5.6 Wildlife Resources

5.6.1 Introduction

Wildlife resources is a VC because of its potential to interact with activities of the Project and because it is considered by LNG Canada, Aboriginal Groups, the public, the scientific community and other technical specialists, and government agencies to have ecological, aesthetic, recreational, economic, and cultural importance. Wildlife resources in the terrestrial wildlife and shipping RSA (see Section 5.6.2.6) are important to the exercise of Aboriginal Interests.

Wildlife resources include terrestrial wildlife (e.g., terrestrial mammals, birds and amphibians), marine birds (includes shorebirds and waterfowl), and their respective terrestrial and marine habitats. Included in these broad species groups are species of conservation concern: those designated under the federal *Species at Risk Act* (SARA), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and the BC Conservation Data Centre (CDC) and species of Aboriginal traditional use.

To facilitate the comprehensive assessment of potential effects on wildlife resources, information was incorporated from several discipline reports and EA sections:

- Acoustic Environment TDR (Stantec Consulting Ltd. 2014a)
- Air Quality TDR (Stantec Consulting Ltd. 2014b)
- Marine Resources TDR (Stantec Consulting Ltd. 2014c)
- Socio-Economic TDR (Stantec Consulting Ltd. 2014d)
- Vegetation Resources TDR (Stantec Consulting Ltd. 2014e)
- Wildlife Resources TDR (Stantec Consulting Ltd. 2014f)
- Section 5.2 Air Quality
- Section 5.4 Acoustic Environment
- Section 5.5 Vegetation Resources
- Section 5.8 Marine Resources, and
- Section 7.4 Marine Transportation and Use.

Effects of potential accidents and malfunctions on wildlife are discussed in Section 10.

5.6.2 Scope of Assessment

5.6.2.1 Regulatory and Policy Setting

The protection and management of wildlife resources in BC is provided by the following acts, regulations, policies, and guidance documents.

5.6.2.1.1 Migratory Birds Convention Act

The *Migratory Birds Convention Act* (MBCA) is a federal act, which applies to all of Canada, including federal, provincial, Aboriginal, and private lands. In addition, the federal government has international responsibilities for the conservation of bird populations shared with the United States. The *Migratory Birds Regulations* prohibit deliberate harm to migratory birds, and incidental destruction, disturbance or taking of their nests, shelters or eggs, as well as possession of live birds, nests or eggs.

5.6.2.1.2 Species at Risk Act

SARA came into effect in June 2003 to protect wildlife species at risk in Canada. SARA is a federal commitment to prevent "at risk" wildlife species from becoming extinct and to implement the necessary actions to secure their viable long-term recovery and conservation. SARA provides a legal framework for the protection of wildlife and conservation of biological diversity in Canada. SARA makes it an offence to kill, harm, harass, capture, or take any individual of a species listed under Schedule 1 as *threatened*, *endangered* or *extirpated*, and prohibits the destruction of critical habitat which has been designated in a recovery strategy or action plan, and which has been subject to a protection order. SARA applies to all species at risk across Canada but the application of the prohibitions is dependent upon the species type and location. All species and critical habitat on federal lands, as well as aquatic species (i.e., fish and aquatic plants as defined under the *Fisheries Act*) and migratory birds, are protected regardless of location. SARA`s prohibitions may be applied to non-aquatic or bird species located on provincial or private land by Order of the Governor in Council under prescribed circumstances. SARA requires reviews conducted under CEAA 2012 to identify adverse effects on any species listed in Schedule 1 of SARA and for measures to be taken to avoid or lessen the effects. Measures must be consistent with recovery strategies and action plans. The environmental assessment requirements are not restricted to aquatic species, migratory birds and federal lands, but must be carried out for any listed species affected by a proposed project, regardless of location.

Species listed in SARA have previously been assessed by COSEWIC, a federal scientific panel representing most areas and species groups in Canada. COSEWIC ranks species as *extinct*, *extirpated*, *endangered*, *threatened*, *special concern*, *not at risk* or *data deficient. COSEWIC* assessment informs listing of species in Schedule 1 of SARA.

Section 79 of SARA contains specific requirements for when project reviews are being undertaken under CEAA 2012. It requires assessment of the adverse effects of a proposed project on any species listed in Schedule 1, and for measures to be taken to avoid or lessen those effects, and to monitor them. All measures must be consistent with any recovery strategies or action plans in place for the species. The section 79 requirement is met by the assessment of wildlife resources for the Project through identification of effects (Section 5.6.2.4), Project interactions (Section 5.6.4), and potential residual effects and proposed mitigations (Sections 5.6.5 and 5.6.6).

5.6.2.1.3 Migratory Birds Environmental Assessment Guidelines

The *Migratory Birds Environmental Assessment Guidelines*, developed by the Canadian Wildlife Service (CWS) (Milko 1998), assist proponents with identifying the information required by Environment Canada where migratory birds are concerned and provides best practices for environmental assessments under the *CEAA 2012*.

5.6.2.1.4 Federal Policy on Wetland Conservation

The Federal Policy on Wetland Conservation was developed to prevent the loss or degradation of wetlands in Canada and to sustain their ecological and socio-economic functions over time. The policy defines the following wetland ecological functions with respect to wildlife:

- habitat for waterfowl, furbearers, and reptiles
- refuge for species of conservation concern, and
- supporting the biodiversity of species.

5.6.2.1.5 Environmental Assessment Best Practice Guide for Wildlife at Risk in Canada

Canadian Wildlife Service developed best practice guidelines for environmental assessments (Lynch-Stewart 2004). These are not specific to either the provincial or federal statutory requirements but are specific to the wildlife species at risk component of the environmental assessment process. Environment Canada and the CEA Agency developed a guideline (2010) to identify relevant SARA requirements for federal environmental assessments, as well as guidelines for integration of these provisions.

5.6.2.1.6 British Columbia *Wildlife Act*

The *Wildlife Act* regulates the management of wildlife in the province. It restricts the harvest of individuals and prohibits the killing, capture, and harassment of wildlife, except by permit or regulation. This *Act* also provides protection for active bird nests, including specific measures for raptors and their habitats. Section 34 of the *Wildlife Act* specifically prohibits the disturbance or destruction of any bird, its active nest, or its eggs. It also protects the nest of any eagle, peregrine falcon, gyrfalcon, osprey, heron, or burrowing owl, regardless of whether it is actively used.

5.6.2.1.7 BC Conservation Framework

The BC Conservation Framework outlines an approach to maintaining biodiversity in BC (BC MOE 2009). Criteria specified in the Conservation Framework are used by the MOE to determine appropriate management actions for conservation. The goals of the Conservation Framework are to:

- contribute to global efforts for species and ecosystem conservation
- prevent species and ecosystems from becoming at risk, and
- maintain diversity of native species and ecosystems.

Species are assessed within these goals using a ranking system of 1 (highest) to 6 (lowest) to determine priority species for conservation. Management actions include further assessments, stewardship, land-use planning, implementation of wildlife management plans, and designation of protected and wildlife management areas.

5.6.2.1.8 BC Best Management Practices

Develop with Care 2012 (BC MOE 2012) documents provide BMP guidelines to ensure urban and rural developments comply with legislation, regulations, and policies. Additionally, provincial Identified Wildlife Management Strategies provide procedures and measures for wildlife requiring special management (BC MOE 2004a).

5.6.2.1.9 Resources Information Standards Committee

The Resources Information Standards Committee (RISC) is responsible for establishing standards for conducting natural resource inventories, providing guidance on taxa-specific inventory methods, and storing and reporting inventory data. Many guides are available and include documents relevant to wildlife studies (see Section 5.6.3.2 and Stantec Consulting Ltd. 2014f).

5.6.2.2 Consultations' Influence on the Identification of Issues and the Assessment Process

The scope and process of the environmental assessment is based on the final AIR approved by the EAO on February 24, 2014. LNG Canada consulted with the EAO, the Working Group, and Aboriginal Groups throughout development of the AIR. A review of the key species selection was also completed with Environment Canada. A draft of the AIR was subjected to a public comment period in November and December 2013. This consultation process has helped to identify potential interactions between the Project and wildlife resources.

As a result of these consultations, the key species list for the assessment of potential effects of the Project on habitat loss or change was refined. This includes the following species of importance to Aboriginal Groups or the broader Working Group: grizzly bear (*Ursus arctos*), black oystercatcher

(*Haematopus bachmani*), glaucous-winged gull (*Larus glaucescens*), and marbled murrelet (*Brachyramphus marmoratus*).

In addition, through LNG Canada's consultation program, potentially affected Aboriginal Groups have identified interests and concerns with respect to wildlife resources, which have, as applicable, informed the assessment of wildlife resources as well as Part C of this Application as they relate to potential adverse effects on Aboriginal Interests (Section 14).

During consultation, the CWS expressed that the inclusion of information on bats, in particular little brown myotis (*Myotis lucifugus*) and Keen's myotis (*Myotis keenii*), great blue heron (*Ardea herodias fannini*), and Canada goose (*Branta canadensis*) would augment the selection of key species (see Section 5.6.2.5.1) used for assessing the potential effects on wildlife resources from the construction and operation of the LNG facility. The potential effects of the Project on these species, as well as other species of conservation concern, are considered in the assessment. However, these species are not included as key species given the lack of available habitat within the facility LSA (see Section 5.6.2.6.1) or the inclusion of other key species whose preferred habitats overlap with the preferred habitats of these species as noted below.

Little brown myotis and Keen's myotis overwinter in caves and abandoned mines with relatively high humidity and where temperatures remain above freezing (Nagorsen and Brigham 1993; Fenger et al. 2006). Based on field studies and desktop review, there is a low likelihood of caves and/or abandoned mines occurring within the facility LSA, and none exist within the Project footprint (see Section 5.6.2.6.1). Potential summer roosting sites for both little brown myotis and Keen's myotis include tree cavities and under the bark of large trees (Nagorsen and Brigham 1993; MOE 2004b; Fenger et al. 2006).

Given the above, there is a low probability of either bat species overwintering in the facility LSA and it is very unlikely they overwinter in the Project footprint. However, these species may be present during the summer, even though there are no known observations in the area to date (MOE 2008). The habitat within the Project footprint that these bats are mostly likely to use for summer roosts is consistent with what has been surveyed and modeled for the marbled murrelet and the Pacific marten (*Martes caurina*). As a result, the potential effects of the Project on the summer roosting habitat of bats is considered by extrapolating from what is known about old forest habitat as identified through the assessment on old-forest specialists including the marbled murrelet and Pacific marten.

Great blue heron are known to occur year-round within the facility LSA and are commonly observed in the Kitimat River estuary. However, no known breeding locations have been noted near the Project footprint (Horwood 2013). Horwood (1992) notes that "Although no nesting colonies exist in our area [i.e., the

Kitimat area], non-breeding herons will roost in groups of twelve to twenty-four individuals. Most sightings exist for late autumn and winter, as spring approaches, sightings decline."

Potential Project-related effects on great blue heron breeding habitat can be assessed through the use of western screech-owl as a key species. Both the western screech-owl and the great blue heron nest in mature forests including deciduous, coniferous and mixed woods in lowland areas, especially near water (Campbell et al. 1990a; Campbell et al. 1990b; Cannings et al. 2001; Vennesland et al. 2011). In addition, though great blue heron and western screech-owl use different nesting structures (i.e., stick nest and cavity nest respectively), nesting structural differences are not expected to have a bearing on whether potential effect mechanisms (e.g., clearing and site preparation) will affect one species more or less than another.

Though an avian grazer, such as the Canada goose, was not specifically selected as a key species, potential effects from the construction and operation of the LNG facility on grazers are expected to be represented by key species that share similar habitat preferences and have displayed known sensitivity to disturbance. The harlequin duck (*Histrionicus histrionicus*), for example, was selected to represent migratory waterfowl and birds that use foreshore and estuarine environments, which is consistent with habitat preferences displayed by Canada goose and other grazers. In addition, harlequin duck have known environmental sensitivities including sensitivities to habitat degradation (e.g., disturbance to suitable riparian breeding habitat and associated fluctuations in invertebrate prey species) and to environmental contaminates (Robertson and Goudie 1999).

