline for the Selection of Valued Components and Assessment of Potential Effects. The rationale for the indicators proposed for the selected VCs is shown in **Table 11.5-3**.

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Table 11.5-1: Candidate Valued Component Rationale

Valued Component Candidates	Interaction with Project Activities	First Nations(1)	The Public and Other Stakeholders(2)
Archaeological Sites	There are known archaeological sites in the Project region (AMEC, 2014) Archaeological sites have the potential to be affected by Project activities such as ROW clearing, land alteration and grading of ROW and access roads: clearing/construction phase	Haisla; Kitselas; Kitsumkalum; Lax Kw'alaams; Metlakatla	No comments noted to date
Historical Heritage Sites	There are known historical heritage sites in the Project region (AMEC, 2014) Historical heritage sites have the potential to be affected by Project activities such as ROW clearing, land alteration and grading of ROW and access roads: clearing/construction phase		No comments noted to date
Cultural Heritage Sites	There are known cultural heritage sites in the Project region (AMEC, 2014) Cultural heritage sites have the potential to be affected by Project activities such as ROW clearing, land alteration and grading of ROW and access roads: clearing/construction phase	Haisla; Kitselas; Kitsumkalum; Lax Kw'alaams; Metlakatla	No comments noted to date

Notes: (1) First Nations concerns are from comments received during consultation.
(2) "The Public and Other Stakeholders" comments do not include comments specific to study design, methods proposed for sampling.
ROW = right-of-way

Table 11.5-2: Evaluation of Candidate Valued Components

Subject Area	Candidate VC	Attributes					Evaluation Key Questions				
		Relevant(1)	Comprehensive(2)	Representative(3)	Responsive(4)	Concise(5)	Measurable(6)	Grouping(7)	Ultimate Receptor(8)	Component of Concern(9)	Selected VC (Included or Excluded)
Heritage	Archaeological Sites	Y	Y - VC needed to have full understanding of the heritage resource subject area	Y - VC is illustrative of the human environments that may be affected by the Project	Y - VC is responsive to potential Project effects	Y - Clear interaction with Project activities and/or Project component	Y - VC has measureable parameters	N - The potential effects of the candidate VC cannot be effectively represented by another VC	Y - VC is an end point in the effects pathway	Y - VC is raised as a concern though the issues scoping process	Y - Archaeological Sites is a selected VC. Included
	Historical Sites	Y	Y - VC needed to have full understanding of the heritage resource subject area	Y - VC is illustrative of the human environments that may be affected by the Project	Y - VC is responsive to potential Project effects	Y - Clear interaction with Project activities and/or Project component	Y - VC has measureable parameters	N - The potential effects of the candidate VC cannot be effectively represented by another VC	Y - VC is an end point in the effects pathway	Y - VC is raised as a concern though the issues scoping process	Y - Historical Sites is a selected VC. Included
	Cultural Heritage Sites	Y	Y - VC needed to have full understanding of the heritage resource subject area	Y - VC is illustrative of the human environments that may be affected by the Project	Y - VC is responsive to potential Project effects	Y - Clear interaction with Project activities and/or Project component	Y - VC has measureable parameters	N - The potential effects of the candidate VC cannot be effectively represented by another VC	Y - VC is an end point in the effects pathway	Y - VC is raised as a concern though the issues scoping process	Y - Cultural Heritage Resources is a selected VC. Included

Notes: (1) Relevant because heritage concerns are clearly linked to the values reflected in the issues raised in respect to the Project.
(2) Comprehensive: Taken together, the VCs selected for an assessment should enable a full understanding of the important potential effects of the Project.
(3) Representative of the important features of the natural and human environment likely to be affected by the Project.
(4) Responsive to the potential effects of the Project.
(5) Concise, so the nature of the Project-VC interaction and the resulting effect pathway can be clearly articulated and understood, and overlapping or redundant analysis is avoided.
(6) Measurable: The potential effects of the Project on the VC can be measured and monitored.
(7) Grouping: The potential effects of the candidate VC cannot be effectively represented by another VC.
(8) Ultimate Receptor: The ultimate receptors are humans.
(9) Component of Concern: includes issues and/or legislation raised by First Nations or by federal or provincial governments.
VC = Valued Component; Y = Yes; N = No

Table 11.5-3: Selected Valued Components and Rationale of Indicators and/or Factors

Subject Area	Valued Components	Indicators and/or Factors for Assessment	Rationale of Indicator and/or Factor[1]
Heritage	Archaeological Sites	• Cultural depressions • Ancestral remains • Culturally modified trees • Subsistence features • Artifact scatters	These parameters are chosen because they are observable and measurable and they capture potential effects of the Project on Archaeological Sites.
	Historical Heritage Sites	• Landmarks • Buildings • Industrial sites • Trails	These parameters are chosen because they are observable and measureable and they capture potential effects of the Project on Historical Heritage Sites.
	Cultural Heritage Sites	• Spirited places • Traditional place names • Ancestral burial places; remains • Culturally modified trees • Subsistence features • Traditional trails	These parameters are chosen because they are observable and measureable and they capture potential effects of the Project on Cultural Heritage Sites.

Notes: (1) Included indicators follow these attributes: Relevant: indicators must relate directly or indirectly to the integrity of the selected VC; Practical: there must be a practical way to evaluate the indicator using existing or achievable data, predictive models or the means; Measurable**:** the measurement of the selected indicator must generate useful data that inform our understanding of the potential effect on the VC; Responsive to the potential effects of the Project; Predictable in terms of their response to the Project.

11.6 Archaeology Studies

11.6.1 Methods

11.6.1.1 Desktop Overview

A desktop heritage resource overview was conducted in 2014 to gather general information on the occurrence of archaeological sites in the Project area. Details regarding the findings of this study are available in AMEC (2014). The heritage component of this study conformed to an Archaeological Overview Assessment (AOA) as defined in the provincial guidelines (Archaeology Branch, 1998).

The principal objective of the AOA was to assist in the selection of a provisional route for the Project by providing information on the potential effect on heritage resources of alternatives.

Preliminary background research included a search for published and unpublished ethnographic and archaeological literature for the North Coast region generally and the Kitimat–Terrace area specifically. Documents on file in the AMEC office library and information acquired from the provincial Archaeology Branch and BC Hydro were reviewed. This review sought general information on pre-Contact and historical, traditional land use practices by First Nations peoples in the LSA, as well as the findings of previous archaeological studies in the Project area and surrounding region.

Geo-referenced location data, site inventory data and archaeological site boundary shapefiles were obtained from the BC Provincial Heritage Register via the Remote Access to Archaeological Data (RAAD) web-based application. The Archaeology Branch (Archaeological Site Inventory Section) supplied a GIS-based archaeological resource potential model developed for the Kalum Forest District.

11.6.1.2 Archaeological Impact Assessment

The AIA involved the following tasks:

- Review the findings of the 2014 desktop environmental overview;
- Review of VRI to identify old growth forest stands that could contain pre-1846 culturally modified tree (CMT) sites;
- Analysis of archaeological resource data gaps, in terms of the extent of archaeological survey coverage within the LSA;
- Acquisition of a Heritage Inspection Permit for the study, issued by the Archaeology Branch after appropriate consultation with First Nations communities;
- Communication with the First Nations communities with traditional interests in the Project area;
- Field surveys of the provisional TKTP route and minor route revisions based on a 100 m buffer on either side of the provisional centre line to identify and record archaeological resources;

- Updates to existing site records and preparation of new site inventory forms for entry into the Provincial Heritage Register; and
- Preparation of an AIA permit report in fulfillment of Permit conditions.

11.6.1.2.1 Pre-field Preparations and Research

The background research for the AIA built upon and updated that conducted for the environmental overview report (AMEC, 2014) and consisted of limited in-office review of historical, ethnological and archaeological documents relevant to the Kitimat and Skeena River Valleys. This aspect of the research sought site-specific details about pre-Contact (i.e. prior to European contact with Aboriginal peoples) archaeology, traditional First Nations occupation, and land use and the historical settlement of the area. The review of archaeological reports describing past research focused on those studies that actually took place within the Terrace–Kitimat area.

Geo-referenced location data, site inventory data and archaeological site boundary shapefiles for sites that had been recorded since the environmental overview report was completed were obtained via RAAD. RAAD was also used to search for information about heritage sites in environmental settings comparable to the TKTP route to gain insight into the distribution and kinds of sites that might be present within the development area.

Topographic and relevant biophysical data were plotted on 1:20,000-scale TRIM-based maps that were used for the field survey. The boundaries of the LSA and TKTP ROW with provisional transmission structure locations were also shown on the field maps. Instead of digitized forest inventory coverage restricted to cedar-leading old growth stands, forest age-class data from the provincial VRI regardless of species composition was displayed.

11.6.1.2.2 Permitting

The application for a Section 14 (Heritage Inspection) Permit was submitted to the Archaeology Branch for review in January 2015. When its in-office technical review was completed, the Archaeology Branch forwarded the permit application to First Nations for a 30-day review of the proposed methodology. Heritage Inspection Permit 2015-0075 was issued to Matt Begg (Amec Foster Wheeler) in April 2015.

11.6.1.2.3 First Nations Involvement

As required by provincial regulation, the Archaeology Branch solicited comments about the Heritage Inspection Permit application from potentially affected First Nations, including Haisla, Kitselas, Kitsumkalum, Metlakatla and Lax Kw'alaams. Prior to the archaeological field studies conducted in the spring and summer of 2015, AMEC arranged for community participants from the five First Nations communities.

11.6.1.2.4 Archaeological Potential Assessment

Archaeological potential is defined as the capability of a landscape (or portion of a landscape) to have supported the kinds of traditional activities that would have resulted in the formation and preservation of archaeological remains. Some kinds of traditional activities (e.g. medicinal plant collection) usually do not result in the creation of physical remains, and such activities cannot be considered in an assessment of archaeological potential. The same constraint also applies to places of cultural significance (e.g. spirited places), but where an extensive body of traditional use/traditional knowledge data are available, these kinds of information can be used as landscape attributes to inform archaeological potential modelling.

The assessment of archaeological potential is based upon a consideration of the locations of documented sites, ethnographic and historical land use information and terrain characteristics that influence (favourably or negatively) the distribution of archaeological sites. Because archaeological site locations are often correlated with particular micro-environmental landscape attributes, the presence or absence of these variables can be used to identify lands with greater or lesser archaeological potential. The landscape attributes that were considered during the field surveys for this AIA included:

- Modern vegetation and/or forest cover;
- Observed or documented wildlife, fisheries and other traditional resource values (e.g. capability for ungulate production, presence/absence of salmon, edible plants);
- Proximity to aquatic features, both modern and ancient (e.g. rivers/streams and confluences, certain wetland classes);
- Presence of terrain features associated with ancient landscapes (e.g. glaciofluvial terraces, raised alluvial fans);
- Proximity to previously recorded archaeological sites;
- Slope (expressed as level, gentle, moderate, steep);
- Aspect (i.e. wind or solar exposure based on direction of slope);
- Documented archaeological resources in comparable environmental settings elsewhere;
- Soil drainage characteristics;
- Documented traditional land use patterns and cultural geography (e.g. crab-apple husbandry, berry-gathering sites, spirited places, place names, travel corridors); and
- Landscape integrity as a reflection of historical land use practices.

11.6.1.2.5 Field Methods

The AIA fieldwork involved a pedestrian survey to evaluate heritage resource potential along the ROW and to identify archaeological sites. As described in the preceding text, the assessment of archaeological potential was an iterative process by each field crew, based on direct observations of landscape characteristics and forest-stand characteristics (i.e. presence or absence of mature to old western redcedar trees).

The survey focused on proposed structure locations as well as lands within the clearing area (a 100 m wide buffer on either side of the transmission centre line), where the requirement for ground disturbance has the greatest risk of affecting archaeological or heritage sites. In all inspected locations, the surface was examined for cultural features (including storage pits, plank-house depressions, CMTs), artifacts and faunal remains and other evidence of past settlement and land use, including trails and historical features. In general, CMTs and cultural depressions were assumed to be the most visible kinds of heritage sites, which would be encountered in the LSA, based on the findings of the AOA. Other types of heritage resources that were sought within the LSA include surface and subsurface scatters of stone artifacts, rock-shelters, ancestral burial places, historical sites and traditional and historical trails.

The extent of surface survey coverage and intensity of subsurface testing varied according to the archaeological potential observed in-field. Evaluation of archaeological potential was based primarily upon VRI forest age-class data information and the topographic considerations listed in the preceding section. For lands evaluated as having moderate archaeological potential, survey transects were spaced at 15 m to 20 m intervals depending on surface visibility and forest age-class. Crew transects were spaced at 10 m to 15 m intervals in settings rated as having high archaeological potential, based on the presence of level elevated landforms, proximity to important aquatic features, or presence of forest stands mapped as VRI age-classes of 7 to 9 where CMTs were predicted to occur.

According to the procedures described in Heritage Inspection Permit 2015-0075, lands evaluated as having high potential for archaeological sites other than CMTs or historical resources were covered by a thorough inspection of subsurface exposures (e.g. tree throws, stream/river cut banks) and subsurface shovel testing. Where conducted, subsurface tests were excavated at intervals ranging from 2 m to 10 m, based on the area and configuration of the high potential landscape feature, extent of surface exposure (if any), soil drainage and compaction qualities and other considerations. Landscape attributes that limited the intensity and effectiveness of pedestrian survey and subsurface testing included the presence of steeply sloping rock outcrops or loose, unstable slopes; presence of standing and fallen trees; or occurrence of bedrock or compact sediments at or near the surface that inhibited subsurface testing.

In high-potential settings where no surficial evidence of archaeological remains (e.g. surface scatters of artifacts, tree-throws, cultural features) was observed, an in-field quantitative analysis was performed at each subsurface test location. This process included input data on the expected site type (site area and predicted artifact density based on comparable sites in the region) and test location parameters (including tested area, average individual test-pit size, and number of tests). Testing intervals were set according to a quantitative analysis approach that calculated a level of confidence that no archaeological sites are present. Based on this approach, a minimum of eight subsurface tests were excavated in areas of 100 m^2 or less. Each subsurface test was excavated through all sediments likely to contain cultural materials to definitive, non-archaeological sediments (e.g. glaciofluvial gravels or glaciomarine clays). Subsurface tests measured at least 40 cm x 40 cm. Excavated sediments from the tests were screened through 6 mm mesh or trowel-sorted (if wet), and all test pits were backfilled and the surface restored upon completion.

Ordinarily, survey traverses and subsurface testing were not done in locations rated as having low archaeological potential. However, nearly all of the route was traversed on foot by the crews, aside from segment re-routes that were proposed after the spring 2015-field surveys or where the route traversed extremely steep, broken terrain. Parts of such settings were often traversed by the crews proceeding from one high potential location to another, so at least minimal coverage was given to the aforementioned places, as shown by the survey-coverage displayed on the map-set. Regardless of potential rating, all lands covered by the field survey were examined for archaeological features (e.g. storage pits), artifacts and other evidence of past settlement and land use, including trails and CMTs.

11.6.1.2.6 Data Recording and Reporting

For this Project, AMEC implemented the use of digital field data collection. There are two primary goals of digital data collection: (1) improving consistency and accuracy of collected data by removing the subjective variability inherent in traditional pen-and-paper recording; and (2) reducing post-field reporting time, since the collected data are automatically produced in a tabular format. For TKTP, each archaeology crew-lead was issued an Apple iPad™ with the iForm™ application installed. This application runs on smartphones and tablets and collects data into customized fields designed prior to the fieldwork. In the field, the iPads™ and iForm™ were used to record notes and to capture Global Positioning System (GPS) coordinates, photographs and other data on observed archaeological sites, features and artifacts. At the end of each field-day, data on the iPads™ were synced with a secure online server, which provided the data backup and redundancy. At completion of fieldwork, data were downloaded from the server and automatically published in tabular form. After a quality review, these data were ready for access during the office-based reporting phase of the Project.

Observations about all heritage resources, regardless of regulatory protection status, were recorded during the AIA field survey. Archaeological observations were recorded in detailed field notes as the field survey progressed. Subsurface tests, CMTs, cultural heritage resources (i.e. non-protected, post-1846 features) and relevant terrain features were mapped on development plans and geo-spatial coordinates acquired using the GPS function of the devices described above. Recorded CMTs were marked with combined blue/white-striped and yellow "no-work zone" flagging labelled with the recording date, Amec Foster Wheeler contact information, temporary site identifier and individual CMT number. Field survey proceedings, contextual views of the landscape and CMT features were photographed with the iPad devices supplemented with digital cameras as necessary.

As specified in the *British Columbia Archaeological Site Inventory Form Guide* (Archaeology Branch, 2015), protected archaeological sites, whether newly discovered or re-visited previously documented sites, were recorded in a standardized Site Inventory Form. Site forms were not prepared for non-protected cultural heritage resources. The site forms and shapefiles showing newly identified CMT locations and site boundary revisions for re-visited sites were uploaded via the Heritage Resource Inventory Application to the Archaeology Branch (Site Inventory Section) for entry into the Provincial Heritage Register.

Lastly, as one of the conditions of Permit 2015-0075, a final permit report has been prepared in accordance with Archaeology Branch requirements. The permit report was submitted to the Archaeology Branch (Permitting & Assessment Section) and copies will be provided to First Nations communities.