5.6.2.3 Traditional Knowledge and Traditional Use Incorporation

Information on TK/TU relevant to the facility and shipping LSAs and RSAs was gathered from both Project studies submitted to LNG Canada and publicly available sources (see Sections 13 and 14 for more detail). The available TK/TU information at the time of writing was used to inform the baseline conditions for the assessment. Haisla Nation provided a Project study to LNG Canada entitled *The LNG Canada Proposed Terminal Site and Tanker Route within Haisla Traditional Territory* (the Haisla Report) (Powell 2013). In addition, the Calliou Group (on behalf of Gitxaala Nation) provided a study entitled *Gitxaała Nation Use Study: LNG Canada Export Terminal Project* (Calliou Group 2014a) and a *Gitxaała Valued Components Report* (Calliou Group 2014b). Other interim reports include *Kitsumkalum First Nation – Interim Report Letter* (Crossroads Cultural Resource Management 2014) and *Metlakatla Interim Report* (DMCS 2014).

The following information was included in the assessment as a result of TK/TU information:

- Knowledge of species distribution, use, and importance was refined based on information obtained from TK/TU studies (see Section 14 Aboriginal Interests for detailed information)
- Mitigation measures to reduce Project effects on wildlife resources consider the importance of traditional use activities.

5.6.2.4 Selection of Effects

Interactions between wildlife resources and the Project associated with construction, operation, and decommissioning activities have the potential to cause the following effects:

- loss or change in habitat. Changes in wildlife habitat quality and availability might occur because of vegetation clearing, dredging, construction activities, and temporary infrastructure. Construction of the Project will remove vegetation, resulting in the direct loss of seasonal or year-round breeding, foraging, or shelter habitat in the Project footprint. Changes in the quality of terrestrial, foreshore, and shoreline habitats might affect the ability of wildlife species to meet life-history requirements in preferred habitats.
- risk of injury or mortality. Potential mortality of terrestrial wildlife (e.g., birds, small mammals, amphibians, and increased mortality risk from bear-human conflicts) will be greatest during clearing activities. Clearing can result in the accidental destruction of bird nests, eggs, or young, and wetland amphibian egg masses during breeding seasons. Persistent loud noise produced by on-land or in-water construction activities could cause adult birds to abandon nests, increasing mortality risk to eggs and hatchlings exposed to cold or predators. Artificial lighting can attract and disorient birds and result in collisions with buildings, light standards, or other structures. Injury or mortality to marine birds may result from bird strikes to the LNG facility, marine terminal structures, and LNG carriers. Increased vehicle traffic during construction and operation of the facility will also increase the potential for vehicle collisions with wildlife.
- sensory disturbance or behavioural alterations. Physical and in-air noise disturbances from equipment used for clearing during facility construction and installation, dredging, pile driving, and activities during operation might reduce the suitability of terrestrial and marine habitats for wildlife resources (i.e., reduced habitat effectiveness). Terrestrial wildlife and marine bird movements might be altered if the Project introduces physical barriers to traditional movement corridors or preferred habitats from construction and operation of the LNG facility, the marine terminal and the movement of LNG carriers. Individual animals might need to establish new routes to access important breeding or foraging habitats, consequently expending additional energy.

5.6.2.5 Selection of Measurable Parameters

The following measurable parameters facilitate the quantitative and qualitative measurement of potential effects of the Project on wildlife resources (Table 5.6-1). Measurable parameters used in qualitative analyses are defined in the absence of metrics or standards to support quantitative analyses.

Table 5.6-1: Project Potential Effects on Wildlife Resources and Measurable Parameters

Potential Adverse Project Effects	Measurable Parameters
Loss or change in habitat for species of interest (e.g., key species, species at risk, traditional uses)	▪ Area of high-, moderate-,and low-value habitat for terrestrial wildlife key species
Risk of injury or mortality	▪ Potential increased mortality to wildlife resources from Project activities (qualitative analysis)
Sensory disturbance or behavioural alterations	▪ Potential change in movement patterns related to placement of Project infrastructure (qualitative analysis)

Measurable parameters provide scientific evidence or management guidance on the status and trends in ecosystem quality, population sustainability, and other variables that measure effects on wildlife resources or selected key species to measure change from baseline conditions. For example, a measurable parameter for loss or change in habitat can be quantified as the area of loss of high-suitability habitat for a key species. The degree of change in these measurable parameters is used to characterize Project and cumulative effects.

5.6.2.5.1 Key Species

It is not possible to assess potential effects on every wildlife species; therefore, key species, whose presence, absence, or population size provides an indication of the overall health of respective ecosystem elements, are used (Noss 1999; Lindenmayer et al. 2000; Mallory et al. 2010). Key species are used to focus the effects assessment on key issues. Terrestrial wildlife key species are representative of the broad range of resident and migrating species potentially affected by the Project, consistent with standard environmental practice. The selection of key species included a review of existing terrestrial and marine habitats and associated species known to occur within the spatial boundaries of the Project. Seven terrestrial key species are assessed for potential effects:

- harlequin duck (*Histrionicus histrionicus*)
- Pacific marten (*Martes caurina*)
- grizzly bear
- marbled murrelet
- western sandpiper (*Calidris mauri*)

- western screech-owl (*Megascops kennicottii*)
- western toad (*Anaxyrus boreas*)

Wildlife habitat suitability models are used for describing the existing conditions in the facility LSA (Stantec Consulting Ltd. 2014f).

Marine birds have been included in the wildlife VC to provide a measure of the potential effects from Project shipping on marine birds that are likely to occur in the shipping LSA (see Section 5.6.2.6). Five key marine bird species are assessed for potential effects:

- black oystercatcher
- marbled murrelet
- double-crested cormorant (*Phalacrocorax auritus*)
- common goldeneye (*Bucephala clangula*)
- glaucous-winged gull

Of the 11 key species, five species are considered to be of conservation concern in BC and are blue-listed: marbled murrelet, double-crested cormorant, grizzly bear, western screech-owl, and western toad. Additionally, western toad and the western screech-owl are listed as *special concern*, and marbled murrelet is listed as *threatened* on Schedule 1 of SARA. COSEWIC assessed western toad and grizzly bear as *special concern*, and western screech-owl and marbled murrelet as *threatened*. These key species each represent a subset of the diverse assemblage of resident and migrant species that use distinct niches within the matrix of marine, coastal, and terrestrial habitats present in the facility and shipping LSA and RSA. Identification of the selected species is based on regulatory guidelines; feedback from Aboriginal Groups, government agencies, stakeholders, and the general public; scientific studies; and the professional judgment of the assessment team. Key species selected fit all or most of the following criteria:

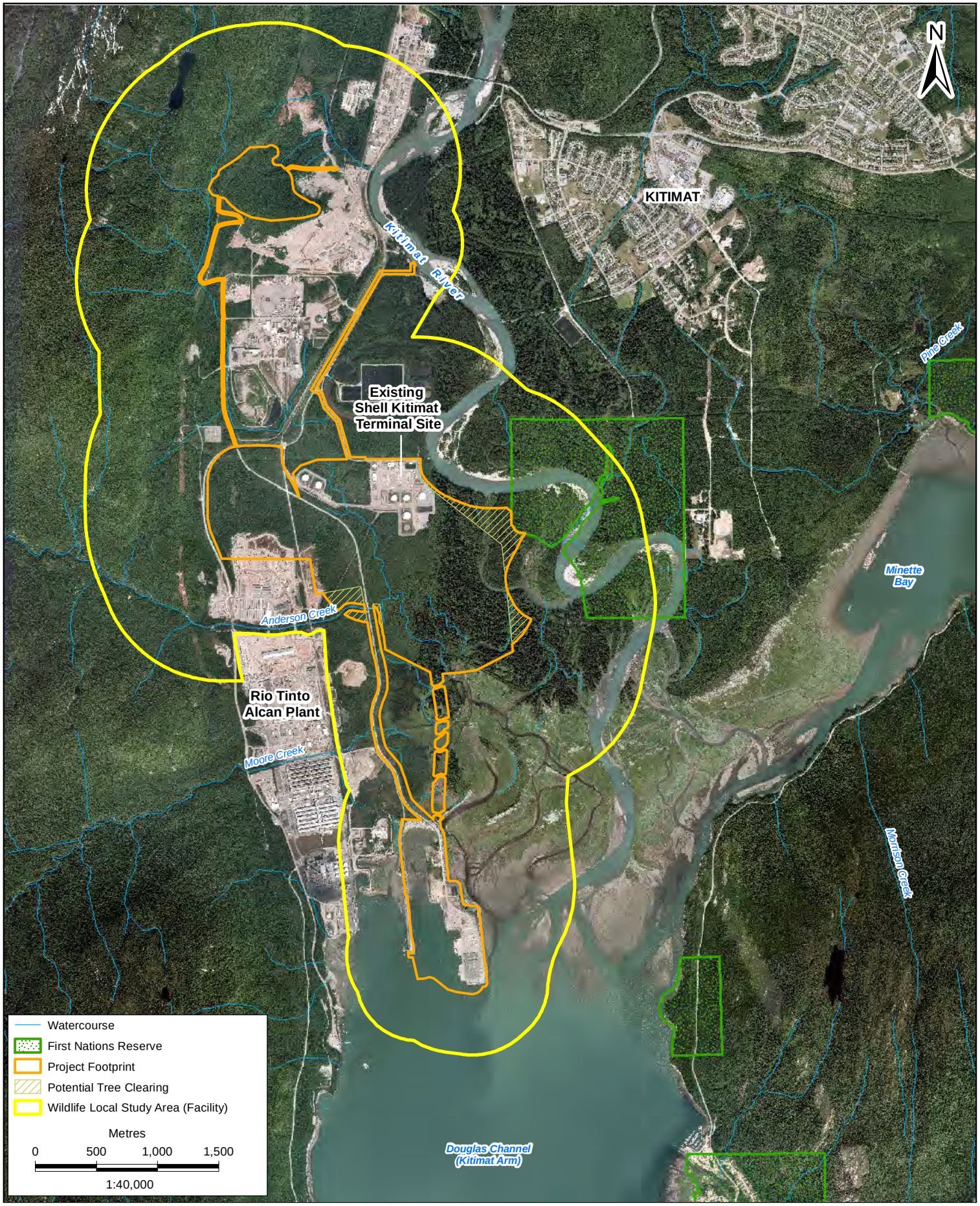
- reside in, or seasonally use, habitats in the facility and shipping LSA and RSA
- have life requisites that are shared by a broad group of other species
- are a species of conservation concern (as identified through COSEWIC or CDC) or a species that is associated with a confined or sensitive ecological community and or is important to one or more of the potentially affected Aboriginal Groups
- have an established baseline that describes their biology, abundance, and distribution
- are documented as a species susceptible to anthropogenic disturbances
- are a species whose extirpation could alter or disrupt the function of the ecosystem, and
- have previously been informative key species in regional effects-based assessments.

5.6.2.6 Boundaries

5.6.2.6.1 Spatial Boundaries

Relevant spatial areas are based on consideration of several factors, including the availability of traditional use and technical or scientific information, and where wildlife resources are likely to interact with Project activities:

- The **Project footprint** is the physical area cleared for the Project (LNG facility) as well as the area that will be cleared of trees only (tree clearing) for safety requirements. The total area is approximately 430 ha, of which approximately 285 ha is currently vegetated.
- The **facility LSA** is approximately 0.24 km^2 (2,376 ha) and encompasses the footprint of the LNG facility plus a 1 km buffer to the east and west, and a 500 m buffer to the north and south of the LNG facility. The buffers are based on 1) a 1 km buffer for potential disturbances to the largest ranging wildlife species known to occur in the area, the grizzly bear, with consideration for habitat connectivity requirements, sensitivity to access features, and potential disturbance from noise and activity at large facilities and 2) a 500 m buffer that assumes decreased potential disturbance effects from linear features (e.g., roads) and the wharf at the marine shoreline (Figure 5.6-1).
- The **shipping LSA** is used for the marine bird assessment, which encompasses the nearshore waters of the northern end of Kitimat Arm, including Minette Bay, and extends through the confined channels with a buffer of 1 km on either side of the marine access route between the terminal and the Triple Island Pilot Boarding Station (589 km^2: Figure 5.6-2).
- The **facility RSA** is approximately 31,000 km^2 (3.1 million ha) and encompasses the area of land designated within the North Coast and Bulkley Lakes Grizzly Bear Population Units (GBPU). The facility RSA extends from the lower Kitimat River estuary to high alpine habitat and acts as an umbrella area to assess potential landscape-level effects, including cumulative effects, for other potentially vulnerable species, including breeding birds that nest inland (Figure 5.6-3).
- The **shipping RSA** for marine birds is approximately 3.7 million km^2 and includes the marine waters and associated marine bird shoreline habitats along the marine access route from the Triple Island Pilot Boarding Station through Principe and Douglas channels to the LNG facility. Where the marine access route is not confined by geography in the north end, a buffer of approximately 10 km is used on the west side of the marine access route (Figure 5.6-4).



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WILDLIFE ENVIRONMENTAL EFFECTS ASSESSMENT

FACILITY LSA

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

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WILDLIFE ENVIRONMENTAL EFFECTS ASSESSMENT

SHIPPING LSA

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

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WILDLIFE ENVIRONMENTAL EFFECTS ASSESSMENT

FACILITY RSA

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

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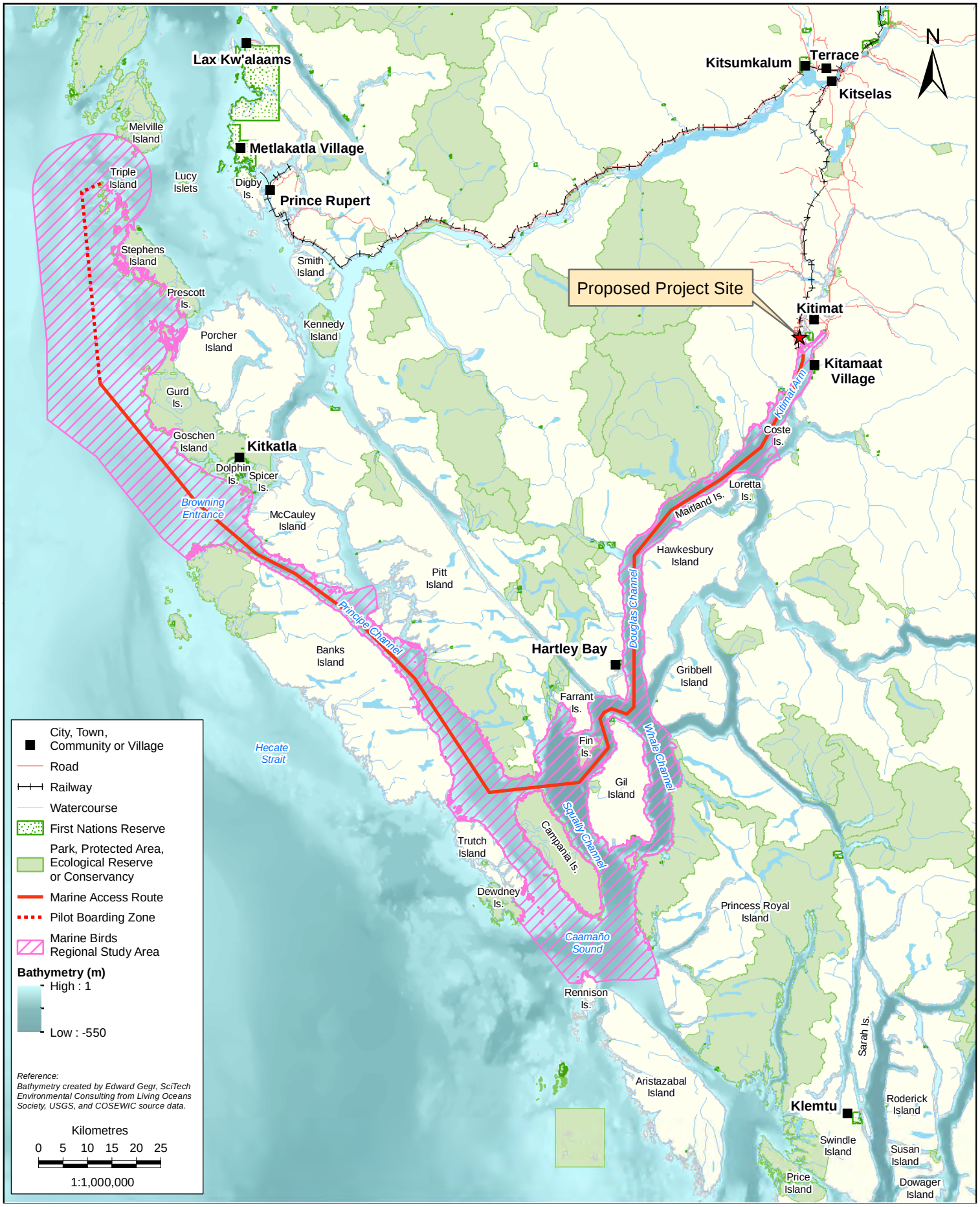

Stantec	LNG CANADA Opportunity for British Columbia. Energy for the world	*WILDLIFE ENVIRONMENTAL EFFECTS ASSESSMENT* **SHIPPING RSA** LNG CANADA EXPORT TERMINAL KITIMAT, BRITISH COLUMBIA	PROJECTION: UTM9	DRAWN BY: SHS
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5.6.2.6.2 Temporal Boundaries

Based on the current Project schedule, the temporal boundaries are:

- construction, Phase 1 (trains 1 and 2) to be completed approximately five to six years following issuance of permits, the subsequent phase(s) (trains 3, 4) to be determined based on market demand
- operation, minimum of 25 years after commissioning, and
- decommissioning, approximately two years at the end of the Project life.

Information on the temporal boundary for decommissioning and abandonment will be at a conceptual level only. Annual or seasonal variability in the effects of Project activities on wildlife are addressed in the relevant effects sections, where such considerations apply.

5.6.2.6.3 Administrative and Technical Boundaries

Administrative boundaries include the federal and provincial wildlife regulatory requirements, management tools (see Section 5.6.2.1), and regional planning initiatives that are relevant to the assessment of the Project's potential effects on wildlife. Federal and provincial management tools include the Marine Planning Partnership for the North Pacific Coast (MaPP 2014), Pacific North Coast Integrated Management Area (Lucas et al. 2007, McFarlane Tranquilla et al. 2007) and the *Kalum Land and Resource Management Plan* (MSRM 2002). Local planning initiatives include the *District of Kitimat Official Community Plan* (District of Kitimat 2008).

The ability to determine potential effects of the Project based on habitat suitability models is limited by the availability of data as well as known species-specific habitat requirements. The limitations of these models are addressed in the Wildlife TDR (Stantec Consulting Ltd. 2014f) as well as in Section 5.6.3.

5.6.2.7 Residual Effects Description Criteria

Residual effects are assessed at the regional population level. Definitions of the terms used to characterize residual effects are provided in Table 5.6-2.

Table 5.6-2: Characterization of Residual Effects for Wildlife Resources

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Magnitude	The expected size or severity of effect. Low magnitude effects may have negligible to little effect, while high magnitude effects may have a substantial effect.	For loss or change in habitat: Percent loss of effective habitat in the facility RSA* For risk of injury or mortality: **Low**—Residual effect is negligible and will not affect sustainability of regional population **Moderate**—Residual effect is moderate but unlikely to affect sustainability of regional population **High**—Residual effect is high and might affect sustainability of regional population For sensory disturbance or behavioural alterations: **Low**—Effect presents a permeable barrier and will not affect sustainability of regional population **Moderate**—Effect presents a semi-permeable barrier but unlikely to affect sustainability of regional population **High**—Effect presents an impermeable barrier and might affect sustainability of regional population
Geographic Extent	The spatial scale over which the residual effects of the Project are expected to occur. The geographic extent of effects can be local or regional. Local effects may have a lower effect than regional effects.	**Project Footprint**—effects are restricted to the Project Footprint **LSA**—effects occur within the facility LSA and or shipping LSA—both of which encompass the Project footprint **RSA**—effects extend beyond the facility LSA and or shipping LSA and into the facility RSA and or shipping RSA
Duration	The length of time the residual effect persists. The duration of an effect can be short term or longer term.	**Short-term**—Effect occurs for less than one breeding season or generation (e.g., less than one year) **Medium-term**—Effect occurs for several breeding seasons or generations, or a Project phase (e.g., one to five years, or the Project construction phase) **Long-term**—Effect occurs across multiple breeding seasons or generations, or multiple Project phases (e.g., 6 to 30 years, or the lifetime of the Project) **Permanent**—Effect occurs across multiple breeding seasons or generations and is unlikely to recover following decommissioning and reclamation of the site
Frequency	How often the effect occurs. The frequency of an effect can be frequent or infrequent. Short-term and infrequent effects may have a lower effect than longer-term and frequent effects.	**Single event**—occurs once **Multiple irregular event (no set schedule)**—occurs sporadically at irregular intervals throughout construction, operation, or decommissioning phases **Multiple regular event**—occurs on a regular basis and at regular intervals throughout construction, operation, or decommissioning phases **Continuous**—occurs continuously throughout the life of the Project

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Reversibility	Whether or not the residual effect on the VC can be reversed once the physical work or activity causing the disturbance ceases. Effects can be reversible or permanent. Reversible effects may have a lower effect than irreversible or permanent effects.	**Reversible**—effect will cease after Project decommissioning and reclamation **Irreversible**—effect will persist beyond the life of the Project (decommissioning and reclamation)
Context	The sensitivity and resilience of the valued component to the residual effect relative to the ecological fragility and degree of disturbance of the area in which the residual effect occurs.	**Low resilience**—occurs in a fragile ecosystem and the level of baseline disturbance can be a contributing factor to reduced sustainability of a local or regional wildlife population **Moderate resilience**—occurs in a stable ecosystem and the level of baseline disturbance not likely to contribute to reduced sustainability of a local or regional wildlife population **High resilience**—occurs in a viable ecosystem and the level of baseline disturbance does not contribute to reduced sustainability of a local or regional wildlife population
Likelihood of Residual Effects		
Likelihood	Whether or not a residual effect is likely to occur	**Low**—unlikely to occur **Medium**—moderately likely to occur **High**—likely to occur

NOTE:
* a precautionary 80 percent residual habitat threshold (i.e., 20 percent loss) in the relevant RSA was used for all species to represent the maximum habitat loss to avoid rapid population declines that could lead to regional extirpation (Betts and Villard 2009; Rompré et al. 2010)

The likelihood of a residual effect occurring is influenced by existing baseline conditions, activities and physical works, Project effect mechanisms, and the implementation of legislated and Project-specific mitigation measures. Information on these factors will be used to determine qualitatively whether there is a low, moderate, or high likelihood of there being an adverse residual effect.

5.6.2.8 Significance Thresholds for Residual Effects

Numerous studies have documented the adverse effects of habitat loss on species and ecological processes (see review in Swift and Hannon 2010). Theoretical and empirical evidence indicates that species-specific thresholds for habitat loss are best described and influenced by landscape type, historical disturbance, and spatial scale (Mönkkönen and Reunanen 1999; Swift and Hannon 2010). In response to habitat loss, regional populations might decline more rapidly than anticipated and risk extirpation if populations become too small. Johnson (2013) emphasized the challenges of using ecological thresholds to assess disturbance effects across broad taxa, especially when species-disturbance responses might vary over time. However, there often is a lack of information to develop unique thresholds for each population at risk.

Given these considerations, residual effects are assessed as significant when there is a moderate to high probability that the Project may affect the sustainability of an identified local or regional wildlife population. The determination of significance is relatively straightforward when there are clear thresholds related to the long-term viability of wildlife populations. Unfortunately, for most effects on wildlife, clear thresholds are not available. As such, a qualitative determination of significance for each key species is made that takes into account the overall spatial distribution of key species habitats in the facility LSA or RSA, the overall health of wildlife populations, as well as professional judgment. A residual effect is significant if the Project does not comply with applicable regulations relevant to wildlife and wildlife habitat (i.e., the *Wildlife Act*, MBCA, and SARA).

5.6.3 Baseline Conditions

5.6.3.1 Baseline Data Sources

Existing data on terrestrial wildlife and their abundance in the region were compiled from traditional knowledge, local community groups, including the Kitimat Valley Naturalists (2011), baseline literature and data (e.g., Campbell et al. 1990a; Horwood 1992; Triton 2012), provincial and federal government reports including grizzly bear population estimates (BC MFLNRO 2012), applicable recovery strategies (Environment Canada 2014b), COSEWIC status reports (e.g., COSEWIC 2002a, 2012a, 2012b), local consultants (e.g., Triton 2012; Horwood 2013), volunteer-based programs (e.g., BC Breeding Bird Atlas; Bird Studies Canada 2013; eBird Canada 2013), Aboriginal Groups, and new surveys and subsequent analyses conducted for the Project.

Triton Environmental Consultants Ltd. completed baseline surveys in the facility RSA and shipping LSA during spring 2012, studying three broad habitat types (terrestrial, wetland and estuary, and marine) in the Kitimat River and Douglas Channel complex (Triton 2012). These studies included stationary bird point count surveys, wetland and estuary bird migration surveys, call-playback raptor and owl surveys, marine bird surveys, and time-constrained amphibian surveys.

Kitimat Valley Naturalists have been collecting data since 1996 on the distribution of marine and terrestrial birds near Kitimat for the annual Christmas Bird Count, BC Coastal Waterbird Surveys, and the Breeding Bird Atlas (Horwood 1992).