11.6.2 Existing Conditions

11.6.2.1 Cultural Setting

11.6.2.1.1 First Nations Inhabitants of the TKTP Area

The TKTP provisional route passes through the asserted traditional territories of the following First Nations: Haisla, Kitselas, Metlakatla, Lax Kw'alaams and Kitsumkalum, the latter four of which are Tsimshian communities. Each of these five communities is understood to have traditional Aboriginal interests within the LSA. The southern Kitimat Valley lies within Haisla Nation traditional territory. A number of Tsimshian communities have traditional interests in the segment of the LSA that drains from Lakelse Lake into the Skeena River near Terrace. The identities and affiliations of the individual communities associated with these Nations are summarized in **Table 11.6-1**.

Table 11.6-1: Aboriginal Groups

Aboriginal Group	First Nation Community
Haisla Nation	Haisla Nation (Kitamaat Village)
Tsimshian Nation	Kitselas First Nation
	Kitsumkalum First Nation
	Lax Kw'alaams First Nation
	Metlakatla First Nation

The Haisla people of Kitamaat Village are speakers of the Wakashan language. Today, their main village is located on Kitimat Arm, at the head of Douglas Channel. The seasonal round of the Haisla was centered on winter residence in permanent villages, with seasonal movements by lineage groups to harvest specific food resources.

Traditional winter villages of Haisla and Tsimshian communities consisted of large post-and-beam houses covered by split-cedar planks. In spring, as seasonal food resources became available, the winter village inhabitants moved to eulachon fisheries on the Kitimat and Skeena Rivers, to nearshore fishing for herring and roe harvesting and to nearshore or offshore marine waters to hunt sea mammals. Summer and fall were spent salmon fishing, land mammal hunting, crab-apple and berry harvesting and processing these foods for winter storage or trading (Burton, 2015; Downs, 2006). Salmon fishing was the principal economic activity of the Haisla (Hamori-Torok, 1990; Olson, 1940; Pritchard, 1977).

Culturally, Haisla people are similar to Tsimshian-speaking communities inhabiting the Skeena River drainage, including the lower Bulkley River around Hazelton. Linguistically, the Haisla speak a language that is related to the Kwakiutl and Nuu-chah-nulth of Vancouver Island (Bouchard and Kennedy, 1990).

The Kitselas and Kitsumkalum people traditionally resided on the middle reach of the Skeena River, are Coast Tsimshian language speakers, and are closely related to the other Coast Tsimshian–speaking Lax Kw'alaams and Metlakatla communities residing downriver on the coast around Prince Rupert (Halpin and Sequin, 1990). Salmon was the principal food resource for the Skeena-dwelling groups, but marine diets of the Lax Kw'alaams and Metlakatla were more diverse and less salmon-dependent. Terrestrial game is more important to the Kitselas and Kitsumkalum than it is to the Haisla or the Lower Skeena communities. Although modern subsistence patterns now incorporate Euro-Canadian foods and agricultural projects, most of the protein in contemporary First Nation diets still comes from these traditional sources. Year-round villages were occupied along the Skeena River and in adjoining coastal localities. These villages consisted of large dwellings of post-and-beam construction covered with cedar planks (Halpin and Sequin, 1990).

Like their immediate neighbours, the Coast Tsimshian and Haisla maintain a system of hereditary house territories, governed by Hereditary Chiefs. Each Hereditary Chief is responsible for the maintenance of traditional law and governance within individual house territories. Feasts are used to acknowledge and validate the right of Hereditary Chiefs to govern, acknowledge hereditary name succession and settle disputes or breaches of traditional law (e.g. Gisday Wa and Delgam Uukw, 1992).

11.6.2.2 Archaeological and Heritage Resources

Archaeological sites are locations with material remains produced by human activities in the past. In BC, archaeological sites are usually attributed to First Nations settlement and land use in pre-Contact and later times, but places with physical evidence of more recent activities pre-dating World War 2 are often recorded as historical archaeological sites.

Archaeological sites are numbered according to the Borden Site Designation Scheme (Borden, 1952), which is used throughout Canada. This scheme is based on the National Topographic System of maps and uses latitude and longitude to generally pinpoint a site's location. The four alternating uppercase and lowercase letters (e.g. GcTd) denote a unique Borden unit measuring 10° latitude x 10° longitude. Sites are numbered sequentially within each Borden unit, based (usually) on the date of discovery. Thus, GcTd-29, partially within the route south of the SKA substation, is the 29th site recorded in the GcTd Borden unit. The documented sites within the present LSA are displayed on the archaeological resource map-set.

Based on previous archaeological work in the Kitimat Valley and the surrounding region, the most commonly encountered archaeological remains are CMTs, artifact scatters, habitation sites, cultural depressions, shell middens, rock art and historical sites. These types are described below, roughly arranged in frequency of occurrence:

- **Forest utilization sites** consist of one or more CMTs, which are trees that have been intentionally altered by First Nations people as part of their traditional use of forest resources. Coastal CMTs fall into two basic types: bark-stripped trees resulting from bark collecting and aboriginally logged trees produced during timber procurement activities. Aboriginally logged trees can be divided into several sub-types, including logged stumps of various kinds, test-hole trees, plank-stripped standing trees and felled logs and canoe blanks (Stewart, 1984). The majority of CMTs will occur within 500 m of the coastline or a major watercourse on well-drained, level ground or hillsides and in old growth forest stands containing straight-grained cedar trees (Archaeology Branch, 2001).
- **Artifact scatters** contain stone tools and waste flakes from the manufacture of stone tools. These items can be found in subsurface contexts but also often appear on the

ground surface. Artifact scatters are typically small in area and represent seasonal or transitory resource procurement camps. They may include fire-altered rocks, sometimes with concentrations of ash and charcoal. Post-moulds from temporary shelters or drying racks may be present. Camps associated with fish weirs would normally be situated near a distributary slough or riverbank, sometimes along marine shorelines or in the intertidal zone. Artifact scatters associated with hunting and plant-gathering camps should be sought in landward settings, along the routes of traditional trails or beside streams and sloughs.

- **Middens** are common archaeological sites in marine coastal settings, although they are infrequently present in freshwater environments. Middens represent the physical remains of villages or recurrently occupied seasonal camps. In coastal environments, they typically contain abundant shellfish remains interspersed with layers of black anthropogenic soils with ash and charcoal, accompanied by artifacts made of bone, stone and shell; fire-altered rocks; faunal remains (i.e. the bones of fish, birds and mammals); and buried cultural features such as hearths, storage pits and post-moulds.
- **Subsistence features** are typically present at locations traditionally used to harvest and process traditional food resources, but are often associated with village sites as well. Cache or storage pits are the most common type of subsistence feature and appear as circular surface depressions between 1 m and 3 m in diameter, frequently in close-spaced clusters and often in proximity to housepits. They may be more commonly associated with inland waters like the Kitimat and Skeena Rivers than they are in coastal settings.
- **House depressions** are square to sub-rectangular depressions (rarely circular) in this region, usually between 4 m and 10 m along the longest axis. These cultural features are the remains of coastal-style plank-houses, sometimes partly semi-subterranean. House depressions frequently occur in small village clusters, as at Kitselas Canyon (e.g. Coupland, 1988), often in association with smaller pits used for food storage. Remains found within the floor and berm of the pit can include butchered animal bones, charcoal, organic remains and artifacts. House depressions are typically found in micro-environmental settings with good solar exposure, some protection from winter winds and close proximity to potable and/or navigable waters, though secluded locations were sometimes selected for defensive purposes. Plank-houses are very characteristic of the North Coast, although they also are present along the Skeena River and in the lower Kitimat Valley as well.
- **Wetsites** are water-logged archaeological remains renowned for exceptional preservation of ordinarily perishable artifacts, such as cedar-bark basketry, matting, cordage, and wooden tools (e.g. yew-wood wedges). These sites always occur in permanently saturated settings, typically with an overlying stratum of fine-textured sediments that prevents seasonal drying. Overall, wetsites are probably rarer than fish weir remnants, though more have been recorded in this region owing to their greater "archaeological visibility." None is reported from the Kitimat Valley, although they should be searched for wherever fine sediments and cultural materials could accumulate in still-water environments not subject to scouring during freshet or rain events.

- **Fish weirs** represent a wetsite variant and always appear as stubs of weathered, wooden stakes in distributary channels or sloughs and on intertidal flats. The wooden stakes may be associated with alignments of cobbles and boulders. Specimens of weir stakes that have been sharpened with stone tools and others with evidence of sharpening with a steel axe have been found in sites throughout BC and in southeastern Alaska (e.g. Moss, 1998).
- **Ancestral burial places** are locations where First Nations people interred their dead. They are most common near traditional villages but also exist throughout the landscape for individuals who died away from their main villages. Until approximately 1,000 years ago, most deceased individuals were interred in shell middens, thereby designating the midden as a place of ceremonial significance beyond its functional importance in subsistence activities. After that date, many First Nations in this region adopted above-ground interment, often in rock-shelters in coastal settings, sometimes wrapped in blankets inside kerfed wooden boxes.
- **Rock art** sites consist of rock paintings (pictographs) or carvings or etchings in stone (petroglyphs) and are usually found on bedrock outcrops or large boulders, often along steep shorelines. Rock art sites may mark traditional trails or other locations of strong spiritual significance to First Nations people or may have served as territorial boundary markers between First Nations or between lands claimed by specific clans. Petroglyphs tend to be more common on the North Coast and along the Skeena River, where a remarkable concentration is recorded from Kitselas Canyon. Pictographs are present but apparently not in the same frequency as petroglyphs.
- **Trails** represent traditional routes used by Aboriginal people for access to resource-harvesting areas and for long-distance trade and communication with neighbouring First Nations. Many traditional trails became historically known routes during the colonial period and were used later still for contemporary roads. CMTs and rock art sites are characteristically found within a short distance of traditional and more recent trails. Cove and Macdonald (1987) have published a map of traditional trade networks as of 1750, showing an important trail, possibly the “grease trail” mentioned in the Kalum LRMP/SRMP concordance table in **Appendix A**, running through the Kitimat Valley from Kitamaat to Gitaus, a Tsimshian village on the Skeena River.
- **Historical sites** contain post-Contact remains, including artifacts, structures, and features usually associated on the North Coast with Euro-Canadian settlement, resource extraction and land use. However, there are also numerous historical sites attributable to First Nations habitation and land use in this region.

11.6.2.3 Cultural Heritage Resource Sites

Cultural Heritage Resource (CHR) sites are defined as sites that indicate historical use of the landscape but ae not positively dated as older than 1846 AD and are therefore not protected by the HCA. Although not protected these cultural resources can provide valuable insight and information regarding land use patterns during the historical period. Examples of cultural heritage resource sites include:

- CMTs that post-date 1846, trails that cannot be confirmed as pre-dating 1846 and are not recorded historically;
- Axe-cut tree blazes;
- Evidence of modern logging practices;
- Evidence of trapping that do not positively pre-dated 1846; and
- Areas with good fishing or resource procurement that are not ethnographically recorded but hold cultural importance for communities (i.e. berry patches, crabapple stands).

11.6.2.4 Archaeological Research in the Skeena–Kitimat Region

The TKTP LSA is within the Northwest Coast Culture Area, which encompasses the west coast of North America from southeastern Alaska to southern Oregon. Ames and Maschner (1999), Matson and Coupland (1995) and Moss (2011) provide recent syntheses of Northwest Coast prehistory. The prehistoric cultural sequence for the North Coast region is based on excavated archaeological sites in: (1) Prince Rupert Harbour (e.g. Ames, 2005; Archer, 1984; Inglis and MacDonald, 1979; MacDonald, 1969); and (2) along the Skeena River (e.g. Allaire, 1979a, 1979b; Allaire and MacDonald, 1971; Allaire et al., 1979; Ames, 1979; Coupland, 1988, 1996; Martindale, 1998, 1999, 2000). Important archaeological sites have also been investigated on the neighbouring islands of Haida Gwaii (e.g. Fedje et al., 1996; Fedje and Mathewes, 2005) and southeastern Alaska (e.g. Ackerman, 1996; Davis, 1989; Moss, 1998; Moss and Erlandson, 1995).

The prehistory of Kitimat Arm and the Kitimat Valley is practically unknown, as few archaeological research investigations have been conducted in this area. However, it is generally inferred that its local prehistory was comparable to the documented cultural sequences from better known neighbouring areas. In contrast, a considerable amount of archaeological research has been published for neighbouring areas of the North Coast, such as the Skeena River (Coupland, 1985a, 1985b, 1985c; MacDonald, 1983; MacDonald and Coupland, 1981; Martindale, 1999), and Prince Rupert Harbour (e.g. Ames, 2005; MacDonald, 1983). This research has produced evidence for a minimum of 6,000 years of human occupation, but occupation has likely been much longer given the presence of several sites in Haida Gwaii now dated to ages greater than 10,000 radiocarbon years before present (Fedje, 2003; Fedje and Mathewes, 2005; Fedje et al., 1996) and in southeastern Alaska (e.g. Ackermann, 1996; Davis, 1989).

Previous investigations along the Skeena and Bulkley Rivers, as far inland as Moricetown, have included regional inventory surveys, excavations and impact assessments for proposed development projects (e.g. Albright, 1986; Archer, 1984, 1988, 2009; Martindale, 1998, 2000). Many investigations have been conducted on the Skeena River, especially around Kitselas Canyon, indicating this location has been occupied for at least 4,500 to 5,000 years. Village sites at Terrace and Kitselas Canyon have been dated to the last 4,000 years (Allaire, 1979a; Archer, 1984, 1987; Coupland, 1988; Inglis and MacDonald, 1979; MacDonald, 1983; Martindale, 1999), and sites at Hagwilget Canyon and Moricetown are as old as 5,000 years (Albright, 1986; Ames, 1970, 1979).

Archaeological studies for infrastructure, transmission line and forestry developments in the Terrace to Kitimat corridor denote the kinds of sites that should be expected within the Project area, their distribution across the landscape and best practice methodologies for discovery and recording. Representative studies of this kind include Arcas Consulting Archeologists (1990, 1999, 2004, 2005 and 2008) and Archer (1984, 2009).

11.6.2.5 Documented Archaeological Resources

The provincial government RAAD application identifies 30 documented archaeological sites within 3 km of the TKTP ROW, of which five are located either completely or partially within the LSA. **Table 11.6-2** summarizes information about the documented sites near the Project.

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Table 11.6-2: Summary of Previously Recorded Archaeological Sites within 3 km of the Project Right-of-Way

Site #	Distance from ROW[1]	Within LSA	Environmental Setting	Type[2]	Revisit	Updated	Conflict	Recommendation
GaTd-3	~2.7 km SE of the ROW near MIN substation	No	Douglas Channel of Kitimat River	Cache and roasting pits (n=indet); shell midden; historical structure	No	N/A[5]	No	No further work
GaTe-1	~2.5 km SE of the ROW near Str 168 (old 340)	No	Close to “Sentinel Hill” Haisla lookout	Cache pit (n=indet)	No	N/A	No	No further work
GaTe-3	~600 m S of the ROW near the Kitimat substation	No	N of Moore Creek	CMT (n=1)	No	N/A	No	No further work
GaTe-5	~2 km E of the ROW near the Kitimat substation	No	Confluence of Anderson Creek and former channel of the Kitimat River	Buried FAR and surface lithics	No	N/A	No	No further work.
GbTe-1	~1 km W of ROW near Str 108 (old 289)	No	Confluence of Raley Creek and Wedeene River	CMT (n=1)	No	N/A	No	No further work.
GcTd-1	~2.5 km E of the ROW near Str 30 (old 220)	No	Terrace at mouth of Herman Creek	Cache pit (n=indet)	No	N/A	No	No further work.
GcTd-2	~2 km E of the ROW near Str 27 (old 217)	No	Near mouth of unnamed creek	Cache pit (n=indet)	No	N/A	No	No further work.
GcTd-4	~2 km E of the ROW near Str 30 (old 220)	No	On Lakelse River	Surface artifact scatter	No	N/A	No	No further work.
GcTd-16	~1.8 km E of the ROW near Str 46 (old 235)	No	Ridgetop overlooking Ena Lake	CMT (n=1)	No	N/A	No	No further work.
GcTd-17	~2 km E of the ROW near Str 46 (old 235)	No	Ridgetop	CMT (n=1)	No	N/A	No	No further work.
GcTd-18	~2.2 km E of the ROW near Str 46 (old 235)	No	Ridge, adjacent to an unnamed seepage	CMTs (n=13)	No	N/A	No	No further work.
GcTd-19	~1.7 km W of ROW near SKA substation	No	Flat, wet ground	CMTs (n=30)	No	N/A	No	No further work.
GcTd-24	~1.5 km SE of ROW near Str 15 (old 206)	No	W slope of Mount Herman, above Lakelse River	CMTs (n=2)	No	N/A	No	No further work.
GcTd-25	~1.5 km SE of ROW near Str 15 (old 206)	No	W slope of Mount Herman, above Lakelse River	CMTs (n=2)	No	N/A	No	No further work.
GcTd-62	~1.5 km SE of ROW near Str 15 (old 206)	No	W slope of Mount Herman, above Lakelse River	CMTs (n=2)	No	N/A	No	No further work.
GcTd-28	~400 m SW of ROW near Str 15 (old 206)	Yes	60 m E of South Road	CMTs (n=89)	No	N/A	No conflict with current ROW alignment	If provisional ROW is re-routed and affects lands in proximity to site, additional AIA recommended prior to clearing/construction
GcTd-29	Within ROW between Str 8 and 11 (old 201 - 203)	Yes	Adjacent to harvested cutblock	CMTs (n=76)	Yes	Site extended through ROW with 41 newly recorded CMTs	Yes	Avoidance through redesign; if avoidance not practicable post-harvest data collection and monitoring as appropriate under Section 12 Permit
GcTd-30	Directly adjacent to ROW between Str 37 and 38 (old 226 - 227)	Yes	E of a forestry road	CMTs (n=5)	Yes	Site extended with 1 new CMT recorded	Yes	Avoidance of unintentional effects during clearing through adherence to heritage management plan; if avoidance not practicable post-harvest data collection and monitoring as appropriate under Section 12 Permit
GcTd-32	Within ROW 70 m N of old Str 194 but avoided by Skeena re-route	Yes	Immediately S of Alwyn Creek	CMTs (n=14)	Yes	Update site form as legacy site	Yes	Site appears to have been destroyed by logging activities; no CMTs identified, update site form with legacy status; no further work
GcTd-33	~500 m N of LSA by SKA substation	No	Immediately S of Alwyn Creek	CMTs (n=5)	No	N/A	No	No further work
GcTd-34	~200 m N of LSA by SKA substation	No	Immediately S of Alwyn Creek	CMTs (n=2)	No	N/A	No	No further work
GcTd-35	~150 m N of LSA by SKA substation	No	Immediately S of Alwyn Creek	CMTs (n=4)	No	N/A	No	No further work

Site #	Distance from ROW[1]	Within LSA	Environmental Setting	Type[2]	Revisit	Updated	Conflict	Recommendation
GcTd-36	~200 m N of LSA by SKA substation	No	Immediately S of Alwyn Creek	CMTs (n=4)	No	N/A	No	No further work
GcTd-37	Located approximately 200 m N of LSA by SKA substation	No	Immediately S of Alwyn Creek	CMTs (n=12)	No	N/A	No	No further work
GcTd-38	Located approximately 500 m N of LSA by SKA substation	No	Immediately S of Alwyn Creek	CMTs (n=5)	No	N/A	No	No further work
GcTd-45	Within original ROW 60 m NW of old Str 195 but avoided by Skeena re-route	Yes	On sloping terrain	Cultural depressions (n=3); suspected to be tree throws; now destroyed; legacy site	Yes	Site does not exist; legacy site	No	No further work
GcTd-47	Located approximately 500 m E of ROW near Str 8 (old 201)	No	1,250 m N of Hai Lake	CMTs (n=9)	No	N/A	No	No further work
GcTd-48	Located approximately 700 m E of ROW near Str 10 (old 202)	No	1,250 m N of Hai Lake	CMTs (n=16)	No	N/A	No	No further work
GcTe-11	Located approximately 2 km W of ROW near SKA substation	No	Near Alywn Creek on level, poorly drained terrain	CMTs (n=10)	No	N/A	No	No further work
GcTe-12	Located approximately 2.2 km W of ROW near SKA substation	No	On both sides of a road on level, poorly drained terrain	CMTs (n=13)	No	N/A	No	No further work

Notes: [1] Positional data downloaded from provincial site records; 2015 field survey conducted before new structure numbers allocated – both new and old structure numbers are cited
[2] Type of site as described in site record
CMT = culturally modified tree; E = east; FAR = fire-altered rock; indet = indeterminate – where numbers of cultural features are not reported in site record, or record is incomplete; LSA = Local Study Area (conforms to Engineering Area); m = metre; MIN = Minette; N = north;
N/A = not applicable; NW = northwest; ROW = right-of-way; S = south; SE = southeast; SKA = Skeena; Str = provisional structure; SW = southwest; W = west

11.6.2.6 In-Field Assessment of Archaeological Resource Potential

As described in the environmental overview report (AMEC, 2014), the RAAD application displays the Kalum AOA GIS-based model of archaeological potential for the Kalum Forest District, in which the Project is situated. However, the Kalum AOA model does not conform to current standards of GIS practice and the Archaeology Branch expressly warns resource companies not to use this model for operational planning. Consultancies who have conducted and who are presently conducting the archaeological components of environmental studies for the numerous oil and natural gas pipelines through the Kitimat Valley may have developed GIS models of archaeological potential for this area, but these are proprietary and were not available for the TKTP study.

However, because the LSA was not particularly wide and the route not particularly long and because CMTs were predicted to be the principal kind of heritage resources, a minimalist model was developed for the field survey based on forest inventory data from the provincial VRI online dataset. In its simplest sense, lands with forest age-classes from 7 to 9 were considered to have high potential for containing protected CMTs (that is, those that were or could have been modified prior to 1846, or more than 169 years ago).

For other kinds of heritage resources, including archaeological sites comprising artifact scatters or cultural depressions or any of the other kinds of remains described above, an inductive approach was used to assess archaeological potential as the field crews proceeded along the TKTP route and various access roads into the LSA. Thus, minimally sloped, well- to moderately well–drained, elevated settings in proximity to significant aquatic features (rivers, small lakes, extensive wetlands) were considered to have high potential for artifacts or cultural depressions, regardless of the VRI age-class for a particular location. The crews were mindful that CMTs (e.g. logged stumps and stumps bearing traces of old bark strip scars) can be found in regenerating logging cutblocks, so they watched for such features while traversing younger forest stands along the route. Lastly, rock faces or bluffs were inspected for evidence of rock art (pictographs and petroglyphs) or for overhangs that could have been used for temporary habitations (rock shelters) or as burial places.

11.6.2.7 Archaeological Field Survey – Schedule

Shift 1 (April 14-25, 2015):

- AIA field survey was conducted within the provisional ROW (including clearing area) from structures 192 to structure 195 (old series) and from structure 199 to structure 266 (old series). The field survey coverage included the clearing area and original ROW, as well as two provisional crossings of the Lakelse River: the proposed western option that was selected and an eastern option that was considered. The field survey was conducted by three crews; each comprised two qualified AMEC archaeologists, assisted by two to three First Nations field workers.

Shift 2 (May 2-14, 2015):

- The AIA field survey continued within the ROW from structure 266 to structure 350 (old series), as well as the provisional MIN substation to KIT substation tie-in. As before, the field survey was conducted by up to three separate crews, with six AMEC qualified archaeologists; however, a full contingent of First Nations field workers were not available for every day of the shift.

Shift 3 (June 8-14, 2015):

- The AIA survey was conducted within private properties where access had not previously been granted, within the All West Trading and Wang/Zhang properties, and the Sandhill re-route. Additionally, new provisional or proposed routes from the SKA substation, the MIN substation to KIT substation tie-in, along Coldwater Creek, the Lakelse River Crossing and the Little Wedeene River Crossing were inspected. The field survey was conducted by one crew of two qualified AMEC archaeologists accompanied by two to three First Nation community participants.

Shift 4 (September 29, 2015):

- Field survey of a proposed geotechnical borehole location (BH#19) within a re-routed portion of the right-of-way where no previous assessment had been conducted.

Shift 5 (June 7-18, 2016):

- AIA field survey of re-routed portions of transmission right-of-way and proposed reconstruction roads. Reflagged CMTs that are within the proposed falling boundary in anticipation of centreline clearing.

11.6.2.8 Archaeological Field Survey – Work Summary

Prior to the commencement of the field program in April 2015, a set of 1:20,000-scale orthophoto maps displaying the VRI forest age-class locations and slope percentage data were created for the transmission line route. The orthophotos also displayed provisional structure locations (i.e. structure 192 to structure 350, old series) and formed the basis for the archaeological resource map-set. Because most of the transmission line route will be built in a "greenfield" environment, the archaeological field survey aimed for 100% coverage of all structure locations, as well as a 100 m buffer on either side of the centre line that enclosed an area larger than the potential clearing areas.

The total area of the LSA for the project is 4,569.72 ha. In 2015, the archaeological survey covered 1,247.51 ha, of which 666.62 ha was within the clearing area; the balance was within the LSA, and along existing and provisional access roads to the LSA.

Subsurface testing took place in any setting rated as having high or moderate potential for buried archaeological or cultural materials. During the 2015 and 2016 field surveys, 41 discrete locations (identified as "LOC" on the archaeology map-set) were tested, with a total of 760 subsurface tests being excavated. All subsurface tests were negative for archaeological deposits or artifacts. No cultural depressions were observed during the field surveys.

Trees in forest stands mapped as VRI age-class of 7 to 9 were inspected by the crews for evidence of traditional cultural modification. During the 2015 field surveys, 193 CMTs were identified and recorded, and when plotted on the map-set were found to be attributable to 15 new archaeological sites and extensions to two previously recorded sites. A detailed description of the archaeological sites recorded or revisited is presented in **Section 11.6.2.9**.

11.6.2.9 Archaeological Field Survey – Survey Results

11.6.2.9.1 Skeena Substation to Lakelse River (structure 1 to structure 21; 192 to 210 old series)

Field surveys began in April 2015, at the northern-most point of the original/provisional route, Str 192 (old series) adjacent to the SKA substation and continued south, avoiding properties for which access had not yet been granted. The transmission line ROW original alignment tied into the northern edge of the substation beginning with Str 192 (old series). As several previously recorded CMT sites are located within 500 m of the substation, 100% pedestrian survey was conducted throughout the 100 m buffered right of way south to the northern boundary of no-access properties between Str 196 and 195 (old series). The private properties were assessed during June 2015 once property access had been granted. One CHR site—CHR1—was identified between Str 195 and Str 196 (old series) of the original route. CHR 1 consists of a single box-style martin trap supported on a tree by a cut-log.

Forest cover in this area comprised patches of old growth western redcedar (VRI 9) interspersed between a general regrowth forest cover of juvenile western redcedar, hemlock and poplar (VRI 2 and 3). Crabapple trees were observed in their preferred environmental setting: moist swampy terrain north of Str 5. These may represent traditional resource harvesting of naturally occurring plant species but likely do not represent horticultural activity such as the crabapple orchards recorded in association with other sites in the region (Downs 2006). Additional information on crabapple and other plant species identified within the project area will be provided in documentation that will accompany the LOO application. Ground visibility was poor due to dense understory vegetation of mosses, cranberry and grasses. A total of 104 subsurface tests were excavated at nine locations (LOC10001, LOC10002, LOC20001, LOC20002, LOC20003, LOC30001, LOC30002, LOC30003, LOC30016) of moderate to high archaeological potential between the SKA substation and Str 20 (old series Str 210). The locations were comprised elevated, level landforms associated with nearby watercourses. All subsurface tests were negative for archaeological remains.

South of Str 7 (old series Str 200) the majority of the 200 m ROW is located on the east side of the provisional centerline. Sections of forest age-class VRI 9 interspersed between recently logged cut blocks of age-class VRI 2 and 3 are present and were inspected for CMTs. Three new CMT sites (GcTd-78, GcTd-79 and GcTd-80) were identified between the SKA substation and Str 19 (old series Str 209). Additionally, 41 new CMTs associated with previously recorded site GcTd-29 were identified and recorded between Str 9 and Str 11 (old series Str 201 and 203).

The project ROW between the SKA substation and Str 19 (old series Str 209) is generally assessed as having low potential for non-CMT archaeological sites. The terrain is generally hummocky and uneven, interspersed with low-lying, poorly drained boggy ground. Forest cover varies between alder and aspen to re-growth hemlock and balsam. The more recent cut blocks are forested with juvenile spruce and Douglas-fir. Eight areas of moderate to high archaeological potential were identified, consisting of level, elevated landforms in proximity to watercourses. All were tested with negative results for archaeological remains.

At Str 19 (old series Str 209) the terrain changes to a mix of moderately sloping, uneven and poorly drained terrain with southwestern aspects and steeply sloping, rocky outcrops bisected by deeply incised, creeks and drainages. Within one of these creeks south of Str 19 (old series Str 209) a CMT site (GcTd-82) was recorded. The majority of the sloping terrain has been disturbed by past logging activities and railway construction. However, on the south side of the CN Rail ROW a section of old-growth western redcedar forest remains with an understory of devil's-club, grasses and huckleberry. The sloping terrain continues down to the Lakelse River where it levels out into a moderately drained terrace. Four CMT sites (GcTd-87, GcTd-88, GcTd-84 and GcTd-85) were recorded on the north bank of the Lakelse River. A total of 76 subsurface tests were excavated at three locations (LOC30005, LOC30006, LOC30007) of high archaeological potential along a level, elevated terrace on the north bank of Lakelse River. All subsurface tests were negative. The terrace appears to be seasonally inundated with water from spring run-off and therefore does not represent a stable environment likely to contain subsurface archaeological deposits. The exposed beach and bank of the river were also investigated, with negative results.

11.6.2.9.2 Lakelse River Crossing – Re-route Options

The south bank of the Lakelse River was accessed via the Lakelse FSR. The provisional ROW centreline was inspected, as were two proposed alternative crossings. These were proposed for the Lakelse River crossing to provide better options for avoiding highly sensitive, old-growth stands beside the river. Terrain along the western re-route was assessed in-field as having moderate to high archaeological potential, based on the presence of a level, elevated river bank. Subsurface tests were excavated at two locations with negative results. Lands between the south bank of the river and the height of land at Str 212 (old series) are assessed as having high potential for CMT sites due to the presence of mature redcedar in VRI age-class 9 stands. Two new CMT sites were recorded within the western re-route (GcTd-87 and GcTd-89). For a detailed description of these sites, see section 4.3 below. Crews surveyed the western re-route from Str 208 (old series) on the height of land above the north bank of the Lakelse River to the height of land on the south bank of the Lakelse River adjacent Str 212 (old series). The portion of the re-route between Str 215 and Str 212 (old series) was not covered by the pedestrian survey but was assessed in-field as having low archaeological potential. This potential assessment is based on terrain observed while surveying the adjacent original/provisional route centerline, which exhibited an absence of level, elevated landforms near watercourses and low-lying poorly drained terrain that had been previously impacted by logging activities. No mature cedar stands were observed in the adjacent terrain and this section of the re-route has a VRI 2 age-class.

The entire eastern crossing alternative was covered by pedestrian survey; it was assessed as having low potential for buried archaeological remains or CMTs. The assessment is based on the presence of sloping, uneven and hummocky terrain observed down to the Lakelse River and because it had been severely disturbed by past logging. Old-growth forest stands are absent, and the eastern alternative is mapped as age class 3 forest consisting of regrowth western hemlock and true fir.

11.6.2.9.3 South Side Lakelse River – North Side Wedeene River (structure 22 to structure 116; 211 to 295 old structure numbering series)

Some of the lands on the southern side of Lakelse River are elevated up to 2 m above the river. Forest cover is dominated by western hemlock, true fir and alder with scattered spruce. Evidence of modern logging was observed throughout the river terrace, including large cedar stumps, blazed trees and old skid roads. Several CHRs were observed on the south side of the Lakelse River, including an historical trail (CHR2), cable-logging scars on a tree (CHR3) and axe-blazed trees (CHR5, CHR6 and CHR7). Terrain in this setting is generally level to gently sloping, interspersed with hummocky, poorly drained places. Understory and ground vegetation consists of devil's-club, skunk cabbage, grasses and mosses. There are a few wetland settings with standing water (in April and May) associated with a backchannel between Str 211 (old series) and the river bank. A total of 132 subsurface tests were excavated in four test locations (LOC30004, LOC30005, LOC20009 and LOC30018) along the southern bank of the river, all with negative results. Sediments in these tests consisted of banded layers of silty sand and clayey silts, denoting recurrent seasonal inundation by the adjacent river.

From Str 211 (old series) the terrain rises to a high, uneven and moderate to steeply sloping terrace with rocky outcrops and a northeastern aspect. Old-growth forest cover with some evidence of logging activities continues up to the top of the terrace where it is bordered by recent cut blocks (VRI age-classes 1 and 3). Two large CMT sites were identified within the old-growth area (GcTd-83 and GcTd-89).

The ROW between Str 213 (old series) to Str 25 (old series 215) was assessed in-field as having low archaeological potential based on the presence of low-lying, moderate to poorly drained terrain and evidence of previous logging (i.e. skid roads, stumps, disturbance of landscape integrity). From Str 25 (old series 215) the provisional route swings to the south and ascends a steep, rocky slope with a western aspect. Forest cover within this section consists of VRI 2 interspersed with patches of VRI 9. The old cedar and hemlock stands are associated with poorly drained settings or rocky cliffs where historical logging practices would not have been viable. No CMTs were observed within these stands. During a revisit to previously recorded site GcTd-30, one new CMT was identified and recorded as part of this site; see Section 4.2 for details.

Between Str 22 and Str 49 (old series 211 and 238) a total of 58 subsurface tests were excavated in six test locations exhibiting moderate to high archaeological potential (LOC20004, LOC10003, LOC10004, LOC10005, LOC20007 and LOC20008). All tests were negative. The test locations are all on level, elevated benches in proximity to unnamed tributaries of Coldwater Creek. Sediments in the tests consisted of banded layers of silty sand and moist clayey-silt up to approximately 70 cm below surface (reach of shovel), or thick layers of humic organics (upper 30 cm to 40 cm) overlying compact silty clays. The first type of deposit is typical of a dynamic montane setting and likely indicates sediment deposition via season run-off. The second soil profile observed is suggestive of previous disturbance by forestry operations during which native top soils are often replaced or mixed with coarse woody debris and organics.

The Coldwater Creek crossing between Str 49 and Str 50 (old series 238 and 239) was assessed as having moderate to high archaeological potential where defined, level creek banks were present. Terrain consisted of level, elevated creek banks east of the Lakelse FSR and hummocky, moderately to steeply sloping terrain west of the road. Forest cover consists of regrowth hemlock and true fir east of the FSR and regrowth cedar, Sitka spruce, alder and poplar on the west side. Groundcover and understory vegetation comprises mosses, devil's-club and sedges. Both the north and south banks of Coldwater Creek have been disturbed by forestry operations, including old branches of the Lakelse FSR that appear to have traversed both sides of the creek to north and south. Forty subsurface tests were excavated in three locations on the north bank of Coldwater Creek (LOC10006, LOC10007 and LOC20006). One location (LOC20005) with 34 subsurface tests was examined on the south bank of the creek. All subsurface tests had negative results. Several subsurface tests struck an old gravel road bed below the litter mat with no native topsoil remaining. The exposed stream bank cut and enclosed sediments were inspected for surface artifacts but none were identified.