The importance of marine birds to potentially affected Aboriginal Groups was noted by Powell (2011, 2013), Marsden (2011, 2012), and Menzies (2011). These studies describe the cultural, spiritual, and traditional uses of marine resources to Haisla Nation, Gitga'at First Nation, Gitxaała Nation, and Metlakatla First Nation.

5.6.3.2 Baseline Overview

5.6.3.2.1 Setting

Kitimat Arm lies in the Kitimat Range, a sub-province of the Coast Mountain Range and the larger marine Pacific Maritime Ecozone. Kitimat Arm is approximately 3 km wide and 20 km long. Douglas Channel is in the North Coast Fjords Ecodistrict of the Pacific Shelf Ecoregion (Environment Canada 1997). The landscape along Douglas Channel is characterized by rocky shorelines and steep fjords. Estuarine circulation and wind- and tide-generated currents influence circulation in Douglas Channel and the exchange of surface waters between the inlet and open waters of Hecate Strait (MacDonald and Shepherd 1983). Kitimat River, which flows south approximately 75 km from the southwestern slope of Mount Davies, discharges into the Kitimat Arm from the north at the Kitimat River estuary. The Kitimat River estuary is a large, flat tidal delta provincially recognized as an important migratory staging and overwintering area for marine birds, waterfowl, and shorebirds (Horwood 1992). Average surface water temperatures in Kitimat Arm are approximately 14°C in the summer and 6°C in the winter (Lucas et al. 2007).

Kitimat Ranges are characterized by dense forest. Terrestrial wildlife habitats are located primarily within the Coastal Western Hemlock Very Wet Hypermaritime biogeoclimatic subzone with a small portion in the Coastal Western Hemlock Southern Very Wet Hypermaritime subzone (Pojar et al. 1991). Low to mid-elevation forests are dominated by Douglas-fir (*Pseudotsuga menziesii*), Sitka spruce (*Picea sitchensis*), western hemlock (*Tsuga heterophylla*), and western redcedar (*Thuja plicata*). Coastal Western Hemlock forests in the facility LSA support large and small mammal species, including black-tailed deer (*Odocoileus hemionus*), moose (*Alces americanus*), grizzly bear, black bear (*Ursus americanus*), Pacific marten, and snowshoe hare (*Lepus americanus*). Amphibian species occurring in ponds and riparian habitats of the upland habitats and in the Kitimat River estuary include Columbia spotted frog (*Rana luteiventris*), northwestern salamander (*Ambystoma gracile*), and western toad (CDC 2013). The mature to old-growth vegetation communities provide important nesting habitat for bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), and many passerine species. The riparian, salt marsh, and riverine habitats of the region also support a diverse abundance of migrating and resident songbirds, raptors, waterfowl, and seabirds.

Marine birds are an important component of coastal ecosystems because of their relatively high diversity and abundance (Milko et al. 2003). Overall, 127 marine bird species have been documented in the shipping RSA based on regional and local datasets. A complex of marine habitats supports breeding efforts (Figure 5.6-5). Between Estevan Sound and Caamaño Sound, breeding species include the black oystercatcher, fork-tailed storm-petrel (*Oceanodroma furcate*), glaucous-winged gull (*Larus glaucescens*), pigeon guillemot (*Cepphus columba*), Leach's storm-petrel (*Oceanodroma leucorhoa*), and other petrel

species. The rhinoceros auklet (*Cerorhinca monocerata*) and tufted puffin (*Fratercula cirrhata*) use adjacent breeding habitat and are likely to forage in the shipping RSA.

Coastal wetlands, nearshore and offshore habitats (including islands, islets, estuaries, and cliffs) are used extensively by marine birds. Important wildlife areas in or near the shipping RSA include two Important Bird Areas (IBA 2012) and one ecological reserve (Table 5.6-3; Figure 5.6-5). Marine and terrestrial provincial parks also provide breeding and foraging habitat for shorebirds, waders, waterfowl, and seabird species. There are 4 provincial parks and 14 conservancies located in and adjacent to the shipping RSA (Stantec Consulting Ltd. 2014f).

Table 5.6-3: Conservation Areas in and Adjacent to the Shipping RSA

Conservation Area	Name	Description	Size (km^2)	Marine Bird Species
IBA BC119	Kitkatla Channel, Goschen Island North to Porcher Island	▪ salt and brackish marshes, tidal rivers and estuaries, mud and sand saline flats, open sea, inlets and coastal marine features, coastal cliffs and rocky shores ▪ globally significant for large congregations of colonial marine birds	1,583.99	High concentrations of surf scoter and waterfowl during spring migrations
IBA BC122	Lucy Island, Chatham Sound	▪ coniferous forest (boreal and alpine), open sea, coastal cliffs, and rocky shores ▪ globally significant for large congregations of colonial marine birds.	73.95	Breeding colonies of rhinoceros auklet, pigeon guillemot, black oystercatcher, and glaucous-winged gull
Ecological Reserve	Dewdney and Glide Islands Ecological Reserve	▪ low-lying islands, islets, and reefs, rocky headlands, coves, muddy lagoons, and beaches with sand and boulder substrate	36.96	Breeding colony of Cassin's auklet and breeding site of sandhill cranes; Canada goose (*Branta canadensis*), common and red-throated loon (*Gavia immer and Gavia stellata)*, red-breasted merganser (*Mergus serrator)*, and great blue heron (*Ardea herodias fannini*).

The Kitimat area is sparsely populated with largely undeveloped shorelines. The Project is located near the municipality of Kitimat and several industrial and port facilities. Industries in the region include commercial, recreational, Aboriginal traditional fishing and hunting, tourism, shipping, aluminum smelting, and forestry. The marine regional setting includes the villages of Lax Kw'alaams, Metlakatla, Kitkatla, Hartley Bay, and Kitamaat. Aboriginal Groups depend on natural resources for their daily cultural, spiritual, food, and livelihood needs.

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WILDLIFE ENVIRONMENTAL EFFECTS ASSESSMENT

IMPORTANT BIRD AREAS, CONSERVANCIES, ECOLOGICAL RESERVES, PARKS AND PROTECTED AREAS IN THE MARINE BIRD RSA

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION	DRAWN BY
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5.6.3.2.2 Species of Conservation Concern

There are 42 species of conservation concern that might occur in the facility LSA and shipping LSA, including 40 species with red or blue provincial designations; 21 species assessed by COSEWIC as e*ndangered*, *special concern,* or *threatened*; and 14 species listed on Schedule 1 of SARA as *threatened* or *special concern* (Table 5.6-4). It is expected that some of these species will not occur in the facility LSA because they lack specific habitat requirements, for example, for fisher (*Pekania pennanti*) and wolverine (*Gulo gulo luscus*).

5.6.3.2.3 Field Studies

Field studies were conducted in 2012, 2013 and 2014 to provide additional baseline data and address gaps in available information for the facility LSA and the shipping LSA with regard to the presence and distribution of large- and medium-sized mammals, breeding and migrating songbirds, raptors, waterfowl, marine birds, and amphibians. Several different survey types were designed and conducted to account for the timing and habitat use of the broad range of species that are expected to occur in the LSAs, with a focus on key species and species of conservation concern (more details available in the Wildlife TDR Stantec Consulting Ltd. 2014f, Section 3.3). Table 5.6-5 summarizes information on field surveys completed by Stantec Consulting Ltd. during 2012 and 2013.

Table 5.6-4: Species of Conservation Concern Potentially Occurring in the Facility LSA or Shipping LSA

English Name	Scientific Name	Conservation Status[a]					
		BC List Status[b]	COSEWIC Status[c]	SARA - Schedule 1 List Status[d]	CF Priority[e]	Habitat Preference[f]	Potential Seasonal Occurrence[f]
Mammals							
Fisher	*Pekania pennanti*	Blue	–	–	2	Prefer dense coniferous forests for living and patches of large cottonwood trees for denning.	Year round
Grizzly bear	*Ursus arctos*	Blue	SC (May 2002)	–	2	Occur in a variety of habitats based on the availability of preferred forage species.	Year round
Little brown myotis	*Myotis lucifugus*	Yellow	E (Nov 2013)	–	5	Roost in buildings, attics, roof crevices, and loose bark on trees or under bridges. Forage near open water.	Spring, summer, fall
Wolverine	*Gulo gulo luscus*	Blue	SC (May 2003)	–	2	Alpine and Arctic tundra, boreal and mountain forests.	Year round
Amphibians							
Coastal tailed frog	*Ascaphus truei*	Blue	SC (Nov 2011)	SC (Jun 2003)	1	Moderately steep, cold, unsilted streams, and nearby adjacent terrestrial habitat.	Year round
Western toad	*Anaxyrus boreas*	Blue	SC (Nov 2012)	SC (Jan 2005)	2	Occurs in a variety of habitats from sea level to 3,600 m. Breeds in calm, open water of wetlands, stream edges, roadside ditches, or shallow margins of lakes.	Year round
Birds							
American bittern	*Botaurus lentiginosus*	Blue	–	–	2	Nests primarily in inland freshwater wetlands, sometimes in tidal marshes or in sparsely vegetated wetlands or dry grassy uplands. Breeding occurs primarily in wetlands with tall emergent vegetation.	Summer
American golden-plover	*Pluvialis dominica*	Blue	–	–	4	Nests on the ground in dry, open areas and can be found foraging for food on tundra, fields, beaches, and tidal flats.	Spring, summer, fall

English Name	Scientific Name	Conservation Status[a]					
		BC List Status[b]	COSEWIC Status[c]	SARA - Schedule 1 List Status[d]	CF Priority[e]	Habitat Preference[f]	Potential Seasonal Occurrence[f]
Ancient murrelet	*Synthliboramphus antiquus*	Blue	SC (Nov 2004)	SC (Aug 2006)	1	Nests under mature canopies of Sitka spruce and western hemlock where undergrowth is scarce or absent; burrows into mossy slopes and establishes nesting chambers in tree root cavities or under fallen trees.	Spring, summer, winter
Band-tailed pigeon	*Patagioenas fasciata*	Blue	SC (Nov 2008)	SC (Feb 2011)	2	Usually found below 1,000 m in a variety of forest types, especially pine-oak, spruce, fir, Douglas-fir, redwood (*Sequoia sempervirens*), cedar (*Thuja* spp.), hemlock (*Tsuga* spp.) and alder (*Alnus* spp.).	Spring, summer
Barn swallow	*Hirundo rustica*	Blue	T (May 2011)	–	2	Forages in open habitats, frequently near water.	Spring, summer, fall
Brandt's cormorant	*Phalacrocorax penicillatus*	Red	–	–	1	Mainly inshore coastal zone.	Year round
Brant	*Branta bernicla*	Blue	–	–	2	Foraging occurs primarily in marine areas that are marshy, along lagoons and estuaries, and on shallow bays.	Spring, summer
Cackling goose	*Branta hutchinsii*	Blue	–	–	4	Forages in open areas, marshes, estuaries.	Spring, fall
California gull	*Larus californicus*	Blue	–	–	4	Seacoasts, bays, estuaries, mudflats, marshes, irrigated fields, lakes, ponds, dumps, cities, and agricultural lands.	Summer, fall
Canada goose	*Branta canadensis occidentalis*	Red	–	–	2	Various habitats near water, from temperate regions to tundra.	Year round
Caspian tern	*Sterna caspia*	Blue	NAR (May 1999)	–	2	Nests on sandy or gravelly beaches and shell banks along coasts or large inland lakes.	Spring, summer
Cassin's auklet	*Ptychoramphus aleuticus*	Blue	C (2011)	–	2	Pelagic	Spring, summer
Common murre	*Uria aalge*	Red	–	–	2	Pelagic	Year round