Terrain between Coldwater Creek (Str 50; old series 239) and Cecil Creek (Str 72; old series 258), is a mix of low-lying and poorly drained settings, undulating to undifferentiated settings and moderate slopes with eastern aspects. Forest cover is VRI age class 2 and 3 and comprises regrowth hemlock and true fir with an understory of mosses, grasses, ferns, skunk cabbage and huckleberry. This section of the ROW is assessed as having low potential for both subsurface archaeological remains and CMTs based on the absence of level, elevated landforms in proximity to watercourses, disturbance from past logging and the absence of mature forest stands. Sixteen subsurface tests were excavated at two subsurface test locations on the banks of Cecil Creek (LOC10008 and LOC10009). All of these subsurface tests were negative.

From Str 72 to Str 97 (old series 258 and 280) the route traverses low-lying wetlands with standing water on the surface in May 2015, interspersed with undulating, uneven terrain with no defined elevated terrain. Forest cover consists of regrowth hemlock and true fir (VRI age-classes 1, 2 and 3). A few patches of age class 8 forest were inspected near structure 263 but were found to consist of small western redcedar and hemlock growing in poorly drained settings. One stand of hemlock-dominated forest (age class 9) was inspected at structure 280 beside an unnamed tributary of the Wedeene River. No evidence of cultural modifications was observed. This section of the ROW is assessed as low potential for both subsurface archaeological remains and CMTs, based on the occurrence of poorly drained terrain; absence of level, elevated landforms; disturbance from past logging and the low frequency of mature forests stands. No subsurface testing was conducted and no CMTs were identified.

From Str 280 to Str 295 (old series) the provisional route traverses upslope and across the top/edge of Iron Mountain above the recently cleared Pacific Coast Trail pipeline ROW to the west. Terrain in this section is very steeply sloping with various aspects and forested primarily with recent regrowth spruce, hemlock and balsam with an understory of mosses, devil's-club, huckleberry and mushrooms. Some portions of the ROW traverse the top of the Iron Mountain slope where VRI age-class 9 sections are present. This forest is predominantly mature hemlock with scattered western redcedar and would have been difficult to access for bark harvesting. Mature trees were inspected for evidence of cultural modification. No CMTs were identified but one cultural heritage resource site (CHR 8) consisting of an undercut cable logging tree was identified near Str 285 (old series). The proposed ROW between 282 and 285 (old series) was not covered by pedestrian survey, although it was visually inspected from the access road at the toe of the slope. The entire ROW across very steeply sloping, logged terrain was visible from this position. Forests in this part of the ROW are mainly age classes 1 and 2 (very recent/dense regrowth), with age-class 9 patches representing hemlock-dominant stands. The ROW from Str 280 to Str 295 (old series) is assessed as low potential for both subsurface archaeological remains and CMTs due to the presence of poorly drained terrain; absence of level, elevated landforms; disturbance from logging and low frequency of mature forest stands. No subsurface testing was conducted.

From Str 295 (old series) the ROW descends a rocky, uneven slope with VRI age-class 2 to the low-lying north bank of the Wedeene River. The north bank of the river consists of a level, elevated sandy bank with VRI age-class 2 forest. Forest cover consists of cottonwood, fir and alder with an understory of devil's-club, false Solomon's seal and mosses. A total of 49 subsurface tests were excavated along the river bank (LOC20010). Sediments consisted of dark brown litter mat and semi-compact medium grey silty-sand, overlying compact medium brown moist silty-clay. All subsurface tests were negative. Sediments consisted of banded layers of silty sand and clayey sits, suggesting seasonal inundation of the landform by the adjacent river. The exposed beach and bank of the river were also investigated with negative results.

11.6.2.9.4 South Bank Wedeene River – North Bank Little Wedeene River (structure 117 to structure 128; 296 to 307 old series)

The southern bank of the Wedeene River is generally level and elevated above the river. The bank has been disturbed by previous logging and railway construction. However, some mature western redcedar trees remain. Forest cover mainly consists of regen hemlock and balsam with a minimal understory of mosses and ferns. Standing and fallen mature cedars were inspected but no evidence of cultural modification was observed. Three subsurface test locations (LOC30013, LOC30014 and LOC30015) were inspected on the level south bank of the river with a total of 58 subsurface tests excavated. All tests were negative for cultural material and/or deposits. Sediments generally consisted of black moist organics/litter-matand medium brown silt with a trace of sand overlying medium tan/orange silt with a trace of sand. Above the lower river bank to the south there is an elevated, southwest-northeast trending, gently sloping to level terrace, which the provisional route will follow. The point where the terrace is closest to the Wedeene River crossing approximately 100 m northwest of Str 117 (the old series Str 296 location) was inspected, and 30 subsurface tests were excavated with negative results. Sediments consisted of a medium brown littermat and medium brown greasy/moist silt with trace clay and some gravels, overlyingmedium grey moist silty-clay. In one test, a length of logging cable was encountered approximately 40 cm below the surface, denoting that this setting was disturbed by logging activities and it may have been levelled for a yarding area or camp.

From Str 117 to Str 128 (old series 296 to 307) the terrain is low-lying, is moderately to poorly drained, is hummocky and undifferentiated and has been disturbed by logging. The archaeological potential for this section of the ROW was assessed in-field as low, based on the absence of level, well drained landforms in proximity to significant hydrological features and no subsurface tests were excavated. Vegetation comprises mosses, grasses, skunk cabbage and devil's-club. The forest cover is mainly regrowth hemlock, true fir and alder (VRI age-classes 1, 2 and 3) with some mature western redcedar and hemlock (age-class 8) in a low-lying, poorly drained setting. All mature cedar trees were inspected for evidence of cultural modification, but no CMTs were identified.

Str 128 (old series 307) is located at the edge of a level, elevated terrace overlooking swampy low-lying terrain surrounding the Little Wedeene River to the south. Forest cover consists of regrowth hemlock, balsam and alder with an understory of mosses, grasses and devil's-club. The terrace edge was inspected (LOC30011) and 22 subsurface tests were excavated with negative results. The location has been impacted by logging and excavated sediments generally consisted of semi-compact black sandy silt with organics, overlying moist grey grey silty clay . An additional subsurface test location (LOC30012) was inspected on the north bank of the Little Wedeene River, on a level, elevated sandy bank. A total of 71 subsurface tests were excavated throughout the 100 m ROW buffer with negative results. Two clear soil horizons are present throughout the tested area, likely representing a recent flood event. More flood events have likely occurred, as the landform appears to be quite dynamic in terms of morphology and sedimentation. A clearly sterile layer was identified, defined by coarse grey sands with sudden appearance of small pebbles, gravels and cobbles. Boulders were occasionally encountered and sometimes apparent on the surface. Testing followed natural features of the landform at 5 m intervals in 3 rows working from the eastern boundary to the west. The western portion of this study area, defined by a recent back channel, is low lying and poorly drained; the forest cover is young, immature alder and spruce.

11.6.2.9.5 South Bank Little Wedeene River to MIN Substation (structure 129 to structure 182; 308 to 350 old series)

The terrain between Str 129 and Str 161 (old series 308 to 332) is assessed as having low archaeological potential for buried cultural deposits, based on the presence of rocky, steeply sloping terrain and absence of level, elevated landforms in proximity to watercourses, with the exception of two terraces on the south bank of the Little Wedeene River.

Terrain on the south bank of the Little Wedeene River is steeply sloping and hummocky with a series of two level, terraced breaks-in-slope above low-lying wetland terrain flanking the river. The fore-end of the terraces have moderate potential but further back by the toe of the slope sediments are imperfectly drained and the ground is hummocky. Understory vegetation consists of skunk cabbage, moss and devil's-club. Forest cover consists of regrowth hemlock, balsam and alder with scattered pine, VRI age-class 1. Previous disturbance from logging was observed. A total of 82 subsurface tests were excavated at two subsurface test locations (LOC30009, LOC30010) on the south bank of the Little Wedeene River. Sediments observed were comparatively shallow compared with those on the north bank. Soil profiles consisted generally of coarse black moist organics/littermat overlyingsemi-compact medium brown sandy silt. Large cobbles were encountered in several of the tests. All subsurface tests were negative for cultural material and/or cultural deposits.

From Str 129 (old series 308) the terrain ascends a moderate to steep slope to the southwest and the ROW changes orientation just south of Str 130 (old series 309), on a side-slope traverse along a steep, rocky cliff. Terrain within this portion of the ROW is assessed as having low archaeological potential based on the extent of disturbance from previous logging, absence of level, elevated terrain features in proximity to watercourses, and presence of unstable rocky slopes. VRI age-class is 1 and 2 with patches of mature western redcedars on rocky slopes with low potential for cultural modifications due to their inaccessibility.

The field crews surveyed the ROW to a point halfway between Str 317 and Str 318 (old series) at which point, steep and unstable talus slopes were encountered that could not be safely traversed. Based on the amount of logging disturbance and presence of talus slopes, the ROW between Str 318 and Str 322 (old series) is assessed as having low archaeological potential and no further inspection is required. South of Str 322 (old series), the terrain is more accessible and moderately sloping, with a southeast aspect and a forest cover of regrowth and mature western redcedar, hemlock and alder (VRI age-class 9). Three new CMT sites (GaTe-6, GaTe-7 and GaTe-8) were identified and recorded between Str 146 and Str 158 (old series 324 and 330). The first two sites are associated with watercourses and each comprises several rectangular bark-strip CMTs. The third site (GaTe-8) is a single bark-stripped CMT identified on the Mount Clague Trail adjacent to CHR9 (industrial logging debris) and CHR10 (blazed trees). For a detailed description of the CMT sites see Section 4.2.

The terrain between Str 158 and Str 161 (old series 330 and 332) is a mixture of low-lying, poorly drained terrain interspersed with steep rocky terrain with an eastern aspect. This area has been previously disturbed by logging and the VRI age-class is a combination of 3 and 9. The only mature western redcedar or hemlock trees within the ROW are on steep, rocky outcrops, which would have been inaccessible as a traditional resource. No CMTs were identified and the survey was halted at an impassable rock-walled gorge just south of Str 332. The terrain between Str 161 and Str 173 (old series 332 and 344 is assessed as low archaeological potential based on observations in comparable settings within the provisional ROW, the presence of steeply sloping rocky terrain, evidence of logging disturbance and the absence of level, elevated landforms. No further archaeological field survey should be required within this section of the ROW.

From Str 176 to Str 182 (old series 348 to 350) the ROW parallels the existing 2L105 transmission line, allowing access to steep rocky terrain between Str 173 and Str 182 (old series 344 and 350) via the MIN Substation. The slope has an eastern aspect and is interspersed with deep, rock-walled canyons and creeks. The terrain has been affected by logging and the forest cover comprises regrowth hemlock, balsam and alder (VRI 1) with patches of mature western redcedar and hemlock (VRI age-class 9) on the upper elevations of the slope. These trees are difficult to access and would not have been practical for traditional resource procurement. The ROW between Str 173 and Str 182 (old series 344 and 350) is assessed as having low archaeological potential, due to the presence of steeply sloping rocky terrain, minimal occurrence of mature forest stands and absence of level, elevated landforms in proximity to watercourses. Based on this potential assessment, further archaeological investigation such as subsurface testing or pedestrian survey is not required.

11.6.2.9.6 Minette Substation to Kitimat Substation

When the archaeological field surveys took place, there were no provisional structure locations for the transmission line extension from MIN substation to KIT substation. Therefore, archaeological potential was assessed for the entire proposed ROW (where it was physically accessible). The original alignment of the MIN substation to KIT substation tie-in ran parallel to the the 2L103 line on its upslope (west) side, while the re-route option as presently envisioned is downslope (east) of the existing line. Both the original alignment and the re-route were covered by the pedestrian surveys in 2015. Terrain observed along the tie-in line was mostly assessed as having low archaeological potential based on the absence of mature tree stands (VRI age-classes 1 and 2), presence of sloping rocky terrain, and absence of level, elevated landforms.

One place on the south side of Anderson Creek was thought to exhibit moderate archaeological potential (LOC30008), and 12 subsurface tests were excavated on a level terrace above the south bank. All tests were negative and no cultural materials and/or deposits were encountered. Elsewhere along Anderson Creek, the banks have been modified by industrial activity or are rocky canyon walls. Forest cover consists of regrowth hemlock, western redcedar and true fir with scattered alder. Ground vegetation comprises mosses, devil's club and skunk-cabbage.

11.6.2.9.7 Skeena Substation Re-route

Following the April AIA survey, the provisional SKA substation tie-in was replaced by the current alignment, commencing approximately 200 m north of structure 197 (old series), proceeding west through the private All West Trading property, northeast adjacent to the CN Rail grade to the tie-in at the southeast corner of the substation. Although no proposed structure locations were plotted along the new route, a complete pedestrian survey was conducted in June 2015. All lands within the 200 m wide study area were assessed as having low potential based on the extent of disturbance from logging and road construction, as well as clearing associated with substation, railway and transmission line construction. Subsurface tests were not required for this location. Terrain within the proposed route is undifferentiated and poorly drained from the SKA substation to Str 5 (old series Str 198). Forest cover in this setting consisted of regrowth hemlock and western redcedar with an understory of mosses, devil's-club and false Solomon's-seal.

11.6.2.9.8 Sandhill Re-route (Option 5)

Due to earlier property access restrictions, the Sandhill re-route (Option 5) was assessed during the third field cycle (June 2015). Access to the proposed ROW for the Sandhill re-route proved challenging due to impassable rock-walled canyons and steep rocky slopes encountered by the field crew at Str 161 and Str 173 (old series 332 and 344), , the northern and southern tie-in points for the re-route, respectively. The survey location was accessed with permission via a neighbouring Alcan property and inspected up to the unnamed, long narrow lake within the ROW. The Sandhill property comprises a steep-sided, elevated glaciofluvial delta at the toe of talus-covered mountain slopes to the west. The creeks and drainages are deeply incised among rocky outcrops and the ground is loose and unstable, interspersed with poorly drained low-lying areas. Forest cover (VRI age classes 1 and 2 with patches of 9) mainly comprises regrowth western redcedar, hemlock, pine, fir and alder with an understory of devil's-club, huckleberry, sedges and mosses. The mature cedar and hemlock are found on the steeply angled talus slopes west of the lake. Some mature cedar trees were observed at the north end of the lake and inspected for cultural modification, but no CMTs were identified. The unnamed lake has steep cliffs and rocky outcrops on the east side and loose talus slopes to the west, with a wetland at the north end outlet draining into an unnamed creek.

Terrain within the Sandhill re-route is assessed as having low archaeological potential based on the extent of past logging disturbance, absence of level, elevated landforms and absence of accessible mature cedar trees with potential for cultural modification. Based on this potential assessment, additional archaeological inspection is not recommended.

11.6.2.9.9 Coldwater Provisional Route (Option 3)

The Coldwater provisional route is located west of the original provisional centre line between structure 44 (233/234 old series) and structure 49 (238 old series). The new alignment was covered by a pedestrian survey in June 2015. Terrain within the provisional route section is hummocky and uneven, interspersed with low-lying wetlands and poorly defined creeks and drainages. Forest cover includes regrowth hemlock, true fir and western redcedar with scattered alder. One small ridge with a reasonably level crest assessed as moderate potential (LOC30017) was identified north of an unnamed tributary of Coldwater Creek. Eight subsurface tests were excavated on this landscape feature, all of which were negative.

The provisional ROW has been disturbed by forestry operations (VRI age class 1 and 2). Two small age class 9 forest patches represent wetland stands of mature western redcedar and hemlock. Ground vegetation consists of vine maple, ferns, skunk cabbage and mosses. All mature trees were inspected for evidence of cultural modification but no CMTs were found. The Coldwater provisional route is assessed as having low archaeological potential based on the prevalence of moderate to poorly drained, uneven terrain and the absence of level, elevated landforms, which was confirmed by the negative subsurface tests.

11.6.2.9.10 Iron Mountain Re-route (Str 97 to North Bank Wedeene River)

The project ROW was re-routed between Str 97 and Str 117 and included a new alignment for the Wedeene River crossing. During June 2016, a crew conducted a pedestrian survey between Str 98 and a point half-way between Str 101 and 102, with a visual survey from the adjacent access road, downslope between Str 102 and Str 116. Terrain between Str 97 and Str 102 alternated between flat and poorly drained to steeply sloping with rocky outcrops and a north/northeastern aspect toward the Wedeene River. Forest cover comprises hemlock, poplar and western redcedar regrowth, with crabapple present in the undifferentiated wetland areas with an understory of elderberry, devil's-club, cranberry, skunk cabbage and salmonberry. Additional information on crabapple and other plant species identified within the project area will be provided in documentation to accompany the LOO application. The area has been previously disturbed by logging activities and the regrowth forest is very dense. Based on the absence of level, elevated lanforms in proximity to waterways suitable for habitation or mature forest stands, the ROW between Str 97 and Str 102 is assessed as having low archaeological potential.

Although it is preferable to conduct pedestrian surveys of all lands to be impacted by TKTP, the extensive field surveys in surrounding areas allow inferences about archaeological resource potential for the new alignment without an in-field inspection. Based on observations from the terrain between Str 98 and Str 101 and the adjacent, original ROW alignment, the Iron Mountain Re-route between Str 102 and Str 116 is assessed as having low potential. This assessment is based on analysis of topographic mapping and VRI age-class data. The forest cover in this segment of the Project is recently logged regrowth spruce, alder and hemlock (VRI age-classes 1 and 2). Terrain is loose and rocky with a moderate to steep southwestern aspect. It is unlikely that level, elevated landforms that would have been utilized in the past as habitation or resource processing sites are present within the proposed re-route alignment. Furthermore, as no mature cedar trees remain in this setting, it is also considered unlikely that CMTs are present in this ROW re-route.

The re-routed Wedeene River crossing is aligned over the same, level, elevated sandy bank on the north side of the river as the original alignment. One reasonably level area of the sandy north bank of the Wedeene River was assessed as moderate potential (LOC-CV-6). Ten subsurface tests were excavated on this feature, all of which were negative. Sediments in these tests consisted of banded layers of silty sand and clayey silts, denoting recurrent seasonal inundation by the adjacent river.

11.6.2.9.11 Little Wedeene River Crossing Provisional Route (Option 4)

The Little Wedeene River Crossing re-route was partially assessed during the June 2015 work cycle. The proposed re-route diverges from the original alignment at Str 124 (old series 304) and crosses the Little Wedeene River approximately 300 m east of the original crossing to tie-in at Str 132 (old series 313). The realignment continues from Str 137 to Str 152 (old series 316 to 327), where the re-route angles out toward the eastern margin of the LSA. The final section of re-route will be shifted 100 m east between Str 156 and Str 161 (old series 329 and 332). The southern side of the Little Wedeene north of the 1074R Road was covered by a pedestrian survey. The road is located on an elevated terrace and terrain descends steeply to a low-lying wetland along the river. This setting has been affected previously by recent and historical logging, with a current forest cover comprising regrowth hemlock, true fir, alder and spruce (VRI age-classes 1 and 3) and a groundcover of tall grasses, skunk cabbage, false Solomon's-seal and mosses. This section of re-route is assessed as having low archaeological potential due to the absence of level, elevated landforms, evidence of logging disturbance and prevalence of low-lying, poorly drained terrain. No subsurface test locations were identified.

It was not possible to complete the field survey of the Little Wedeene River Crossing re-route in 2015. However, an in-office potential assessment for the remaining re-route segment was conducted based on a review of topographic mapping and VRI data, as well as results of field survey results in surrounding lands. The results of the in-office assessment of potential are presented here. On the north side of the river, the re-route will cross the same landform tested at LOC30011, as well as a localized mature forest stand (VRI age-class 8). The re-route alignment between the 1074R Road and Str 313 and between Str 316 and Str 327 appear to traverse a mix of low-lying wetland and moderately sloping and level, undifferentiated terrain. However, the presence of age-class 9 forests and proximity of documented forest utilization sites suggest potential for additional CMTs. For these reasons, portions of the little Wedeene River Crossing re-route are assessed as having moderate to high archaeological potential.

The Little Wedeene re-route proposed in 2015 was not selected for the provisional ROW. Instead, the line was re-routed between Str 137 and Str 145, as described in Section 4.1.12. As no construction is planned, no additional field survey or subsurface testing of this reroute is required.

11.6.2.9.12 ROW Re-route Structure 137 to Structure 145 (old series 317 to 323)

A section of the provisional ROW was realigned eastwards between Str 137 and Str 145 (downslope) to avoid the steep, unstable talus slope traversed by the original alignment. During June 2016, a pedestrian survey was conducted between Str 138 and 140 to ground-truth the in-office assessment of low potential for this section of the ROW. Terrain in this section of the ROW was found to consist of moderately to steeply sloping terrain with a southeastern aspect and rocky outcrops. It is more accessible than the original alignment, with a forest cover of regrowth western redcedar, hemlock and alder (VRI age-classes 2 and 3). The area is dissected by sloping rocky drainages interspersed with low-lying, poorly drained benches. No CMTs were identified and no subsurface testing was conducted. Based on the amount of logging disturbance, absence of level, elevated banks associated with watercourses, and presence of steep, rocky slopes, the ROW between Str 137 and Str 145 is assessed as having low archaeological potential and no further inspection is required.

11.6.2.9.13 Site 30 – Proposed Bridge Location - Wedeene FSR

During the June 2016 field survey, a location proposed for a new bridge (identified as Site 30) at approximately 32 km on the Wedeene FSR was assessed for archaeological potential. Terrain at the creek crossing consisted of hummocky, uneven and poorly drained banks flanking a rocky creek-bed. The area has been disturbed by logging, road construction and adjacent rail construction. Forest cover comprises regrowth hemlock, poplar and alder with an understory of salmonberry, thimbleberry, horsetail and ferns. The Site 30 creek crossing is assessed as having low archaeological potential due to the absence of level, elevated landforms, regrowth forest cover and extent of previous disturbance. No subsurface testing was conducted and no further archaeological investigation is required.

11.6.2.9.14 Proposed Road Construction and Upgrades

At the time of the 2015 field assessment, no access plan had been prepared and therefore no specific proposed new roads or road upgrades were assessed. The access road plan information was provided and assessed during the 2016 field program. The majority of proposed new access roads fall within lands assessed during the 2015 field program as part of the 200 m buffered provisional transmission line ROW. The proposed road access plan will include 23.8 km of new road construction and various reconstruction road upgrades. An in-office assessment of proposed roads outside lands previously assessed for other project components was conducted. The assessment included review of biophysical maps, VRI forest age-class data, and results from adjacent field assessments to identify roads, which may affect lands rated as having moderate or high archaeological potential. The majority of these road sections proved to be within steeply sloping terrain with VRI age-classes 2 and 3 or within low-lying, undifferentiated and poorly drained terrain with VRI age-classes 1 and 2, all assessed as low archaeological potential.

Several segments of proposed road construction and upgrade are in proximity to known archaeological resources, watercourses and/or lands identified as high potential during the field survey. In-field assessment was recommended for 10 segments of proposed new road and reconstruction access upgrades. These 10 segments were inspected in June 2016. As stated above, all other proposed new and reconstruction roads were assessed in-office as low potential and no field assessment was conducted. The results of new and reconstruction access road field assessments are summarized in **Table 11.6-3**.

Table 11.6-3: New and Reconstruction Access Road Assessment Results

Road ID	Location	Date Assessed	Subsurface Test Locations	Assessment Results
Thunderbird West FSR STR 210	Access to Str 18 to Str 21	June 9, 11, 2016	LOC_CV-4 LOC_CV-5	Moderately sloping terrain with southeastern aspects interspersed with low-lying wetlands. Forest cover consists of poplar, fir, hemlock, cottonwood and cedar. The majority of forest cover is regrowth but mature stands are present along the major creeks. CMT site GcTd-86 consisting of one rectangular bark-stripped cedar was identified approximately 40 m from

Road ID	Location	Date Assessed	Subsurface Test Locations	Assessment Results
				the existing road. No impacts are anticipated during construction. Two level, elevated creek banks were tested with a total of 13 subsurface tests. All tests negative for archaeological remains.
Reconstruction Road 1218R, R07737 D 4 0835	Access to Str 24 and Str 25	June 12, 2016	N/A	Moderately sloping terrain with a northwestern aspect interspersed with undifferentiated low-lying wetlands. Forest cover consists of regrowth fir, hemlock, cedar and poplar. Previous disturbance from logging and road construction. Assessed as low archaeological potential.
Reconstruction Road 1010R	Access to Str 5	June 13, 2016	N/A	Undifferentiated low-lying wetland. Forest cover consists of regrowth fir, hemlock, cedar and poplar. Previous disturbance from logging and road construction. Assessed as low archaeological potential.
New Road from BR13 PTPL	Access to Str 84	June 15, 2016	N/A	Gently to moderately sloping with west aspect and interspersed with low-lying wetlands. Forest cover consists of regrowth fir, hemlock and poplar with some crabapple trees . Previous disturbance from logging and road construction. Assessed as low archaeological potential.
Reconstruction Road 1064R/CAL-001	Access to Str 89	June 15, 2016	N/A	Gently to moderately sloping terrain with a western aspect interspersed with low-lying wetlands. Regrowth forest cover of hemlock and fir. Previous disturbance from logging and road construction. Assessed as low archaeological potential.
Reconstruction Road Dubose Side Rd 1031, 1033R, 1034R, 1035R	Access to Str 62 to Str 68	June 14, 2016	N/A	Gently to moderately sloping terrain with a western aspect interspersed with low-lying wetlands. Regrowth forest cover of hemlock, poplar and fir. Previous disturbance from logging and road construction. Assessed as low archaeological potential.
Reconstruction Road 1048R	Access to Str 76	June 14, 2016	N/A	Undifferentiated, low-lying, poorly drained terrain. Forest cover consists of hemlock, fir and poplar. Previous disturbance from logging and road construction. Assessed as low archaeological potential
Reconstruction Road 1057R	Access to Str 70	June 14, 2016	N/A	Undifferentiated, low-lying, poorly drained terrain. Forest cover consists of hemlock, fir and poplar. Previous disturbance from logging and road

Road ID	Location	Date Assessed	Subsurface Test Locations	Assessment Results
				construction. Assessed as low archaeological potential.
Reconstruction Road 1080R, 1081R	Access to Str 138 to Str 142	June 7, 2016	N/A	Moderate to steeply sloping terrain with rocky outcrops and uneven, sloping creeks with poorly defined banks. Previous disturbance from existing road and logging. Assessed as low archaeological potential.
Reconstruction Road to Clague Mountain Trail	Access to Str 158	June 7, 2016	N/A	Gently to moderately sloping terrain with southern aspects and regrowth forest cover of hemlock, fir, cedar and alder. Previous disturbance from logging and road construction. Assessed as low archaeological potential.

11.6.2.10 Archaeological Field Survey – Archaeological Sites

No archaeological resources other than CMTs were discovered during the AIA.

A total of 193 newly identified CMTs attributable to 15 new CMT sites and two previously recorded CMT sites were recorded during the field survey program for TKTP (**Table 11.6-4**). CMT sites were identified mainly near the SKA substation on either side of the Lakelse River Crossing and east of Clague Mountain. There are 226 distinct features recorded amongst the 193 new CMTs, because some trees exhibit evidence for more than one modification event. A detailed summary of CMT features by site is presented in **Table 11.6-5**. The majority of CMT features recorded (n=177) were bark stripped (tapered=79, lenticular=31, rectangular=60 and unknown=7). Features that were recorded as “unknowns” could not be identified in the field due to tree-fall, grown-over bark lobes or rotten trees. Aboriginal logging features were also recorded (n=24) including test hole trees (n=15), kindling collection trees (n=6), a notch (n=1), a cultural burn scar (n=1), and a blazed tree scar (n=1).

Table 11.6-4: Culturally Modified Tree Sites Identified or Re-visited in 2015

Site #	Temp. Site ID	Date Identified/Re-visited	Location	Total # CMTs	Update to Existing Site?
GcTd-78	SITE10002	14-April-2015	E side of ROW between Str 3 (196) and Str 5 (197)	1	No
GcTd-79	SITE20002	14-April-2015	Approximately 20 m SE of Str 14 (205)	1	No
GcTd-80	SITE20003	15-April-2015	E side of ROW between Str 14 (205) and Str 15 (206)	2	No
GcTd-81	SITE20005	16-April-2015	W side of ROW, between Str 17 and Str 18 (NE of old 208)	3	No
GcTd-82	SITE20006	16-April-2015	Throughout ROW, E and S of Str 19 (old 209)	12	No
GcTd-30	SITE20007	18-April-2015	Approximately 200 m E of Str 37 (old 226) within LSA	1 new 6 total	Yes
GcTd-83	SITE20008	21-April-2015	Throughout ROW and into LSA, S of Str 22 and E of Str 23-24 (NE of old Str 212)	46	No
GcTd-84	SITE30009	21-April-2015	Outside of W boundary of LSA on N bank of Lakelse River	3	No
GcTd-85	SITE30010	21-April-2015	N bank of Lakelse River; E side Option 2 Lakelse re-route	2	No
GcTd-29	SITE30011	23-April-2015	Throughout ROW between Str 9 and Str 11 (old 202 and 201)	41 new 117 total	Yes
GcTd-86	SITE30012	22-April-2015	Outside of LSA on S side of Thunderbird West FSR	1	No
GcTd-87	SITE30013	22-April-2015	Within W side ROW on the N bank of Lakelse River, W of Str 21 (SW of old 210)	16	No
GcTd-88	SITE 30013B	22-April-2015	E side ROW on the N bank of Lakelse River, E of Str 21 (SE of old 210)	1	No
GcTd-89	SITE30014	24-April-2015	Slope above N bank of Lakelse River, encompassing and extending SE of Str 22	29	No
GaTe-6	SITE30015	4-May-2015	W side ROW W of Str 155 (between old Str 329 and 328	13	No
GaTe-7	SITE30016	6-May-2015	W side of ROW at Str 147 (between old 324 and 325	20	No
GaTe-8	SITE30017	10-June-2015	NE side of Mount Clague Trail within LSA, WNW of Str 158 (W of old 330)	1	No
Total Newly Recorded CMTs				**193**	

Notes: CMT = cultural modified tree; FSR = Forest Service Road; ROW = right-of-way; E = east; ID = identifier; LSA = Local Study Area; NE = northeast; NW = northwest; S = south; SE = southeast; SE = southwest; Str = [provisional] structure; W = west

Table 11.6-5: Summary of Culturally Modified Tree Feature Types by Site within the Local Study Area

Borden #	Temporary Site ID	Bark Stripped				Aboriginally Logged		Tool Marks Present?			Tool Mark Type		
		Tapered	Lenticular	Rectangular	Unknown	Test Hole	Other	Y	N	Unknown	Metal	Stone	Unknown
GcTd-78	SITE10002	1								1			
GcTd-79	SITE20002	1								1			1
GcTd-80	SITE20003	1	2						3				
GcTd-81	SITE20005	1		2					3				
GcTd-82	SITE20006	6	5	1				2	10				1
GcTd-30	SITE20007	1							1				
GcTd-83	SITE20008	18	3	17	3	7	2	22	23	5	4	4	14
GcTd-84	SITE30009			1		2		3			2		1
GcTd-85	SITE30010	1		1		2	1	5			2	2	1
GcTd-29	SITE30011	17	10	16	1			6	34	4	2		4
GcTd-86	SITE30012			1				1					2
GcTd-87	SITE30013	5	4	3		2	6	11	10		6		5
GcTd-88	SITE 30013B		1						1				
GcTd-89	SITE30014	15	4	10	2			9	22		1	1	7
GaTe-6	SITE30015	10		7		1		6	4	8		5	1
GaTe-7	SITE30016	1	2	1	1	1		1		22			1
GaTe-8	SITE30017	1							1				
Total		**103**	**79**	**31**	**60**	**7**	**15**	**9**	**66**	**112**	**41**	**17**	**12**

Notes: CMT = cultural modified tree; N = no; Y = yes

11.6.2.10.1 Updates to Previously Recorded Sites

11.6.2.10.1.1 GcTd-29

Big Pine Heritage originally recorded this site in 2002 during an assessment of a proposed forestry cutblock. It was reported to consist of 76 CMTs (63 tapered bark-strips and 13 rectangular bark-strips). Amec Foster Wheeler revisited the site in April 2015. The original site boundary is located within the western side of the clearing area between structure 201 and structure 203 (old series), approximately 5.8 km southwest of the Terrace Airport and 1.8 km northeast of the Lakelse River. An additional 41 western redcedar CMTs were recorded during the site revisit, some with two or three scars. There were a total of 44 bark stripped features (16 rectangular scars, 17 tapered scars, 10 lenticular scars, and one scar shape could not be recorded). Two CMTs are standing dead, 18 CMTs are fallen dead; and 21 CMTs are standing alive. A total of 6 CMTs have tool marks (**Photo 11.6-1**). There are now a total of 117 CMTs recorded from this site. The site boundary was extended to the east to encompass the 41 additional CMTs not previously documented. The estimated date of the CMTs is pre-1846 AD, based on the size of their healing lobes, presence of pre-1846 CMTs in the area and a confirmed dendrochronological date of AD 1835 from one of the previously recorded CMTs from the site. The newly recorded trees have not been cored for dendrochronological dating.

Photo 11.6-1: View north of rectangular bark stripped CMT#19 at GcTd-29 (23/04/15)

11.6.2.10.1.2 GcTd-30

Big Pine Heritage also recorded this site in 2002 when it was reported to consist of five bark-stripped cedar CMTs. Two CMTs were rectangular bark-strips and three displayed tapered bark-strip scars. Amec Foster Wheeler revisited GcTd-30 in April 2015, as it is located within the LSA east of structure 226 (old series). The site is located 4 km east of the Lakelse River outlet from Lakelse Lake and 11 km southwest of Terrace. One additional CMT was recorded northwest of the original site boundary. The new CMT is a tapered bark-stripped western redcedar. The original site boundary was extended to the northwest to encompass the new CMT. A portion of the site has been logged (TSL A65308), although CMTs recorded in 2002 remain intact. The estimated date of the CMT is pre-1846 AD, based on lobe size and occurrence of other pre-1846 CMTs in the region. The tree was not cored.

11.6.2.10.2 Newly Recorded Sites

11.6.2.10.2.1 GcTd-78 (temporary number: SITE10002)

Amec Foster Wheeler recorded this site in May 2015. The site is within the east side of the clearing area buffer between structure 196 and structure 197 (old series). The site is located south of Terrace, approximately 8.3 km east of the confluence of the Lakelse and Skeena Rivers. GcTd-78 consists of a single, tapering bark-stripped western redcedar with possible tool marks. The site boundary site measures 20 m x 20 m, including a 10 m buffer around the CMT. The estimated date of the CMT is pre-1846, based on lobe size and presence of other pre-1846 CMTs in the region.