English Name	Scientific Name	Conservation Status[a]					
		BC List Status[b]	COSEWIC Status[c]	SARA - Schedule 1 List Status[d]	CF Priority[e]	Habitat Preference[f]	Potential Seasonal Occurrence[f]
Common nighthawk	*Chordeiles minor*	Yellow	T (Apr 2007)	T (Feb 2010)	2	Habitats include mountains and plains in open and semi-open areas: open coniferous forests, savanna, grasslands, fields, near cities and towns. Nesting occurs on the ground on a bare site in an open area.	Summer
Double-crested cormorant	*Phalacrocorax auritus*	Blue	NAR (May 1978)	–	2	Lakes, ponds, rivers, lagoons, swamps, coastal bays, marine islands, and seacoasts; usually within sight of land.	Year round
Great blue heron	*Ardea herodias fannini*	Blue	SC (Mar 2008)	SC (Feb 2010)	1	Freshwater and brackish marshes, along lakes, rivers, bays, ocean beaches, fields, and meadows.	Year round
Horned puffin	*Fratercula corniculata*	Red	–	–	2	Mostly pelagic	Summer
Long-tailed duck	*Clangula hyemalis*	Blue	–	–	2	Coastal waters (e.g., rough water of rocky coasts, deep but calm bays and coves), large inland lakes and (less commonly) rivers.	Year round
Marbled murrelet	*Brachyramphus marmoratus*	Blue	T (May 2012)	T (Jun 2003)	1	Exposed coastal waters, bays, inlets, lagoons, harbours, coves, inlet mouths, and shallow banks	Year round
Northern fulmar	*Fulmarus glacialis*	Red	–	–	2	Pelagic. Nests in colonies primarily on sea cliffs, less frequently on low, flat, rocky islands.	Summer, winter
Northern goshawk	*Accipiter gentilis laingi*	Red	T (Apr 2013)	T (Jun 2003)	1	Typically nests in mature or old-growth forests	Year round
Olive-sided flycatcher	*Contopus cooperi*	Blue	T (Nov 2007)	T (Feb 2010)	2	Breed in various forest and woodland habitats: taiga, subalpine coniferous forest, mixed coniferous-deciduous forest, burned-over forest, spruce or tamarack bogs and other forested wetlands, and along the forested edges of lakes, ponds, and streams	Spring, summer, fall

English Name	Scientific Name	Conservation Status[a]					
		BC List Status[b]	COSEWIC Status[c]	SARA - Schedule 1 List Status[d]	CF Priority[e]	Habitat Preference[f]	Potential Seasonal Occurrence[f]
Pelagic cormorant	*Phalacrocorax pelagius pelagicus*	Red	–	–	2	Bays, inlets, and outer coastal areas, especially in rock-bottom habitats.	Year round
Peregrine falcon	*Falco peregrinus pealie*	Blue	SC (Apr 2007)	SC (Jun 2003)	1	Various open situations from tundra, moorlands, steppe, and seacoasts, especially where there are suitable nesting cliffs, to mountains, open forested regions, and human population centres.	Spring, fall, winter
Pink-footed shearwater	*Puffinus creatopus*	Blue	T (May 2004)	T (Jul 2005)	2	Pelagic	Summer
Red knot	*Calidris canutus*	Red	E/T (Apr 2007)	1-E/T (Feb 2010)	1	Primarily seacoasts on tidal flats and beaches, less frequently in marshes and flooded fields.	Transient
Red-necked phalarope	*Phalaropus lobatus*	Blue	C (Jul 2011)	–	2	Nests in grass-sedge borders of ponds and lakes.	Spring, summer, fall
Rusty blackbird	*Euphagus carolinus*	Blue	SC (Apr 2006)	SC (Mar 2009)	2	Breeding habitat includes moist woodland (primarily coniferous), bushy bogs and fens, and wooded edges of watercourses and beaver ponds.	Summer, fall, winter
Short-billed dowitcher	*Limnodromus griseus*	Blue	–	–	3	Prefers shallow saltwater with soft muddy bottom, but visits various wetlands during migration.	Spring, summer, fall
Surf scoter	*Melanitta perspicillata*	Blue	–	–	4	Primarily marine littoral areas, less frequently in bays or on freshwater lakes and rivers.	Year round
Tufted puffin	*Fratercula cirrhata*	Blue	–	–	2	Pelagic	Summer
Tundra swan	*Cygnus columbianus*	Blue	–	–	4	Lakes, sloughs, rivers, sometimes fields during migration. Open tundra marshy lakes and ponds and sluggish streams in summer. Shallow lakes, ponds, and estuaries in winter.	Year round

English Name	Scientific Name	Conservation Status[a]					
		BC List Status[b]	COSEWIC Status[c]	SARA - Schedule 1 List Status[d]	CF Priority[e]	Habitat Preference[f]	Potential Seasonal Occurrence[f]
Wandering tattler	*Tringa incana*	Blue	–	–	4	Mainly rocky shores and islands, also sandy island beaches along coast, sometimes on mudflats and along rocky streams. Occasionally found on freshwater impoundments near coast and on estuarine substrates.	Spring, summer, fall
Western grebe	*Aechmophorus occidentalis*	Red	C (Jul 2011)	–	1	Marshes, lakes, and bays; in migration and winter also sheltered seacoasts, less frequently along rivers.	Year round
Western screech-owl	*Megascops kennicottii kennicottii*	Blue	T (May 2012)	SC (Jan 2005)	1	Prefers broadleaf and riparian woodland. Also moist coniferous forest and woodland.	Summer, fall, winter
Yellow-billed loon	*Gavia adamsii*	Blue	NAR (May 1997)	–	3	Generally near shore, in protected waters.	Spring, summer, fall

NOTES

[a] Conservation status as of August, 2013 (CDC 2013)

[b] BC List Status:
Red – *extirpated*, *endangered*, or *threatened*
Blue – *special concern*
Yellow – *not at risk*

[c] COSEWIC Status:
C –candidate: species short-listed for future assessment
NAR – *not at risk*
SC – *special concern*: species sensitive to human activities or vulnerable to natural events
T – *threatened*: species likely to become endangered
E – *endangered*: species facing imminent extirpation or extinction

[d] SARA Schedule:
Species at Risk Act schedule, status (definitions the same as COSEWIC) and date of last review

[e] Conservation Framework Priority:
A rank applied to species of 1 (highest) to 6 (lowest) for a set of three goals: 1) contribute to global efforts for species and ecosystem conservation, 2) prevent species and ecosystems from becoming extinct, and 3) maintain the diversity of native species and ecosystems

[f] Campbell et al. 1990a, 1990b; CDC (2013)

Table 5.6-5: Field Surveys Completed in the Facility LSA or Shipping LSA

Focal Group	Survey Type	Survey Period
Wildlife habitat assessments	Conducted concurrently with terrestrial ecosystem mapping (TEM) to support wildlife habitat suitability models	August 2012, May 2014
Breeding birds	Fixed-radius point count surveys	May, early June, and late June 2013
Raptors and wetland birds	Call-playback surveys	May 2013, May and June 2014
Marbled murrelet surveys	Dawn audio/visual surveys and habitat assessment surveys	May, June, and July 2014
Large mammals	Survey transects	All seasons 2013
Amphibians	Transect and intensive surveys	May and June 2013
Incidental observations	Wildlife or wildlife sign, important habitat features (e.g., wildlife trees), and wildlife movement corridors recorded opportunistically	All periods
Migrating waterfowl	Intensive estuary boat surveys	February, April, and June 2013
Marine bird	Vessel fixed-width transect surveys (marine access route) and stationary point surveys (Kitimat River estuary)	August and September 2012, January to October of 2013

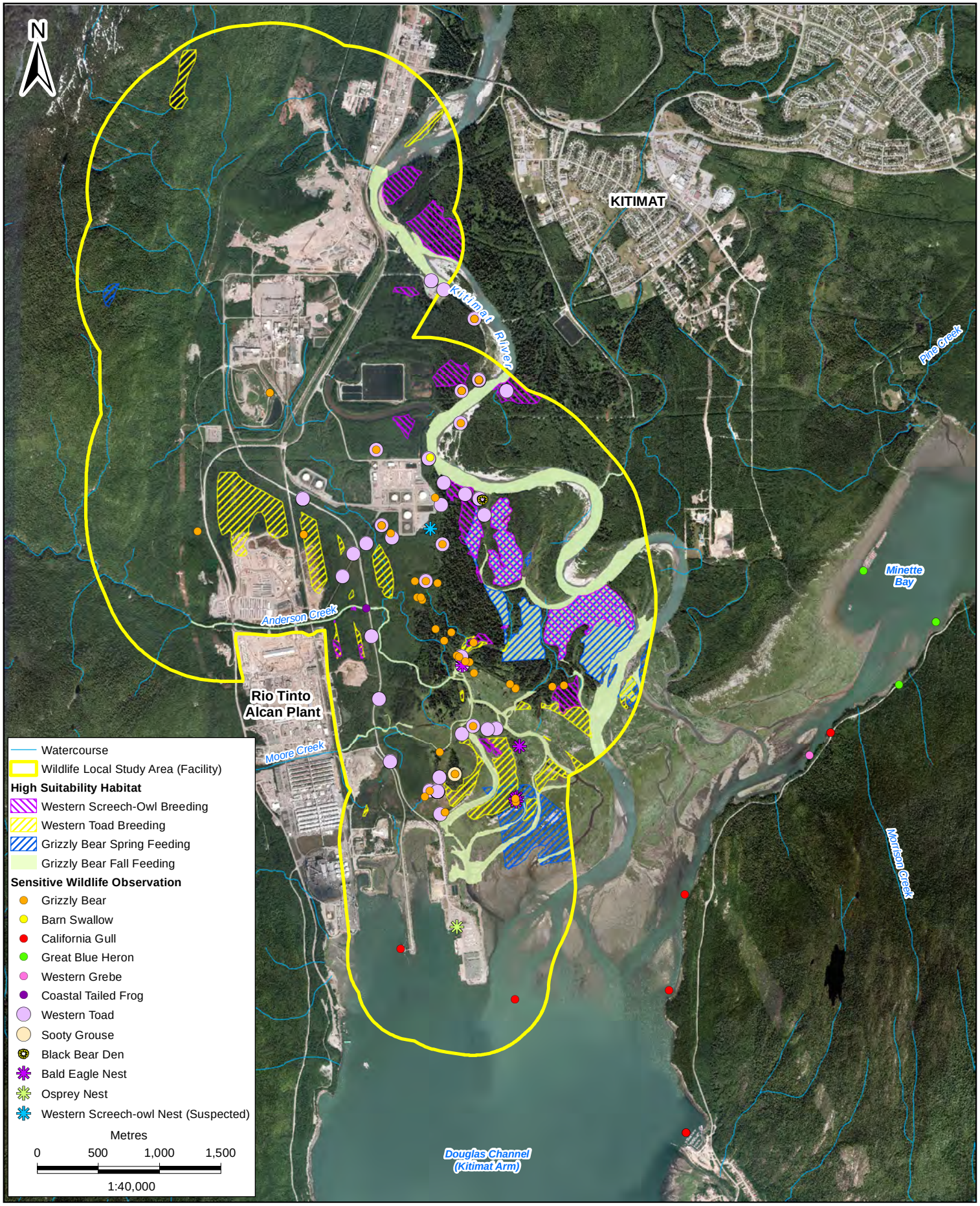
5.6.3.2.4 Field Study Results

Terrestrial Breeding Bird Surveys

A total of 1,237 observations of 58 species were made during breeding bird surveys completed in the facility LSA in May and June of 2013. In May, 48 bird species were detected during point counts dominated by five species: American robin (*Turdus migratorius*), ruby-crowned kinglet (*Regulus calendula*), song sparrow (*Melospiza melodia*), warbling vireo (*Vireo gilvus*), and yellow-rumped warbler (*Setaphaga coronata*) (48.6% of species observed). In June, 55 bird species were detected and dominated by the same five species (41.2% of species observed). Rare or uncommon species were black swift (*Cypseloides niger*), house finch (*Haemorhous mexicanus*), greater yellowlegs (*Tringa melanoleuca*), red-tailed hawk (*Buteo jamaicensis*), ruffed grouse (*Bonasa unbellus*), sandhill crane (*Grus canadensis*), and white-crowned sparrow (*Zonotrichia leucophrys*).

Raptor Call-Playback Surveys

Two owl species were detected during nocturnal surveys in the facility LSA: western screech-owl and northern saw-whet owl (*Aegolius acadicus*) (Figure 5.6-6). Western screech owl response suggested the possible presence of a nest. However, follow-up surveys in 2013 and 2014 did not result in any detections of western screech owl.



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WILDLIFE ENVIRONMENTAL EFFECTS ASSESSMENT

SENSITIVE WILDLIFE AREAS

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION	DRAWN BY
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Three bald eagle nests and two osprey nests were documented in the facility LSA. One active osprey nest is a long-term breeding site located on a light standard at the end of RTA Wharf "B". A second nest pole was constructed on RTA Wharf "B" in 2014. Field surveys completed in 2014 revealed that the osprey from the original nest have relocated to the new nest. Project activities include modifications to this wharf. Two active and one inactive bald eagle nest are located in the central portion of the facility LSA. The bald eagle nests are not located within the Project footprint.