11.6.2.10.2.2 GcTd-79 (temporary number: SITE20002)

Amec Foster Wheeler recorded this site in April 2015 adjacent to proposed structure 205 (old series). The site is located south of Terrace and 8.8 km east-southeast of the confluence of the Lakelse and Skeena Rivers. The site is a single, tapered bark-stripped cedar tree with possible tool marks at the base of the scar (where the wood is too rotten to make a conclusive determination). The site measures 20 m x 20 m, including the buffer. The estimated date of the CMT is pre-1846, based on lobe size and presence of other pre-1846 CMTs in the region.

11.6.2.10.2.3 GcTd-80 (temporary number: SITE20003)

Amec Foster Wheeler recorded the site in April 2015. The site is located on the eastern side of the clearing area buffer between structure 205 and 206 (old series). It is located 10 km south of Terrace and 2 km northeast of the Lakelse River. GcTd-80 comprises two bark-stripped cedar trees. One tree exhibits a lenticular scar and the other has a tapered or triangular scar. The site boundary measures 20 m x 32 m north–south. The estimated date of the CMT is pre-1846, based on lobe size and presence of pre-1846 CMTs in the region.

11.6.2.10.2.4 GcTd-81 (temporary number: SITE20005)

Amec Foster Wheeler recorded GcRd-81 in April 2015. It is located on the western side of the clearing area buffer, approximately 70 m northwest of structure 208 (old series). The site is approximately 1 km north of the Lakelse River, 10.5 km south of Terrace. This site comprises three cedar bark-stripped CMTs. Two specimens (CMT#1 and CMT#2) have large rectangular scars and one (CMT#3) has a tapered/triangular scar. The site boundary measures 24 m x 42 m northeast–southwest. The estimated date of the CMT is pre-1846, based on lobe size and presence of pre-1846 CMTs in the region.

11.6.2.10.2.5 GcTd-82 (temporary number: SITE20006)

Amec Foster Wheeler recorded the site in April 2015. The site is situated on the steeply sloping bank of an unnamed tributary of the Lakelse River, 11.8 km south of Terrace and approximately 500 m north of the Lakelse River. GcTd-82 comprises 12 bark-stripped cedar CMTs. Six have triangular scars (tapered), five have lenticular scars and one has a rectangular scar. CMT #2 and CMT #10 were fallen and rotten. Tool marks were observed on CMT #4 and CMT#11. On CMT #5, the bark strip was abandoned/not completed, and bark is still present at the top of the tree. The site boundary measures 62 m x 293 m N-S. The estimated date of the CMT is pre-1846, based on lobe size and presence of pre-1846 CMTs in the region.

11.6.2.10.2.6 GcTd-83 (temporary number: SITE20008)

Amec Foster Wheeler recorded GcTd-83 in April 2015. The site was initially recorded as several smaller sites and then amalgamated as a result of post-field data analysis. The site is located 12.3 km southwest of Terrace on the level to steeply sloping south bank of the Lakelse River. The site boundary measures 162 m x 562 m and extends northwest–southeast across the LSA north of structure 212 (old series). The forest cover within the site is VRI age class 9 and there are no other CMTs beyond old cutblock boundaries outside the LSA, suggesting the site may have extended considerably further along the sloping terrace into the cutblocks. The site consists of 46 CMTs. The majority of CMTs have one feature, with four CMTs having two features. There is a total of 41 bark-stripped CMTs at the site, including tapered scars (n=18), large rectangular scars (**Photo 11.6-2**) (n=17), lenticular scars (n=3) and unknown scar shapes (n=3). Seven Aboriginally logged trees include test hole trees (**Photo 11.6-3**) (n=7), a single notched tree and a single kindling collection tree. The estimated age of the CMTs is pre-1846, based on lobe size and presence of other pre-1846 CMTs in the region.

Photo 11.6-2: View northeast at rectangular bark strip scar tool marks observed on CMT#4 in GcTd-83

Photo 11.6-3: View southeast showing test hole CMT#9 at GcTd-83 (9/06/15)

11.6.2.10.2.7 GcTd-84 (temporary number: SITE30009)

Amec Foster Wheeler recorded this site in April 2015. It is situated on the north side of the Lakelse River within the LSA, southeast of provisional structure 210 (old series). The site is 12.8 km southwest of Terrace and 40 m southwest of the Kilometre Post 11 marker on the nearby CN Rail track. GcTd-84 consists of three western redcedar CMTs. CMT#1 and CMT#2 are Aboriginal test-holes and exhibit metal tool marks. CMT#3 is a large rectangular bark-stripped CMT. The site measures 20 m x 114 m. The estimated date is pre-1846 based on tree stand age class 9 (250+ years), lobe size, tree modification (e.g. aboriginally logged, tested) and presence of abundant pre-1846 CMTs throughout the region.

11.6.2.10.2.8 GcTd-85 (temporary number: SITE30010)

Amec Foster Wheeler recorded GcTd-85 in April 2015. The site is located on the north bank of the Lakelse River within the eastern half of the clearing area for the Option 2 (east) Lakelse River Crossing re-route, south of structure 210 (old series). The site is 12.8 km southwest of Terrace and 5.5 km northwest of the Lakelse River outlet from Lakelse Lake. The site consists of two standing CMTs. CMT#2 is a cedar tree with four modification features (large rectangular bark-strip, two test holes and kindling collection scars) exhibiting both stone and metal tool marks. CMT#3 is a tapered scar bark strip exhibiting metal tool marks. One post-1846 CMT was also identified. It is a blazed western hemlock tree, exhibiting metal tool marks. The site area measures 20 m x 53 m. The estimated date is pre-1846 based on tree stand age class 9 (250+ years), lobe size, type of modification (i.e. logged, tested) and presence of other pre-1846 CMTs in the region.

11.6.2.10.2.9 GcTd-86 (temporary number: SITE30012)

Amec Foster Wheeler recorded the site in April 2015. It is located at the base of a bluff on the north side of an unnamed creek approximately 580 m northeast of its confluence with the Lakelse River and 440 m northeast of the CN Rail Kilometre Post 10 marker. The site was observed beside the decommissioned Thunderbird West FSR (utility task vehicle–accessible), en-route to the provisional ROW. It is located outside the LSA and should not be affected by the Project. The site comprises a single cedar bark-stripped CMTs exhibiting tool marks. CMT#1 is a large rectangular scar. The site measures 20 m x 20 m. The estimated date of the CMTs is pre-1846 based on lobe size and presence of additional pre-1846 CMTs in the region.

11.6.2.10.2.10 GcTd-87 (temporary number: SITE30013)

Amec Foster Wheeler recorded this site in April 2015. It is situated along the base of a bluff less than 60 m from the Lakelse River and about 70 m west of the CN Rail grade. The site is located within the western Lakelse River Crossing re-route and extends outside the LSA. The site consists of two standing dead CMTs and 14 standing live CMTs. There are up to four modification features on each CMT. The site comprises (1) 12 cedar bark-strips (five tapered; three large rectangular; four lenticular); (2) two test holes (one cedar and one hemlock); (3) six “other” category modification features on cedar trees (one burned, one blazed and four kindling collection) and (4) one “other” category modification feature on a hemlock tree (blaze). The site area measures 82 m x 475 m. The estimated date of the CMTs is pre-1846 based on lobe size and presence of pre-1846 CMTs throughout the region.

11.6.2.10.2.11 GcTd-88 (temporary number: SITE30013B)

Amec Foster Wheeler recorded the site in April 2015. GcTd-88 is located 121 m northeast of the Lakelse River, 6.3 km northwest of Lakelse Lake and 9.1 km southeast of the confluence of the Skeena and Lakelse Rivers. It is situated within both the provisional ROW and the western part of the clearing area buffer for the Option 2 Lakelse River Crossing re-route. The site consists of one standing living red cedar tree with a lenticular bark-strip. The site measures 20 m x 20 m, corresponding to a 10 m buffer around the tree. The estimated date of the CMTs is pre-1846 based on lobe size and presence of pre-1846 CMTs in the region.

11.6.2.10.2.12 GcTd-89 (temporary number: SITE30014)

Amec Foster Wheeler recorded GcTd-89 in April 2015. GcTd-89 is located approximately 13 km south of Terrace and 5.8 km northwest of the Lakelse River outlet from Lakelse Lake. The site is located south of the Lakelse River between the provisional ROW centre line and the Option 1 Lakelse River Crossing re-route. A total of 29 bark-stripped CMTs were recorded at the site: 25 were standing and alive, two were fallen, and two were standing but dead. Several of the CMTs had more than one modification for a total of 15 tapered (triangular) scars, 10 rectangular scars, four lenticular scars and two unknown scar types. One cedar tree with a historical blaze was identified within the site boundary but clearly post-dates 1846 and is not included in the totals listed above. One of the CMTs displays a pattern of tool-marks characteristic of those made by metal chisels (**Photo 11.6-4**), denoting a potential early-Contact period date for this feature. The site measures 320 m x 220 m. The estimated date of the CMTs is pre-1846, based on lobe size and presence of pre-1846 CMTs throughout the region.

Photo 11.6-4: View showing CMT#26 at GcTd-89; long, parallel scars are interpreted as chisel marks

11.6.2.10.2.13 GaTe-6 (temporary number: SITE30015)

Amec Foster Wheeler recorded GaTe-6 in May 2015. The site is located west of Kitimat on the lower slopes of the Kitimat River Valley, 8.3 km northwest of the Kitimat River estuary and 2.2 km southeast of Bowbyes Lake on the north bank of an unnamed tributary of the Kitimat River. The site is within the western half of the clearing area buffer between structure 328 and structure 329 (old series). A total of 13 cedar CMTs were recorded at the site: three are standing and alive and 10 are standing but dead. The majority of the CMTs exhibit a single modification, with the exception of four trees that have two to three modifications each. There are 18 tapered (triangular) bark-strip scars, six large rectangular scars and one test-hole tree with stone tool marks. The site measures 215 m x 112 m. The site is estimated to date before 1846 based on lobe size, evidence of stone-tool use, and the presence of other pre-1846 CMTs throughout the region. The trees were not cored for dendrochronological dating.

11.6.2.10.2.14 GaTe-7 (temporary number: SITE30016)

The site was recorded by Amec Foster Wheeler crew lead Ryan Dickie on May 6th, 2015. The site is located west of Kitimat, on an elevated slope at the base of the west side of the Kitimat River valley, 10.3 km northwest of where Kitimat River flows into Minette Bay, 4.7 km east-northeast of the peak of Mt.Clague, and 1.1 km southeast of Bowbyes Lake. The site is located on the banks of an unnamed tributary of the Kitimat River between Str 147 and 148 (old series 324 and 325). The site consists of a total of 20 western redcedar bark stripped CMTs, 11 standing dead, eight standing alive and one fallen dead. There are a total of 16 tapered (triangular) scar CMTs; two CMTs with scar lobes which have completely grown over and the descriptor could not be identified; one CMT with three tapered scars and one scar which has grown over; and one CMT with both another scar (lenticular) and large rectangular scar. See CMT table for details. The site boundary measures 216 x 164 m east-west and is likely to extend outside the project area. The estimated age of the CMTs is pre-1846 AD, based on lobe size, presence of Aboriginally logged trees in the area and presence of pre-1846 CMTs in the region.

11.6.2.10.2.15 GaTe-8 (temporary number: SITE30017)

Amec Foster Wheeler recorded this site in June 2015. GaTe-8 is situated on the lower slopes of Mount Clague, 5.2 km northwest of the intersection of Lahakas Boulevard and Nalabila Boulevard in Kitimat, 4.2 km east of the peak of Mount Clague and 2.4 km south of Bowbyes Lake. The site in located within the LSA but outside of the clearing area buffer on the provisional ROW centre line on the north side of the Clague Mountain Hiking Trail. The CMT was identified en-route to inspect suspected CMTs reported by the Amec Foster Wheeler plant biology team. The site comprises a single tapering bark-stripped redcedar CMT. Two non-protected cultural heritage resources (CHR9 and CHR10) consisting of historical logging debris and a blazed tree, respectively, were observed in proximity to site GaTe-8. The site is estimated to be pre-1846 based on lobe size and the presence of other pre-1846 CMTs in the region.

11.6.2.11 Archaeological Field Survey – Cultural Heritage Resource Sites

During the archaeological field survey, CHR sites were identified within the LSA and/or clearing area of the provisional ROW. CHR sites are defined as evidence of human activities on the landscape but cannot be positively determined to be older than AD 1846 and therefore are not protected by the *HCA*. However, these heritage resources provide valuable insights into the historical period, particularly into land use patterns, including continued traditional Aboriginal land use.

In 2015, 12 CHR sites were identified; they are portrayed on the heritage resource map-set. **Table 11.6-6** shows a summary of pertinent information about the CHR sites observed in 2015.

Table 11.6-6: Cultural Heritage Resources Identified in 2015

CHR #	Identified	Location	Type	Comments
CHR1	14-April-2015	W of Str 3 between Str 195 and Str 196 (old series)	Trapping and land use	Wood-box trap suspended in tree with log support
CHR2	24-April-2015	N bank of Lakelse River	Trail and blazed trees	Historical trail with eight axe-blazed trees along the river terrace edge
CHR3	17-April-2015	Between Str 21 and Str 22	Historical logging	Cable-scarred tree for historical logging activities
CHR4	23-April-2015	Str 10 (old 201)	Blazed trees	Six historical blazed trees near site GcTd-29
CHR5	24-April-2015	S bank of Lakelse River	Blazed tree	Axe cuts at base of large natural scar on western redcedar tree
CHR6	24-April-2015	S bank of Lakelse River	Blazed tree	One historical axe blaze
CHR7	24-April-2015	S bank of Lakelse River	Blazed tree	One historical axe blaze
CHR8	09-May-2015	E of Str 101 (between old and 285	Historical logging	Cut tail holding stump for historical cable logging
CHR9	10-June-2015	Clague Mountain locality	Historical logging	Historical logging debris in proximity to CMT site GaTe-8
CHR10	10-June-2015	S bank of Lakelse River	Blazed tree	Historical blazed tree in proximity to CMT site GaTe-8
CHR11	14-June-2015	Reroute option within Wang/Zhang property; SSE of Str 2	Trapping and land use	Wood-box trap suspended in tree with log support
CHR12	21-April-15	Re-route Option 2, N bank Lakelse River	Blazed tree	Historical blazed tree in proximity to CMT site GcTd-85

Notes: CHR = cultural heritage resource; CMT = culturally modified tree; E= east; N = north; S = south; Str = structure; W = west

11.6.2.11.1 Blazed Trees

Blazed trees are trees that show scarring or tool marks from metal tools for activities other than bark harvesting or aboriginal logging. Although blazed trees can originate from traditional activities (i.e. trail marking) and pre-date 1846 AD none of the blazed trees observed during the assessment meet that criteria. CHR 4 consists of a grouping of six blazed trees in close proximity to GcTd-29, all of which appear to have been associated with recent logging cut block delineation. CHR 5 is a single blazed tree displaying axe cuts at the base of a large natural scar on a western redcedar tree, in association with an old logging skid trail on the south bank of the Lakelse River. CHR 6 and CHR 7 are similar axe-cut trees along the south bank of the Lakelse River.

11.6.2.11.2 Historical Logging Features

Logging has been conducted in the Kitimat Valley since the earliest attempts at settlement in the area by Euro-Canadian people, but which is later than many other areas along the BC Coast. Some kinds of logging practices provide evidence of older methods of timber harvesting and transportation or clues about when a cutblock was worked by loggers. Characteristic examples of CHRs that denote historical logging sites include: (1) logging cables and cable scars around the base of trees used as anchors for high-lead yarding; (2) springboard notches on stumps, typically a metre or more above the ground, but rarely as deep as the traditional test-holes made by First Nations' forest-users to inspect the soundness of a tree; (3) abandoned remnants or wreckage of logging equipment and machinery; and (4) remains of camps, log dumps and yarding areas.

In the TKTP LSA, CHR3 was a cable-scarred tree recorded amongst several other CHR sites on the south side of the Lakelse River. CHR8 is a "cut tail" observed on the upper portion of a mature western redcedar in the Iron Mountain locality. A cut tail was used for holding cable equipment for historical logging activities. CHR9 comprises several pieces of logging machinery adjacent to the Clague Mountain Trail and a blazed tree. CHR10 is a single blazed tree adjacent to the Clague Mountain Trail, in apparent association with CHR9 but suspected to be a trail marker.

11.6.2.11.3 Trapping and Land Use Features

Two wooden box traps supported by logs (CHR1 and CHR11) were observed along the provisional ROW between structure 195 and structure 196 (old series) within private property (**Photo 11.6-5**). These are likely to be marten traps and indicate the presence of a trapline that has been inactive.

Photo 11.6-5: View southwest showing disused marten box trap (CHR 11), supported with log (14/06/15)

11.6.2.11.4 Lakelse South Bank Trail

A well-defined trail was encountered on the south bank of the Lakelse River, paralleling the river. The trail is presently used as a game trail, which has kept the alignment of the trail visible through the forest (**Photo 11.6-6**). Several axe-blazed trees are situated along either side of the trail, at approximately 10 m to 20 m intervals. Subsurface testing was carried out along the river bank beside the trail, but no archaeological evidence for pre-Contact antiquity was found. The trail was recorded as CHR2 (incorporating blazed trees, CHR2-1 to CHR2-5) and attributed to use of the landscape by hunters, trappers and early loggers. However, its proximity to the Lakelse River is strongly suggestive of a more ancient origin.