Marbled Murrelet Surveys

A series of marbled murrelet dawn audio and visual, and habitat assessment surveys were completed in the area of the Project footprint identified as overlapping with critical marbled murrelet habitat (61.5 ha) (Environment Canada 2014b). These surveys were completed to document the potential occurrence of this species in the area and the suitability of the habitat for supporting breeding. Audio and visual surveys were repeated at five stations during May, June, and July 2014 and six habitat plots were surveyed (Stantec Consulting Ltd. 2014f). All surveys followed provincial standards for completing marbled murrelet surveys (RIC 2001). During these surveys, six visual detections of marbled murrelet were made of birds flying well above the stand canopy and were not occupancy detections. Marbled murrelet breeding habitat is characterized as variable, with small areas with suitable nesting platforms.

Amphibian Surveys

The western toad was observed in abundance in the facility LSA. Areas of breeding concentrations were observed at wetland sites located with the facility LSA as noted in the Wildlife TDR (Stantec Consultants Ltd. 2014f). Western toad is intimately linked to natal breeding ponds and show high breeding site fidelity in successive years. As such, breeding ponds in and around the facility LSA have the potential to be important habitat for western toad. Other amphibians observed were Columbia spotted frog (*Rana luteiventris*) and northwestern salamander (*Ambystoma gracile*).

Large Mammal Transects

Large mammal transect surveys were conducted in the facility LSA and focused on mammals and opportunistic observations of other wildlife, and wildlife sign; habitat features were also recorded. Six mammal species, twenty-three bird species, and two amphibian species were detected during these surveys. The predominant type of wildlife sign was scat (38.4%). Other types of observations included game trails, mammal feeding sites, mammal resting or bedding sites, large mammal tree markings, ungulate mineral licks, tracks, amphibian breeding ponds, and auditory observations of birds and mammals. Overall, grizzly bear, western tanager (*Piranga ludoviciana*), and western toad were most commonly detected (Stantec Consulting Ltd. 2014f).

Incidental Terrestrial Wildlife Observations

A total of 2,480 observations of 85 species were recorded during and outside of structured surveys focussed on specific species groups within the facility LSA. Seven species listed provincially or federally were identified, including grizzly bear, great blue heron, California gull (*Larus californicus*), peregrine falcon (*Falco peregrinus*), barn swallow (*Hirundo rustica*), coastal tailed frog (*Ascaphus truei*), and western toad. Incidental observations of moose (*Alces americanus*), Canada goose, greater white-fronted goose (*Anser albifrons*), pectoral sandpiper (*Calidris melanotos*), and western toad comprised 71.3% of recorded data. One black bear (*Ursus americanus*) refuge den was observed incidentally.

Marine Bird Vessel-Based Surveys

A total of 9,401 observations of at least 50 species were detected during the vessel surveys (Table 3.3-2 in Stantec Consulting Ltd. 2014f) within the shipping LSA. The four most common species accounted for 41% of observations: rhinoceros auklet (12%), sooty shearwater (*Puffinus griseus*) (12%), surf scoter (*Melanitta perspicillata*) (10%), and ancient murrelet (*Synthliboramphus antiquus*) (7%). Black scoter (*Melinitta americana*), brant (*Branta bernicla*), tufted puffin (*Fratercula cirrhata*), flesh-footed shearwater (*Puffinus carneipes*), yellow-billed loon (*Gavia adamsii*), and pomarine jaeger (*Stercorarius pomarinus*) were observed only once during structured surveys. Of the 50 species observed, two are listed under SARA: ancient murrelet (*Synthliboramphus antiquus*) and marbled murrelet; four are provincially red-listed species: common murre (*Uria aalge*), northern fulmar (*Fulmarus glacialis*), pelagic cormorant (*Phalacrocorax pelagius pelagicus*), and western grebe (*Aechmophorus occidentalis*); and 13 species are provincially blue-listed species: ancient murrelet, long-tailed duck (*Clangula hyemalis*), brant, marbled murrelet, cackling goose (*Branta hutchinsii*), red-necked phalarope (*Phalaropus lobatus*), California gull, surf scoter, Cassin's auklet (*Ptychoramphus aleuticus*), tufted puffin, double-crested cormorant (*Phalacrocorax auritus*), yellow-billed loon, and flesh-footed shearwater.

Marine Bird Shore-Based Surveys

In total, 5,178 observations of 53 species were observed during stationary counts within the facility LSA – all species noted as occurring within the estuary are identified as migratory birds under the MBCA. The three most common species accounted for 30% of observations: Canada goose (10%), western sandpiper (10%), and mallard (*Anas platyrhynchos*) (9%). Less common species included merlin (*Falco columbarius*), least sandpiper (*Calidris minutilla*), Pacific loon (*Gavia pacifica*), peregrine falcon (*Falco peregrinus*), pigeon guillemot (*Cepphus columba*), rock sandpiper (*Calidris ptilocnemis*), western grebe, and Wilson’s snipe (*Gallinago delicata*). The highest diversity of species was observed in the fall and spring (38 species); and, the lowest was observed in winter (24 species). The highest number of observations were in the spring (3,331), followed by fall (1,401), and winter (446). The largest number of

species observed in spring was Canada goose (14%), western sandpiper (14%), greater white-fronted goose (*Anser albifrons*) (9%), and mallard (8%). In winter, the most observations were of mallard (33%), Canada goose (16%), mew gull (*Larus canus*) (13%), and greater white-fronted goose (13%). The most observations in fall were of herring gull (*Larus argentatus*) (19%), California gull (18%), mew gull (9%), and common merganser (*Mergus merganser*) (8%).

5.6.3.2.5 Terrestrial Wildlife Habitat Suitability Modelling

Wildlife habitat suitability models are used for six key wildlife species: grizzly bear, Pacific marten, western screech-owl, harlequin duck, western sandpiper, and western toad, and one key marine bird species, marbled murrelet. These models aid in the assessment of potential effects on key species by identifying the availability of species-specific habitat requirements. The models use provincial standards for wildlife habitat suitability ratings (RIC 1999) and integrated ecosystem mapping units from TEM developed for the Project (RIC 1998). Models are based on species life requisites, seasonality of habitat use in the facility LSA, and critical periods and vulnerabilities for each species. These models also incorporate species-specific disturbance buffers. Key species accounts and figures showing suitability modelling results are described in Stantec Consulting Ltd. 2014f.

Habitat Availability at Baseline

The results of habitat suitability modelling indicate that 627.5 ha of the facility LSA (Table 5.6-6) is effective (the sum of moderate- to high-suitability habitat) grizzly bear spring feeding habitat, primarily within the southeast portion near the mouth of the Kitimat River (Stantec Consulting Ltd. 2014f). Effective fall feeding habitat for grizzly bear covers 680.0 ha (28.6%) of the facility LSA. Grizzly bear spring and fall feeding habitat is primarily associated with the Kitimat River and sedge-dominated habitats surrounding the estuary.

Table 5.6-6: Grizzly Bear Spring and Fall Feeding Habitat at Baseline in the Facility LSA

Habitat Suitability	Spring Feeding Habitat Area of Suitable Habitat (ha)	Fall Feeding Habitat Area of Suitable Habitat (ha)
High	93.6	165.6
Moderately high	340.5	210.6
Moderate	193.4	303.8
Low	214.6	537.7
Very low	807.9	548.8

Effective Pacific marten year-round living habitat is limited to 132.7 ha in the facility LSA (Table 5.6-7). Most of this habitat is located on the west and east sides in mature coniferous forests. Marten depend on the availability of structurally diverse mature and old-growth coniferous forests, which are moderately limited here by previous disturbances and natural fluctuations of large aquatic features: river, estuary, creeks, and the ocean.

Models indicate that effective western screech-owl year-round living habitat covers 288.1 ha of the facility LSA (Table 5.6-7). Western screech-owls prefer open woods and riparian habitat within 300 m of waterbodies. In the facility LSA, this habitat occurs adjacent to Kitimat River in riparian and deciduous forests. Wildlife trees with cavities that have been documented during field studies in these areas may provide nest sites.

There is limited availability of high and moderate marbled murrelet breeding habitat in the facility LSA (31.0 ha and 106.3 ha, respectively) (Table 5.6-7).

The amount of effective western toad breeding habitat is limited (143.6 ha) and occurs primarily in the central wetlands (Table 5.6-7).

There are 142.1 ha of effective western sandpiper spring and fall foraging habitat in wetlands, along ocean shoreline, and in mudflats in the Kitimat River estuary. Habitat models indicate that 181.9 ha of effective harlequin duck spring and fall foraging habitat are available in the facility LSA (Table 5.6-7). This is located in the nearshore channel, upstream aquatic habitats, and in the Kitimat River estuary. The Kitimat River estuary has been identified as a provincially recognized and important staging area for these and numerous other shorebird and waterfowl species.

Table 5.6-7: Habitat Availability at Baseline for Key Species in the Facility LSA

Habitat Suitability	Harlequin Duck Spring and Fall Foraging	Marbled Murrelet Breeding	Pacific Marten Year-Round Living	Western Sandpiper Spring and Fall Foraging	Western Screech Owl Year-Round Living	Western Toad Breeding
	Area of Suitable Habitat (ha)	Area of Suitable Habitat (ha)	Area of Suitable Habitat (ha)	Area of Suitable Habitat (ha)	Area of Suitable Habitat (ha)	Area of Suitable Habitat (ha)
High	159.3	31.0	81.0	32.4	75.3	69.6
Moderate	22.6	106.3	51.7	109.7	212.8	74.0
Low	399.7	590.1	843.0	294.7	730.1	171.8

Sensitive Wildlife Areas

Western screech-owl detection during 2013 raptor call-playback surveys conducted in the facility LSA suggested a potential nest location; however, this was not confirmed as follow-up surveys in 2013 and 2014 did not result in any further observations (Stantec 2014f). Should a western screech-owl breeding site be present in the area, it would be considered regionally important given the relatively limited distribution of suitable breeding habitat: patches of older riparian woodlands with large-diameter trees and cavities suitable for nesting and roosting. Three bald eagle nests and two osprey nests were also detected in the facility LSA. One osprey nest is a long-term breeding site located on a light standard at the end of the RTA Wharf "B" within the proposed marine terminal (Stantec Consulting Ltd. 2014f: Figure 2.3-4). A second nest pole was installed in early 2014 on behalf of RTA, also on the RTA Wharf "B". In the summer of 2014 an osprey was observed actively nesting on this new structure while the original structure was empty suggesting that the osprey likely relocated its nest to the new structure. Two active and one inactive bald eagle nests were located in the central portion of the LSA but outside of the Project footprint.

Western toad was relatively abundant during the summer 2013 field season. Areas of breeding concentrations were observed at wetland sites located within the facility LSA as noted in the Wildlife TDR (Stantec 2014f). Western toads have high breeding site fidelity in successive years. As such, breeding ponds in and around the facility LSA have the potential to be important habitat for western toad. Other amphibians observed were Columbia spotted frog (*Rana luteiventris*) and northwestern salamander (*Ambystoma gracile*).

Grizzly bear use a diversity of habitat types in their home ranges for travel, thermal cover, seclusion, feeding, and denning (Schwartz et al. 2003). Grizzly bear were seasonally abundant, especially during the fall salmon migration in Kitimat River (Stantec 2014f). Movement corridors used by bears that normally reside in upland habitats outside of the facility LSA were evident on human-made dikes in the central portion of the facility LSA. The dikes were used to approach the sedge communities along the river, riparian zones, and the river itself.

5.6.4 Project Interactions

Table 4.4–1 (Section 4) identifies potential interactions of concern between Project activities and each of the selected VCs that are assessed. The potential effects identified in Section 5.6.2.4 that might result in an adverse effect as a result of interactions with Project activities are assessed. The extent to which the interactions are considered is ranked in Table 5.6-8. The ranking categories (i.e., 0, 1, or 2) are defined in a footnote to the table.