Burton (2015) references a “walking trail” between the traditional villages of Kitamaat and Gitaus on the Skeena River near Kitselas Canyon. Her reference came from a map of Coast Tsimshian transportation/trade networks in 1750, published by Cove and MacDonald (1987). The map was reviewed, and it shows a trail commencing at the Kitimat River estuary, proceeding up the west side of the Kitimat Valley, crossing the Little Wedeene and Wedeene Rivers and passing along the east side of Lakelse Lake before hitting the Skeena River near the mouth of Zymoetz River. This *may* be the same route identified in the LRMP concordance table (**Appendix A**) as a “grease trail,” but is described as “crossing the Little Wedeene and Lakelse Rivers.” Although the Lakelse River South Bank Trail (name coined for present study) seems like an obvious route from the Kitimat Valley to the Skeena River, unless further site-specific traditional knowledge is forthcoming about its potential antiquity, this trail can only be verified as being used historically.

Photo 11.6-6: View south (upstream) along historical trail (CHR2), south bank of Lakelse River (24/04/15)

11.7 Archaeology Effects Assessment

11.7.1 Potential Effects

Practically all of the potential effects on archaeological and other cultural heritage resource sites will occur during the clearing/construction phase of TKTP (due to ground-disturbing and vegetation clearing activities), with only a low possibility that any potential effects will arise during the operation/maintenance of the transmission line. The closure and post-closure phases are not expected to result in any potential effects. The potential Project effects result from various kinds of land-altering activities that directly affect archaeological and other heritage sites. Project components in which direct effects on archaeological sites could occur are presented in **Table 11.7-1** and shown in **Appendix G.2**. Project components that could affect non-protected cultural heritage are presented in **Table 11.7-2**.

Table 11.7-1: Potential Project Effects on Archaeological Sites

Project Component	Project Phase	Potential Project Effect	Identified Archaeological Sites	Project Component	Total CMTs within Clearing Area	Recommendations
Transmission Line ROW	C	Land-altering activities affecting sites	GcTd-78	Structure 3	1	Avoidance through redesign. If not feasible collection of post-logging dates under a Section 12 Permit.
	C	Land-altering activities affecting sites	GcTd-29,	Structure 9	17	Update site form. Avoidance through redesign. If not feasible collection of post-logging dates under a Section 12 Permit. 14 in clearing area and 3 within new access road.
	C	Land-altering activities affecting sites	GcTd-79,	Structure 14	1	Avoidance through redesign. If not feasible collection of post-logging dates under a Section 12 Permit. Inside MM-2 Clearing Standard (See Section 3.x for definition of MM-2).
	C	Land-altering activities affecting sites	GcTd-82,	Structure 19	2	Avoidance through redesign. If not feasible collection of post-logging dates under a Section 12 Permit. One falls within new access road ROW and the other within HH-1 clearing standard (see Section 3.X for definition of HH-1)
	C	Land-altering activities affecting sites	GaTe-7	Structure 147	10	Avoidance through redesign. If not feasible collection of post-

Project Component	Project Phase	Potential Project Effect	Identified Archaeological Sites	Project Component	Total CMTs within Clearing Area	Recommendations
						logging dates under a Section 12 Permit.
	O, CL, PC	ROW maintenance affecting sites	Uncertain*	n/a	Uncertain	To be determined
New Access Road ROWs.	C,	Land-altering activities affecting sites	None*	n/a	None	No further action required

Notes: * C = Clearing/Construction Phase; * surveys to be completed 2016CL = Closure Phase; KIT = Kitimat; M = Minette; O = Operation/Maintenance Phase; PC = Post-closure Phase; ROW = right-of-way; SKA = Skeena;

Table 11.7-2: Potential Project Effects on Cultural Heritage Resource Sites

Project Component	Project Phase	Potential Project Effect	Likelihood of Occurrence	Identified Cultural Heritage Resource Sites
Transmission Line ROW	C	Land-altering activities affecting sites – i.e. removal of CMTs or disturbance of archaeological sites by transmission ROW and access road clearing	Likely	CHR11
	C	Land-altering activities affecting sites – i.e. removal of CMTs or disturbance of archaeological sites by transmission ROW and access road clearing	Not likely	CHR2, CHR3
	O, CL, PC	Right-of-way maintenance affecting sites	Not likely	CHR2, CHR3, CHR11
New access roads	C, O, CL, PC	Land-altering activities affecting sites – i.e. removal of CMTs or disturbance of archaeological sites by transmission ROW and access road clearing	Not likely	None

Notes: C = Clearing/Construction Phase; Cl = Closure Phase; KIT = Kitimat; MIN = Minette; O = Operation/Maintenance Phase; PC = Post-closure phase; ROW = right-of-way; SKA = Skeena; CHR = Cultural Heritage Resource

11.7.1.1 Clearing/Construction Phase

The majority of potential Project effects on archaeological and cultural heritage sites will occur during the clearing/construction phase. All potential effects are linked to activities in which land-altering activities take place, including new construction or reconstruction of existing access roads, clearing and any other ground-disturbing work that may be required along the transmission line ROW and erection of transmission structures. Effects may also occur during the development of aggregate borrow pits for the access roads and marshalling areas for lay-down and assembly of structure components.

11.7.1.2 Operation/Maintenance Phase

There is believed to be low potential for the Project to affect archaeological or cultural heritage resources during the operation/maintenance phase for TKTP, due to the lack of new ground disturbance. Through the operational life of the transmission line, trees along the margin of the clearing area may come to pose a hazard to the conductor or structures. If danger trees were CMTs attributable to sites previously affected during the clearing/construction phase, their removal would further affect the integrity of those sites. There is negligible chance of potential effects resulting from operation of the transmission line in lands where no archaeological sites were discovered during the AIA.

11.7.1.3 Closure Phase

No potential Project effects are expected to occur during the closure phase. No component of the closure phase will affect any lands that have not already been affected during earlier Project phases.

11.7.1.4 Post-Closure Phase

No Project effects will occur during the post-closure phase. No component of the post-closure phase will affect any lands that have not already been affected during earlier Project phases.

11.7.2 Proposed Mitigation

Effects on archaeological sites, specifically effects to sites by land-altering activities associated with the Project, can be avoided or minimized to some extent by mitigation measures. Mitigation measures for the Project are discussed below and summarized by phase in **Table 11.7-3**.

Based on the archaeological and heritage resource study, five protected archaeological sites and one CHR site will be affected by the Project. The five archaeological sites require protection and/or mitigation and were identified within the Project footprint or adjoining lands within the LSA. Additional, as-yet undocumented, archaeological sites may be discovered during follow-up AIA field studies to assess proposed re-routes that could not be inspected during 2015 and 2016 or along the routes of proposed and/or reconstruction roads outside the LSA. There is believed to be only a slight chance that unidentified archaeological sites will be encountered during construction. If any sites are identified, they can be managed through an Archaeology and Heritage Resources Management Plan or through implementing the protocols described in BC Hydro's *Best Management Practices – Managing for Heritage Resources*. For both options, the management plan will guide the identification, recording, assessment, consultation, avoidance and/or data recovery mitigation options.

Specific measures for mitigating effects to heritage resources are identified in the *BC Archaeological Impact Assessment Guidelines* (Archaeology Branch, 1998). Generally, site conservation by avoidance is the preferred strategy for sites or portions of sites threatened by proposed developments. Project redesign is the most commonly invoked version of this option, but in this instance is not feasible at all locations due to the restricted parameters of the ROW within the LSA. Mitigation in the form of data recovery (i.e. dendrochronological determinations of modification dates for CMTs within the ROW or clearing area) is a typical recommendation for

CMTs that can be dated by such means. Archaeological surveillance and/or monitoring is another type of mitigation, more often recommended for construction within lands with potential for containing sensitive archaeological remains other than CMTs to ensure that emergency impact management measures are undertaken if unanticipated archaeological remains (e.g. ancestral burials) are encountered.

Archaeological resources are non-renewable and mitigative measures such as Project design changes and site protection are preferred where conflicts between proposed developments and archaeological sites have been identified. In situations where such measures are not practicable (e.g. redesign options limited by environmental constraints), data recovery is undertaken to salvage information about archaeological and cultural heritage materials from a threatened site or affected portions of a site. Where adverse Project effects cannot be avoided by Project redesign, BC Hydro will work with qualified archaeological professionals and consult with the appropriate First Nations to develop a mitigation plan that takes into account the concerns of the affected communities, then present that plan to the Archaeology Branch for its endorsement.

Table 11.7-3: Mitigation Measures

Potential Effect	Valued Components	Mitigation Measures
Land-altering activities affecting sites – i.e. removal of CMTs or disturbance of archaeological sites by transmission ROW and access road clearing	Archaeological Site: bark-stripped CMTs	Clearing/Construction Phase: If avoidance not practicable, conduct, dendrochronological dating (tree-ring counts) of modification event on stem-round disk sample (or "cookie"), cut from harvested log under supervision of qualified archaeologist
	Archaeological Site: test-hole CMTs	Clearing/Construction Phase: possible dendrochronological dating of modification event on cookie, cut from log across the hole under supervision of qualified archaeologist
	Cultural Heritage Resource Site: blazed trees	No further action required
	Cultural Heritage Resource Site: historical logging remnants	No further action required
	Cultural Heritage Resource Site: trapping and traditional land use features (e.g. marten traps)	No further action required
	Cultural Heritage Resource Site: Lakelse South Bank Trail	Clearing/Construction Phase: Conduct post-construction inspection to ensure materials were not dropped or dragged across the trail during clearing or conductor-stringing

Notes: CMT = culturally modified tree; ROW = right-of-way.

11.7.2.1 Transmission Line – Skeena substation to Minette substation

As currently envisioned, five archaeological sites (GcTd78, GcTd-29, GCTd-79, GcTd-82 and GaTe-7) and three CHR sites (CHR2, CHR3 and CHR11) appear to be within the transmission line ROW or clearing area.

All of the archaeological sites comprise greater or lesser numbers of CMTs, most of which should return interpretable dendrochronological data. Revisions to the ROW or the LSA layout are not recommended as practicable solutions to avoiding interactions with protected CMTs during clearing/construction phase for the following reasons: (1) because CMTs are the most abundant archaeological resource in the Kitimat and Skeena Valleys; (2) because of the constraints of the Project within the LSA; and (3) because of the high likelihood that shifting the ROW or LSA would encounter additional, as-yet undiscovered CMTs. Instead, the Archaeology Branch will require that the removal of timber from CMT sites within the ROW and clearing area be conducted in accordance with a Section 12 (Site Alteration) Permit issued pursuant to the *HCA*. One of the conditions of this Permit will require concurrent data recovery in the form of collection of stem-round "cookies" from CMTs as they are felled during the clearing/construction phase. Selection and collection of the cookies is done under the direct supervision of the archaeologist identified as the Alteration Permit co-applicant. The cookies will be returned to a laboratory for dendrochronological analysis and reporting in fulfillment of the Permit conditions.

The most sensitive non-protected cultural heritage site (CHR2, the Lakelse South Bank Trail) is a fairly well maintained and marked route with no direct evidence of pre-Contact antiquity, at least within the LSA. Although the trail will pass beneath the transmission span across the Lakelse River, it should be protected from construction interactions due to its situation within the protected old forest stand by the river, which has been avoided through mitigation in design. For this reason, there is believed to be only a slight risk that ROW clearing operations or stringing conductors between the river-crossing structures might drop materials on the trail. A post-construction inspection should be carried out to ensure that measures adopted to prevent interactions with the riverside forest were effective in protecting the trail as well. This inspection would not need to be carried out by an archaeologist (e.g. could be done by environmental monitor). No further actions are recommended for the other CHR sites observed during the AIA field survey, as none is protected or as likely to be important to the descendent communities in this region.

11.7.2.2 Transmission Line – Minette Substation to Kitimat Substation Tie-in

No protected archaeological sites or cultural heritage resources were identified along this short segment of transmission line in Kitimat. Consequently, no recommendations for managing Project interactions with heritage sites is required.

11.7.2.3 Skeena Substation Tie-in

No protected archaeological sites were identified in the vicinity of the SKA substation. One CHR site (CHR11; wooden marten trap) is present in this location. No further action is recommended to mitigate Project interactions with this feature.

11.7.2.4 Minette Substation Tie-in

No protected archaeological sites or cultural heritage resources were identified in the vicinity of the MIN substation. No recommendations for managing Project interactions with heritage resources is required for this component.

11.7.2.5 Proposed New Access Road and Reconstruction

No protected archaeological sites or CHRs have been identified in the vicinity of any existing roads that were used to gain access to the LSA by the archaeology crews with the exception of GcTd-86 and CHR11. It was determined in-field that site GcTd-86 (a single CMT) is likely outside of the proposed Thunderbird West access road upgrade footprint. However, monitors should be on-site during clearing to ensure the site is not affected. It can be reasonably expected that roadwork may affect protected archaeological sites or CHR sites, particularly in the Lakelse River crossing locality where a high density of such resources are present. Additionally proposed road upgrades near the SKA substation may affect CHR11, a trap-set tree.

11.7.3 Residual Effects

Residual Project effects are anticipated on five archaeological sites, 31 CMTs and one CHR site within the transmission line ROW (**Table 11.7-4**). The potential for the Project to conflict with as-yet unidentified archaeological sites is considered to be low. With the implementation of proposed mitigation measures (i.e. dendrochronological data recovery from CMTs in Project footprint) where Project interactions cannot be avoided, information from archaeological sites pertaining to traditional First Nations land use within the LSA will be identified and recorded.

Table 11.7-4: Summary of Residual Effects

Potential Effect	Valued Component	Residual Effect (yes/no)	Rationale
Land-altering activities affecting sites – i.e. removal of CMTs or disturbance of archaeological sites by transmission ROW and access road clearing	Archaeological Sites (CMTs)	Yes – adverse	Likely not possible to avoid CMTs within proposed transmission line ROW or most of those on access roads, but these losses can be mitigated by obtaining dendrochronological dates at point of harvest
Land altering activities i.e. removal of CMTs will result in dendrochronological dating	Archaeological Sites (CMTs)	No – positive	Modification dates for CMTs harvested from Project ROW enhances understanding of antiquity and intensity of traditional forest utilization in Kitimat Valley
Land altering activities – i.e. removal of CMT wind-throws along margins of clearing area	Archaeological Sites (CMTs)	Yes – adverse	CMTs would have remained in wind firm forest settings if Project had not been constructed
Land altering activities - Improved access to mature redcedar stands adjacent to Project footprint	Cultural Heritage Resource Sites: traditional land use features	Yes – positive	Access to redcedar stands via the Project ROW may contribute to reconnection of First Nations communities to traditional life-ways
Land altering activities - Improved access to mature redcedar stands adjacent to Project footprint	Archaeological Sites (CMTs)	Yes – positive	Increased presence of local people in the landscape opened up by Project ROW may result in discovery and recording of new CMT sites
Land-altering activities affecting sites – i.e. removal of CMTs or disturbance of archaeological sites by transmission ROW and access road clearing	Cultural Heritage Resource Sites (traditional land use features)	Yes – adverse	Likely not possible to avoid in all cases

Notes: CMT = culturally modified tree; ROW = right-of-way.

11.7.4 Characterization of Residual Effects

The full characterization of residual effects on archaeological and CHR sites is presented in **Table 11.7-5**. Assessment for residual effect attributes includes context, magnitude, geographic extent, duration, frequency and reversibility, as described in **Section 3.3.8**.

The archaeological sites identified in 2015 and 2016 have low to moderate importance within the Kitimat Valley regional context. While CMTs are the most common archaeological resources found in the Kitimat Valley as a whole, their presence in the LSA provides evidence for traditional forest utilization in the Project area and contributes to an expanded understanding of settlement patterns, landscape archaeology and regional prehistory. In addition, it must be stressed that archaeological sites are finite in number and are non-renewable resources and that their position in the landscape is static. As such, the context is rated as high (**Table 11.7-5**) as the VC has low resilience to stress (physical alteration to the site). In addition, magnitude is ranked from medium to high, given that 31 of 151 (21%) of the CMTs will be lost and two out of the five CMT sites (40%) identified are small in area and the entire site will be lost. The direction of residual effects on CHRs are characterized as positive and adverse (**Table 11.7-4**). The context is high because resilience to stress is low and the magnitude is medium to high given an entire site may be lost. These residual effects are not anticipated to require further planning.

Table 11.7-5: Characterization of Residual Effects on Archaeological and Heritage Resources

Valued Component	Direction	Context	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
Archaeological Sites	Positive and Adverse	High	Medium to High	Point or site-specific	Long-term/permanent	Once	Irreversible
Cultural Heritage Sites	Positive and Adverse	High	Medium to High	Point or site-specific	Long-term/permanent	Once	Irreversible

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12 SUMMARY OF PROJECT AND RESIDUAL EFFECTS

The ESER concludes that following the implementation of in-design and standard BC Hydro construction mitigation, the Project will have adverse residual effects on some VCs. Residual effects will mainly result from vegetation clearing and site preparation for the transmission line ROW and new access roads. Overall, the potential Project effects are localized or site-specific, their frequency is intermittent as vegetation management is perpetuated throughout the operation/maintenance phase and in some cases, but not all, the effects are reversible with time and upon closure (decommissioning) of the Project. The primary exception, where potential Project effects are not likely reversible, are related to the construction of new permanent access roads. Activities related to construction of new access roads alter the land and its ecological components to the extent that a return to current ecological conditions is simply not likely.