Table 5.6-8: Potential Project Effects on Wildlife Resources

Project Activities and Physical Works	Potential Effects				
	Terrestrial Wildlife			Marine Birds	
	Loss or change in habitat for species of interest	Risk of injury or mortality	Sensory disturbance or behavioural alterations	Risk of injury or mortality	Sensory disturbance or behavioural alterations
Facility Activities and Works					
Construction					
Site preparation (clearing, grubbing, grading, levelling, and set-up of temporary facilities)	2	2	2	0	0
Onshore construction (installation of LNG facility, utilities, ancillary support facilities, access roads, and includes hydrotesting)	2	2	2	0	0
Dredging (includes disposal)	0	0	1	0	1
Marine terminal construction (modifications to existing wharf, installation of sheet piling, material offloading and laydown areas, transfer piping and electrical infrastructure)	2	2	2	2	2
Waste management (waste collection and treatment)	0	1	0	1	0
Vehicle and rail traffic (haul road upgrades, road use, vehicle traffic)	0	2	2	0	0
Commissioning and start-up	0	0	1	1	1
Operation					
LNG production (including natural gas treatment, condensate extraction, storage, and transfer), storage, and loading	0	1	1	2	2
Waste management (solid and liquid waste collection and disposal, wastewater effluent collection and treatment, site stormwater management)	0	1	0	0	0
Vehicle and rail traffic (road use, vehicle traffic)	0	2	2	0	0
Decommissioning and Reclamation					
Dismantling of land-based and marine infrastructure	0	2	2	1	2
Remediation and reclamation of the site	0	1	1	0	1
Waste management	0	1	0	0	0
Shipping Activities					
Construction					
Shipping equipment and materials	0	0	0	2	2
Operation					
LNG shipping	0	0	0	2	2

Project Activities and Physical Works	Potential Effects				
	Terrestrial Wildlife			Marine Birds	
	Loss or change in habitat for species of interest	Risk of injury or mortality	Sensory disturbance or behavioural alterations	Risk of injury or mortality	Sensory disturbance or behavioural alterations
Decommissioning					
Shipping equipment and materials	0	0	0	2	2

KEY:

0 = No interaction.

1 = Potential adverse effect requiring mitigation, but further consideration determines that any residual adverse effects will be eliminated or reduced to negligible levels by existing codified practices, proven effective mitigation measures, or BMPs.

2 = Interaction may occur and the resulting effect may exceed acceptable levels without implementation of Project-specific mitigation. Further assessment is warranted.

NOTE: Only activities with an interaction of 1 or 2 for at least one effect are shown.

A conservative approach is taken in assigning a Rank of 1, whereby interactions with a meaningful degree of uncertainty are assigned Rank 2 so that a detailed effects assessment is conducted.

5.6.4.1 Justification of Interaction Rankings

Project activities identified in Table 5.6-8 that could potentially cause an adverse residual effect are ranked as 2 and are assessed in Section 5.6.5 and Section 5.6.6. Interactions ranked as 1 are those where residual effects may occur but are well managed through standard operating procedures, BMPs or proven effective mitigation measures and the resulting effect would be eliminated or managed to negligible levels through implementation of these operating procedures. As a result, no further assessment is warranted in the Project-specific assessment sections. However, interactions ranked as 1 that result in residual effects are considered in the cumulative effects assessment as part of the potential addition to cumulative effects that the Project may make. Activities assessed as having no measurable interaction with wildlife resources and ranked as 0 are not further assessed. The following section describes and justifies potential interactions that are ranked as 1.

5.6.4.1.1 Facility Activities and Works

Terrestrial Wildlife

Activities associated with construction have the potential to interact with terrestrial wildlife. These activities include discharge into the river and marine environment. These activities will be managed to meet regulatory standards for health and safety and will have minimal effects that extend to wildlife and wildlife habitats.

Waste management might attract large and small mammals to the Project site. Application of the Waste Management Plan (Section 12) to correctly dispose of waste, effluent, and storm water, will mitigate the potential for human-wildlife conflicts, property damage, and wildlife removal or destruction.

LNG production will contribute to sensory disturbance and behavioural alterations to terrestrial wildlife for the life of the Project. Terrestrial wildlife might avoid the LNG facility and the immediate area surrounding the facility because of noise, lighting, and the physical presence of the facility. Operation of the LNG facility will introduce an increased level of human and equipment activity, which may continue to disturb some sensitive species. Although the response to physical or auditory disruptions varies by species or by individual familiarity, wildlife will tend to avoid moderate- to high-level disturbances (Habib et al. 2007; Bayne et al. 2008; Schaub et al. 2008). However, mitigation designed to manage noise and design considerations for wildlife passage along the LNG loading line will help mitigate these effects so that the level of disturbance is managed.

The Project may contribute to an increased risk of injury or mortality to wildlife due to potential increases in airborne sulphur dioxide and nitrogen dioxide concentrations or through nitrogen, sulphur, or acid deposition on soil or water. Amphibians may be the most susceptible group to deposition of nitrogen, sulphur and acid into water as they spend large portions of their life history within aquatic systems (Vitt and Caldwell 2013). In particular, changes in water acidity have been shown to influence the reproduction of amphibians by causing direct mortality of embryos and larvae, and/or by disrupting trophic relationships between amphibians and other aquatic organisms (Freda 1986). Given that amphibians have both aquatic and terrestrial life requisites the pathway of potential effects can be assessed by evaluating adverse changes in surface water quality (Section 5.9) and vegetation (Section 5.5.5.3). In the surface water quality assessment, the determination of acidification effects is based on critical load exceedances identified for the protection of aquatic life and is assessed as not significant (Section 5.9.5.2), while the determination of eutrophication effects is based on a change in trophic status causing eutrophication and is assessed as not significant (Section 5.9.5.3). In the vegetation assessment, the determination of deposition effects is based on critical load exceedances identified for the protection of ecosystem structure and function and is assessed as not significant, while the assessment of fumigation effects is based on critical levels identified for the protection of plant health and is assessed as not significant

(Section 5.5.5.3.6). Effects on amphibians due to Project emissions are not expected to occur since the conservative approach used to evaluate the acidification of freshwater systems and vegetation is anticipated to protect all biota.

Remediation and reclamation activities, although targeted at restoring wildlife habitat, might lead to an increased risk of injury or mortality, sensory disturbance or behavioural alterations for terrestrial wildlife. These activities will include an increase in activity and access to the site, which can lead to altered wildlife movement. Machinery and equipment used for these activities might also interact with terrestrial wildlife, therefore, increasing mortality risk. These activities are, however, directed at restoring wildlife habitat and, with the implementation of standard operating procedures, BMPs and/or proven effective mitigation measures, will not lead to potential adverse effects that cannot be mitigated.

Based on experience, professional judgment, and the ability to mitigate effects through legislated standards and BMPs, effects potentially associated with the activities listed above will be negligible.

Marine Birds

Activities associated with facility or marine terminal construction might interact with marine birds. These activities will be managed to meet regulatory standards for health and safety and will not have potential effects that extend to marine birds and marine bird habitats.

Dredging will be required to allow for LNG carriers to move in and out of the marine terminal. This activity might cause sensory disturbance or behavioural alterations to marine birds. However, this disturbance will be short-term and localized, occurring in an industrial area already heavily used by large and small vessels.

Activities associated with dismantling of land-based and marine infrastructure might increase the risk of injury or mortality for marine birds. The dismantling of marine infrastructure is expected to take approximately 24 months and will require in-water works and equipment that might result in a localized, increased risk of mortality for marine birds. Many marine bird species are sensitive to disturbance and will move away from vessels and loud noises, flushing away from these areas and avoiding any interaction. However, given that this will be a localized disturbance that will occur sporadically over the time period and will likely only result in a low level risk of injury or mortality.

Remediation and reclamation activities, although targeted at restoring habitat, might lead to sensory disturbance or behavioural alterations for marine birds given the potential for noise disturbance to occur. These activities are, however, directed at restoring habitat and will not lead to potential adverse effects that cannot be mitigated.

Based on professional judgment, available information and experience, the effects on marine birds from the above activities will be negligible.

5.6.4.1.2 Shipping Activities and Works

Terrestrial Wildlife

All shipping activities and associated effects are restricted to the marine environment along the marine access route. Therefore, there are no identified pathways of effects on terrestrial wildlife from marine shipping activities along the marine access route.

Marine Birds

All activities associated with marine shipping are assessed for marine birds (Section 5.6.6).

5.6.5 Assessment of Residual Effects from the LNG Facility

5.6.5.1 Analytical Methods

5.6.5.1.1 Analytical Assessment Techniques

Potential effects of the Project on wildlife resources are assessed using both a quantitative habitat-based geographic information system (GIS) spatial analysis (to measure habitat loss or alteration) as well as a qualitative approach (to estimate sensory disturbance or risk of mortality). A qualitative approach is used where thresholds are not defined in the literature or standards are not available, and includes the professional expertise and judgment of the assessment team.

To assess the potential loss or alteration of terrestrial wildlife habitats, habitat suitability models characterize the availability of suitable habitat at baseline in the facility LSA for seven key terrestrial species (Section 5.6.5.2) and the subsequent potential change from construction of the Project. Effects of the Project on terrestrial wildlife and marine birds are assessed with consideration for the principles of ecosystem-based management. These principles provide a strategy for assessing Project effects on wildlife and marine bird communities with seasonally overlapping niches and habitat requirements during breeding, foraging, staging, and migration. Modelling results are combined with data from TEM field validation studies, eight types of technical surveys to document use of the site by wildlife species and species groups, historical data, and supporting information from literature sources.

Sensory disturbance is qualitatively assessed based on species-specific sensitivities and the potential for sensory disturbance to influence changes in suitable habitat use, or induce stress, behavioural alterations, or habitat avoidance as a result of construction or operation activities. The potential for wildlife injury or mortality is qualitatively assessed based on the known behavioural tendencies during movement or migration, sensitivity to night lighting of the LNG facility or berthed LNG carriers, level of risk or

familiarity, and seasonal use by the species relative to changes to habitat and structures during construction and operation.

These combined approaches provide a strong basis for assessing potential effects of the Project on wildlife overall and are consistent with recommended approaches (see RIC 1998, 1999; Coast Information Team 2004; Hanson et al. 2009; BC MOFR and MOE 2010).

5.6.5.1.2 Assumptions and the Conservative Approach

A conservative approach manages the likelihood that an effect will be understated and takes into account available data, incomplete understandings of interactions between Project activities and key species, and inherent limitations in models. As a result, assumptions need to be made. Defined mitigation measures are also considered adequate for eliminating or reducing effects to negligible levels. The assessment considers Project effects on individual key species as well as on terrestrial wildlife and marine birds as a whole. This approach manages the averaging of effects and is therefore conservative.

The effects assessment considers changes from baseline conditions and uses a comprehensive suite of information to establish baseline conditions. Data collected during field studies, and used in conjunction with historical and available data, are used to establish baseline conditions. Data used to prepare a disturbance layer for the LSAs were compiled from multiple existing sources. These data were reviewed in their entirety for duplication of disturbance features, and duplicates were removed. Where possible, disturbance features were validated against imagery. It is likely that some disturbance features are not yet captured in the data sources that were acquired, mainly as a result of time since these datasets were last updated.

5.6.5.2 Assessment of Loss or Change in Habitat

5.6.5.2.1 Description of Project Effect Mechanisms for Loss or Change in Habitat

Activities associated with the construction phase of the Project, including site clearing and grading, are the primary mechanisms through which the abundance and distribution of suitable wildlife habitat will be altered. This activity will take place in the Project footprint of the facility LSA; therefore, the assessment primarily focuses on terrestrial key species.

5.6.5.2.2 Mitigation for Loss or Change in Habitat

The following mitigation measures will manage the adverse effects on wildlife of loss or change in habitat for terrestrial key species.

- Develop and implement a Wetland Compensation Plan to address loss of wetland habitat function for breeding and foraging terrestrial mammals, amphibians, and birds (Mitigation 5.5-10).

- Clearly delineate (flag) vegetation clearing limits to avoid damage to important wildlife habitat features (e.g., large boulders, nurse logs, raptor nests, mammal dens, ungulate mineral licks) in the facility LSA but outside of the Project footprint or the areas of temporary construction disturbance. Major game trails will be cleared of equipment, brush piles, and felled trees to maintain their use as movement corridors for wildlife, where practicable (Mitigation 5.6-1).
- Develop and implement an approved raptor management plan (Mitigation 5.6-2).
- A Wildlife Management Plan will be developed and will include requirements for reporting wildlife sightings, including bat or bird collisions. Reporting will include information such as species, location, and weather conditions (Mitigation 5.6-3).
- Develop and implement a Decommissioning Plan before decommissioning to allow habitat recovery and wildlife movement to proceed as soon as possible (Mitigation 5.6-4).

These mitigation measures will manage the magnitude and permanency of potential loss or change in habitat by limiting the extent of potential habitat loss from Project construction activities. These mitigation measures (e.g., Wildlife Management Plan) also address potential issues associated with marbled murrelet and SARA. Results from the review of BMPs, literature, and mitigation measures conducted for similar projects, as well as professional judgment for the Project-specific required or best management measures, are considered in determining the mitigation measures.