With that in mind, BC Hydro's project design team took into account environmental features and, where practicable, found ways to avoid them. As a result, numerous route refinements have taken place to date. An example of this came about following First Nations feedback, public consultation and discussion with the LRMP implementation committee at which time it was determined that the Lakelse River crossing was of high concern to the community. Consequently, BC Hydro redesigned the river crossing to minimize cutting any of the old growth trees within 200 m on either side of the river, which has been identified as a SRMZ by the Kalum LRMP. In-design mitigation was achieved by relocating the crossing and increasing structure height on both sides of the river. Furthermore, BC Hydro recognizes the value of the LRMP and has provided a concordance table that links each of the LRMP objectives to the relevant section in which it is addressed within the document.

Nevertheless, the ESER does conclude that following the implementation of standard BC Hydro mitigation the Project will have adverse residual effects on the biophysical environment, including all of the fisheries VCs, all but one of the vegetation VCs and all wildlife VCs. In particular, the magnitude, frequency and duration of the potential Project effects will likely lead to residual effects for grizzly bear and may require further consideration. BC Hydro understands that grizzly bear is of value and concern to First Nations and stakeholder groups. Additional considerations and/or mitigations for grizzly bear will be incorporated as appropriate into the EMP that is to be developed for the Project. The EMP will be developed in consultation with First Nations and with direction, as appropriate, from regulators.

Adverse residual effects will remain for NTLU VCs, including land use and ownership, forestry, fishing, agriculture, hunting and recreation. However, the magnitude and context of these effects are low to negligible and the effects are reversible. An increase in access may allow the land to be more readily accessible for non-traditional land uses such as hunting, fishing and recreation, although this could also be seen as an adverse Project effect. Visual resources identified negative residual effects due to a direct line-of-sight from two recreation areas to the provisional route; in all but one, these effects are site-specific and do not impact the wider community.

Positive Project effects are anticipated for socio-economic values such as employment, procurement opportunities and temporary accommodation, although there will be a temporary increase in traffic and higher demand on emergency health and policing services. Residual effects, both positive and adverse, are expected on archaeological resources such as archaeological sites (i.e. CMTs) and cultural heritage sites. No residual effects are anticipated for contaminated sites as mitigation measures are anticipated to be achieved through the construction EMP and on-site monitoring.

Detailed discipline-specific summary results are provided below.

12.1 Fish and Aquatic Resources, Vegetation and Wildlife

Residual effects to coastal cutthroat trout, coho salmon and fish habitat are unlikely to be completely avoided due to loss of riparian vegetation and increased fishing pressure (**Table 12-1**). However, the effects will be localized to the ROW of the transmission line and access roads and are considered reversible. It is unavoidable that the Project will require the removal of some or all riparian vegetation at some watercourse crossings to maintain the security, integrity and safety of the transmission line. This may include the Wedeene River, Little Wedeene River anderson Creek, Cecil Creek, Coldwater Creek and other unnamed fish-bearing creeks. At unnamed watercourse crossings, BC Hydro will avoid causing serious harm to fish by implementing the riparian vegetation management (RVMA) techniques and mitigation measures. However, these techniques may not fully prevent all possible effects to cutthroat trout, coho salmon and their habitat at these stream crossings where riparian vegetation removal or alteration is required. Removal of trees may reduce the input of large woody debris, reduce shading and potentially reduce bank stability. Importantly, however, these residual effects will be limited to the immediate stream crossing locations. Increased fishing pressure on coastal cutthroat trout and coho salmon are also likely to occur due to increased access from transmission line ROW and new access roads despite mitigation measures to prevent access. The residual effect on the coho salmon and the coastal cutthroat trout VCs is considered irreversible, because many of these ROWs will remain useable to recreational anglers. However, the magnitude is negligible because many of the streams and rivers are already accessible to anglers and the Project is not anticipated to have a large influx of outside workers. Furthermore, no instream work will occur in any of the fish-bearing watercourses to be crossed by the transmission line except at designated access road watercourse crossings. Structures will be placed outside of watercourses and RVMAs wherever practicable and the line stringing will be completed via equipment from outside of RVMAs. For access roads, Instream work will be avoided, where practicable, in all unnamed fish-bearing creeks and all non-fish-bearing creeks that are directly connected to fish-bearing creeks and have potential to release significant amounts of sediment into fish-bearing creeks. However, if instream works are required for Project clearing/construction, operation/maintenance or closure activities, they would be scheduled, whenever possible, to occur within BC MOE's preferred instream work windows to reduce the risk of harm to fish and fish habitat. If both spring and fall spawning species are present in the stream, resulting in a small work window or no work window, then site-specific mitigation plans will be developed by a qualified professional as part of the construction environmental management plan

All but one of the vegetation VCs will likely incur adverse residual Project effects. Adverse residual effects on those vegetation VCs that overlap new roads will likely be irreversible (**Table 12-1**). First Nations Botanical Resources that occur in riparian ecosystems, wetlands, ecological communities at risk or new roads are unlikely to return to existing condition (127 ha). Devil's club and Pacific crabapple are of particular traditional and contemporary importance to local First Nations and primarily occur in riparian ecosystems and wetlands The plant species at risk VC may encounter the greatest adverse residual Project effects, because 31% (5 hectares) of suitable habitat for plant species at risk in the LSA will potentially be negatively affected by the Project and these potential Project effects will likely result in a negative population growth rate during the life of the Project. The ecological communities at risk (33 ha), old forest (62 ha), OGMAs (10 ha), riparian (109 ha) and wetland (15 ha) VCs will be directly subjected to irreversible or partially reversible adverse residual Project effects during the life of the Project. Residual Project effects on the unlisted terrestrial ecosystems VC (450 ha) are likely reversible with the exception of 67 ha which overlap with proposed new access roads.

Effects on wildlife are anticipated primarily through the clearing of vegetation, construction of structures and infrastructure components, vegetation management for ROW and access road maintenance, Project-related road traffic and increased human access. Because of the sensitivity of many of the subcomponent species to vegetation clearing and road traffic on one hand and the regulatory requirements of transmission line design, construction and maintenance on the other hand, mitigation measures with high effectiveness are limited. All subcomponent species are anticipated to have adverse residual effects after implementation of mitigation, with the highest number of residual effects for mammals and amphibians (**Table 12-1**). Characterization and evaluation of the residual effects showed that grizzly bears will likely be affected more than any other assessed species, primarily due to the species' high sensitivity to linear corridors and road traffic, which may reduce grizzly bear use of important low-elevation habitats and increase the risk of mortality. Additional consideration to and/or mitigation for subcomponent species, especially grizzly bear, will be incorporated into the Project's EMPs.

12.2 Non-Traditional Land Use

After applying mitigation measures, residual effects remained for all NTLU VCs, mostly due to unavoidable loss or disruption of lands available for non-traditional land uses (**Table 12-1**). Residual effects on land use planning and management, agriculture, forestry, hunting, trapping and guide outfitting, tourism, parks and recreation are expected to be minor, mainly due to a low magnitude rating, which was applied because the affected area showed a 1% to 10% change from existing condition. The frequency of the residual effect is continuous, with a long-term duration (beyond operation) for land use planning and management, agriculture, forestry, tourism, parks and recreation. Residual effects have site-specific or local geographic extent and are reversible due to the decommissioning and revegetation of the affected areas during the post-closure phase. The frequency of the residual effects for hunting, trapping and guide outfitting is intermittent, with a short-term duration at specific locations as the activities move along the entire length of ROW during the construction phase. The direction of the effect is adverse. Residual effects on access and transportation and fishing are expected to be negligible, mainly due to a negligible magnitude rating, which was applied because the affected area identified showed a 0% to 1% change from existing conditions. The residual effects have an intermittent frequency (residual effect occurs several times), have a site-specific or local geographic extent and are reversible due to the decommissioning and revegetation of the affected areas during the post-closure phase. The direction of the effect on access and transportation is both positive and adverse on the land use. The direction of the effect on fishing is adverse due to improved access to fishing areas, which increases pressure on two sport fish species inhabiting Lakelse River and Weedene River—coastal cutthroat trout and coho salmon.

12.3 Socio-Economic Resources

The Project is anticipated to have a positive effect on local employment and businesses (**Table 12-1**). During the three years of construction, the Project would purchase goods and services from local and regional businesses and provide an average of 44 person-years of employment annually, with a maximum of 140 jobs at peak periods. Given BC Hydro hiring policies and local labour force availability, it is estimated that 45% of positions (average 20, peak 42) will be resourced locally. Most jobs would be temporary and short term. Residual effects on employment and procurement are considered positive but low in magnitude and are expected to extend beyond the local area. Given competition from other major projects and Project-specialized workforce requirements, it is estimated that 55% of the total workforce will be resourced from communities outside the study area and therefore will require local accommodation while working on the Project. The maximum number of workers from outside the study area would average 24 people and peak at 98 people for short periods of time. It is anticipated that there is sufficient temporary accommodation capacity in the study area to serve this additional demand. However, at peak periods there could be some increased pressure on local accommodation if demand coincides with the tourist season or other Project demands.

The residual effects on temporary accommodation are considered positive and adverse. There will be positive residual effects for local accommodation businesses who will benefit from additional demand for their services. However, adverse effects could be experienced during peak periods. These adverse effects would be low in magnitude, short term, local, reversible and intermittent (since increased pressure would only occur at peak times).

During the construction phase, there would be a temporary increase in vehicle volume on Highway 37, Beam Station Road and forest service roads associated with the delivery of materials and personnel to and from the construction sites along the Project corridor. Traffic patterns are expected to be within baseline levels experienced when active logging took place in the Project area. Following mitigation, the residual effect would be low in magnitude, local in extent (as the largest increase in volume would be at access points), short term and reversible. The frequency of the effect would be intermittent since it would occur during peak periods.

Project construction is also expected to result in an increase in demand for emergency, policing and health services if accidents occur or if a non-local workforce uses local services or engages in socially disruptive activities. These effects are expected to be lessened by maximizing local hiring and by implementing mitigation measures and transportation management plans. Residual Project effects on emergency, health and policing services are anticipated to be low in magnitude, regional in extent (regional medical services could be needed if accidents occur), short term, intermittent and reversible.

12.4 Visual Resources

Spatial analyses with effective modelling tools are used to objectively describe and measure potential effects on visual resources (**Table 12-1**). Viewshed analyses identify lines-of-sight between observation points and the Project as the main indicators of potential effects on visual resources. The length of route visible combine with the contrast and viewer sensitivity rating to produce an effects rating, ranging from low to moderate to high. Contrast ratings consider proximity to the Project and alignment with the transmission line ROW. Viewer sensitivity ratings are based on indicators of public concern, including existing scenic quality and viewer numbers. Two sites were identified as having high potential effects: the Lakelse River Crossing, and the Clague Mountain Hiking Trail Crossing. The Clague Mountain Hiking Trail Crossing receives a high effects rating, as a short visible route length is countered by a stark contrast rating and high viewer sensitivity. Line-of-sight is somewhat restricted at the Lakelse River crossing by a bend in the river and high vegetation cover. However, the >60 m-high structures on either side of the river and 592 m of the ROW will be visible to kayakers and canoeists along approximately 600 m of the river. Given these parameters and high viewer sensitivity, the effects rating are considered high. Mitigation measures are proposed to lessen the effects of the project during the operation/maintenance phase as well as the closure (decommissioning) phase.

12.5 Contaminants

The contaminants discipline defined VCs as environmental media that had a potential to be contaminated and to affect other VCs either directly or indirectly through altered habitat. A desktop review was conducted for the LSA to evaluate the likelihood of encountering contaminated media during construction and to assess whether Project activities had the potential to generate contaminated media. Five potential sources of historical contamination were identified: the Skeena substation, the location at which the provisional route crosses the railway, a historical landfill near the Eurocan pulp and paper facility, the Minette substation and locations affected by industrial air emissions from historical smelting operations in the Kitimat area. Seven Project activities were identified as having a potential to either generate or relocate contaminated media. These are associated with construction (e.g. clearing, grubbing, excavations, importing soils, dewatering foundation excavations and operating and servicing equipment) and maintenance activities (e.g. vegetation control and road maintenance). Potential Project effects were determined to be preventable or can be mitigated by implementing appropriate procedures to be provided in the construction EMP; therefore, no residual effects are anticipated.

12.6 Archaeology

Based on the findings of a desktop archaeological review (AMEC Environment & Infrastructure, 2014) and in accordance with Heritage Inspection Permit #2015-0075, an archaeological impact assessment (AIA) was conducted in April, May and June 2015 and June 2016. The AIA field survey focused on heritage resource VCs identified during the desktop review (i.e. archaeological sites, cultural heritage resource sites and historical sites) within a 200 m-wide buffer centred on the provisional route and road design of the Project as then designed. No archaeological resources other than CMTs were discovered. Thirty-one CMTs within five protected archaeological sites and one cultural heritage resource site within the provisional ROW and clearing area will be affected by the Project. Historic sites were not identified. The potential of the Project to conflict with as yet unidentified archaeological sites is considered to be low. With the implementation of proposed mitigation measures where Project interactions cannot be avoided, adverse residual Project effects on archaeological sites and cultural heritage resource sites are anticipated as it is likely not possible to avoid all CMTs within the transmission line ROW or most of those on access roads (**Table 12-1**). Loss of culturally modified trees can be mitigated by obtaining dendrochronological dates at point of harvest. Where cultural heritage resources such as blaze trees, marten traps and trees with old logging features cannot be avoided, adverse residual effects will ensue. Positive residual effects such as access to redcedar stands via the Project ROW may contribute to the reconnection of First Nations communities to traditional life-ways. As well, the increased presence of people in the landscape opened up by the Project ROW may result in discovery and recording of new CMT sites. Clearing/construction phase work at the Lakelse River crossing should not result in disturbance to the most important cultural heritage resource, the Lakelse South-Side Trail, as this site lies within the SRMZ.

Table 12-1: Summary of Residual Effects

Discipline	Valued Component	Direction	Context	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
Fish and Aquatic Resources	Fish Habitat	Adverse	Medium	Low	Site-specific	Medium term	Intermittent	Reversible
	Coastal cutthroat trout	Adverse	Medium	Negligible	Local	Long term	Continuous	Irreversible
	Coho salmon	Adverse	Low	Negligible	Local	Long term	Continuous	Irreversible
Vegetation	First Nations Botanical Resources	Adverse	Medium	Low	Local	Long-term	Intermittent	Fully to partially reversible
	Plant Species At Risk	Adverse	High	High	Local	Long-term	Intermittent	Fully to partially reversible
	Ecological Communities At Risk	Adverse	High	Low	Local	Long-term to Permanent	Intermittent	Irreversible
	Old Forest	Adverse	High	Low	Local	Long-term to Permanent	Intermittent	Irreversible
	OGMAs	Adverse	High	Low	Local	Long-term to Permanent	Intermittent	Irreversible
	Riparian	Adverse	High	Low	Local	Long-term to Permanent	Intermittent	Partially reversible to irreversible
	Wetlands	Adverse	High	Low	Local	Long-term to Permanent	Intermittent	Partially reversible to irreversible
	Unlisted Terrestrial Ecosystems	Adverse	Low	Low to Medium	Local	Long-term	Intermittent	Fully Reversible
Wildlife	Landbirds	Adverse	High	Low	Local	Long-term	Intermittent	Reversible
	Waterbirds	Adverse	High	Low	Local	Long-term	Intermittent	Irreversible
	Raptors	Adverse	High	Negligible	Local	Long-term	Once	Irreversible
	Bears	Adverse	High	High	Regional	Long-term	Continuous	Irreversible
	Ungulates	Adverse	Medium	Low	Local	Long-term	Intermittent	Irreversible
	Furbearers	Adverse	Low	Medium	Local	Long-term	Intermittent	Reversible
	Bats	Adverse	High	Low	Local	Long-term	Once	Irreversible
	Amphibians	Adverse	High	Medium	Local	Long-term	Intermittent	Reversible

Discipline	Valued Component	Direction	Context	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
Land Use	Land Use Planning and Management	Adverse	Low	Low	Site-Specific	Long term	Continuous	Reversible
	Land Ownership	Adverse	Low	Low	Site-Specific	Long term	Continuous	Reversible
	Access and Transportation	Neutral (Positive and Adverse)	Low	Negligible	Site-Specific	Long term	Intermittent	Reversible
	Forestry	Adverse	Low	Low	Site-Specific	Long term	Continuous	Reversible
	Hunting, Trapping and Guide Outfitting	Adverse	Low	Low	Site-Specific	Short term	Intermittent	Reversible
	Tourism, Parks and Recreation	Adverse	Low	Low	Local	Long term	Continuous	Reversible
	Fishing	Adverse	Low	Negligible	Local	Short term	Intermittent	Reversible
	Agriculture	Adverse	Low	Low	Site-Specific	Long term	Continuous	Reversible
Visual Resources	OP-33 – Clague Mountain Hiking Trail Crossing	Adverse	Medium	High	Local	Long term	Continuous	Reversible
	OP-42 – Lakelse River	Adverse	Medium	High	Local	Long term	Continuous	Reversible
Socio-Economics	Employment and Procurement Opportunities	Positive	Low	Low	Regional	Short term	Continuous	Reversible
	Temporary Accommodation	Positive and Adverse	Low	Low	Local	Short term	Intermittent	Reversible
	Transportation and Traffic	Adverse	Low	Low	Local	Short term	Intermittent	Reversible
	Emergency Health and Policing Services	Adverse	Low	Low	Regional	Short term	Intermittent	Reversible
Archaeology	Archaeological Sites	Positive and Adverse	High	Medium to High	Point or site-specific	Long-term/permanent	Once	Irreversible
	Cultural Heritage Sites	Positive and Adverse	High	Medium to High	Point or site-specific	Long-term/permanent	Once	Irreversible

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