5.6.5.2.3 Characterization of Loss or Change in Habitat

The loss or change in terrestrial wildlife habitat is adverse in direction, moderate to high in magnitude, and local in geographic extent. Habitat loss will occur once, but the effects will be long-term. Available wildlife habitat will be directly reduced for key species during construction to accommodate the required area for the facility. Habitat will be cleared in the Project footprint and outside of existing disturbed industrial areas for facility buildings, infrastructure, roads, and the LNG loading line.

An estimated 265 ha will be cleared of vegetation within the Project footprint to accommodate the full build out of the LNG facility which will result in a direct and permanent loss of habitat for key species, or an alteration of habitat to early seral plant communities. Habitat loss includes approximately 40 ha of upland forest, 80 ha of wetland habitats and 145 ha of floodplain habitat (See Section 5.5; Table 5.5.5). There will also be approximately 20 ha that may be subject to tree clearing but will not result in loss of understory vegetation. Key wildlife species most affected by these habitat losses include Pacific marten, marbled murrelet, grizzly bear, and western screech owl.

Removal of mature and old-growth coniferous and mixed forest patches in the Project footprint will reduce canopy cover and create edge habitat along the boundary of the footprint. An increase in forest edge has been shown to be detrimental to nesting success of marbled murrelet (Environment Canada 2014b). Breeding birds that nest in interior forest patches become susceptible to predation and resource

competition from edge species, such as squirrels, hawks, and corvids, as edge habitat increases (Robinson et al. 1995; Burger 2002; Malt and Lank 2009). Fragmented stands of forest can confine interior species into small, sometimes nonviable, populations.

Increasing the density of human-made disturbance features requires that wildlife adapt through alterations in natural behaviour, which might adversely affect overall community diversity. In this landscape, it is important to maintain connectivity corridors to allow wildlife movement within the matrix of changed habitats and sustain natural species diversity and viability. This is particularly true for wide-ranging species such as grizzly bear, which requires secure movement corridors with adequate vegetative cover to allow bears to access seasonally important habitats (Schwartz et al. 2003).

As patches of old forest and woody debris are cleared, natal dens and refuges for Pacific marten and other small mammals may be lost or exposed (Powell et al. 2003). Snag removal might also limit opportunities for breeding, foraging, and roosting for insectivorous and or cavity-nesting birds and mammals (e.g., western screech-owl, woodpeckers, owls, ducks, nuthatches, chickadees, and bats).

The amount of habitat loss from clearing for all key species is summarized in Table 5.6-9.

Operation and decommissioning will not contribute to further loss of habitat.

Grizzly Bear

At completion of facility construction, approximately 120 ha (≤0.003% of facility RSA) of effective grizzly bear spring foraging habitat in the facility LSA will be removed (Table 5.6-9). The remaining spring foraging habitat is primarily located in the southeast portion of the facility LSA, associated with the Kitimat River estuary (Stantec Consulting Ltd. 2014f). At completion of facility construction, approximately 112ha of effective grizzly bear fall foraging habitat will be removed.

Harlequin Duck

At completion of facility construction, approximately 13 ha (≤0.003% of facility RSA) of effective summer and fall foraging habitat for harlequin duck will be removed, in part from construction of the marine terminal. Marine and wetland habitats in the facility LSA are identified as potential spring and fall foraging locations for harlequin duck during annual migration events. These areas, seasonally used by harlequin duck, are concentrated at the south marine interface and represent a relatively small component of the remaining marine and estuarine habitats.

Table 5.6-9: Predicted Change in Modelled Habitat for Key Species in the Facility Study Areas

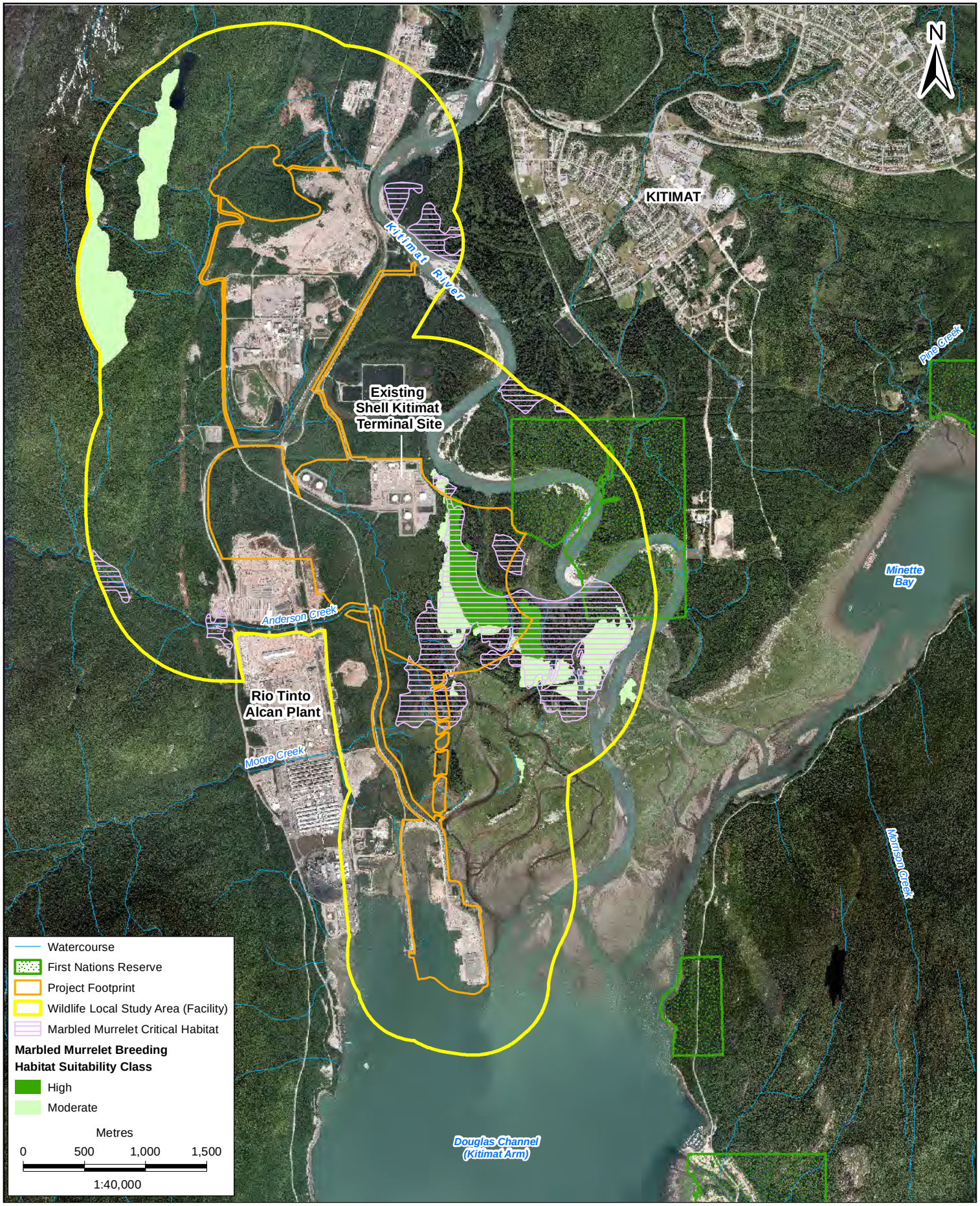
Species	Season	Habitat Suitability Class	Baseline	Operation	Change	
			Area in LSA (ha)	Area in LSA (ha)	Change from Baseline to Operation (ha)	Change (%) in RSA
Grizzly bear	Spring foraging	High	93.6	71.5	-22.1	≤0.003
		Moderately high	340.5	281.2	-59.3	≤0.003
		Moderate	193.4	155.5	-38.0	≤0.003
		Total effective	627.5	508.2	-119.4	≤0.003
Grizzly bear	Fall foraging	High	165.6	141.7	-23.9	≤0.003
		Moderately high	210.6	152.5	-58.1	≤0.003
		Moderate	303.8	274.1	-29.8	≤0.003
		Total effective	680.0	568.3	-111.8	≤0.003
Harlequin duck	Summer / fall foraging	High	159.4	150.7	-8.7	≤0.003
		Moderate	22.6	18.6	-4.0	≤0.003
		Total effective	182.0	169.3	-12.7	≤0.003
Marbled murrelet	Breeding	High*	31.0	1.9	-29.1	≤0.003
		Moderate	106.4	96.6	-9.8	≤0.003
		Total effective	137.4	98.5	-38.9	≤0.003
Pacific marten	Year-round living	High	81.0	31.7	-49.3	≤0.003
		Moderate	51.7	51.7	0	≤0.003
		Total effective	132.7	83.4	-49.3	≤0.003
Western sandpiper	Summer / fall foraging	High	32.4	30.5	-1.9	≤0.003
		Moderate	109.7	91.4	-18.3	≤0.003
		Total effective	142.1	121.9	-20.2	≤0.003
Western screech-owl	Year-round living	High	75.3	56.6	-18.8	≤0.003
		Moderate	212.8	157.5	-55.3	≤0.003
		Total effective	288.1	214.1	-74.1	≤0.003
Western toad	Breeding	High	69.6	34.6	-35.0	≤0.003
		Moderate	74.0	47.0	-27.0	≤0.003
		Total effective	143.6	81.6	-62.0	≤0.003

NOTE:
* Based on habitat suitability modelling this was categorized high suitability. Subsequent field studies indicate it is of moderate quality.

Marbled Murrelet

Environment Canada has spatially identified and mapped nesting critical habitat for marbled murrelet for six conservation regions in BC (Environment Canada 2014b). Within the Northern Mainland Coast conservation region, a small portion of nesting critical habitat overlaps with the facility LSA (187.4 ha) and an even smaller portion with the Project footprint (61.5 ha) (Figure 5.6-7). Environment Canada's estimate of potentially suitable nesting habitat in the Project footprint and facility LSA are 22.6 ha and 50 ha greater respectively than the TEM based modelling approach applied by Stantec (Stantec 2014). However, the spatial distribution of these two datasets are closely aligned. This discrepancy is in part due to the fact that the spatial resolution of data used for habitat suitability modelling by Environment Canada did not remove unsuitable habitat areas (i.e., proposed habitat overlaps with the Kitimat River and non-forested estuary habitats) (Figure 5.6-7) thus overestimating total area.

Although identified as critical habitat, the area in the Project footprint was assessed to be of marginal value based on information provided in the marbled murrelet recovery strategy (Environment Canada 2014b,c), supporting reports (e.g., Burger 2002; CMMRT 2003) and recent field surveys (Stantec Consulting Ltd. 2014f). Mature forest habitat bordering the ocean provides less suitable nesting habitat where exposure and predator densities reduce suitability or nesting success (CMMRT 2003). Generally, nesting habitat within 500 m of the shoreline is less suitable than nesting habitat further than 500 m away (CMMRT 2003). Forest edges may also affect habitat suitability. Natural edges (e.g., rivers, bogs, avalanche chutes) appear to have no adverse effects on suitability, but disturbed sites, recent clearcuts, and young forest (i.e., less than 40 years old) adjacent to suitable habitat may be adversely affected, particularly where human activity is likely to attract potential nest predators. Edge effects, if present, are estimated to extend from 50 m to 100 m into suitable nesting habitat patches. Edge effects will be exacerbated in forest patches that are relatively small (i.e., 40 ha to 50 ha), and where the edge is particularly elongated or with convoluted boundaries (CMMRT 2003). The Project infrastructure will be located in an industrialized area where considerable human activity has already occurred and continues to occur. Critical habitat in the facility LSA that will be affected has elongated and convoluted edges, comprises relatively small patch sizes, and is located relatively near ocean shoreline and the surrounding industrial activities. These conditions reduce the suitability of this habitat for marbled murrelet nesting in the facility LSA.



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LNG CANADA
Opportunity for British Columbia. Energy for the world

WILDLIFE ENVIRONMENTAL EFFECTS ASSESSMENT

MARBLED MURRELET CRITICAL HABITAT

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION: UTM9	DRAWN BY: SS
DATUM: NAD 83	CHECKED BY: SW
DATE: 22-AUG-14	FIGURE NO.: **5.6-7**

To address the uncertainty regarding the presence and quality of marbled murrelet critical habitat in the Project footprint, field surveys were completed during the marbled murrelet breeding period (May, June, and July 2014). These surveys documented the presence/absence of marbled murrelet as well as the quality of marbled murrelet critical habitat. Marbled murrelet were not detected during May and July 2014 surveys, but six observations were made during June surveys (Stantec Consulting Ltd. 2014f). Birds detected in June were well above canopy height, which, based on the characteristic flight behaviour of marbled murrelet, suggests that these were flybys and not occupancy observations (i.e., resident birds). Quality of potential breeding habitat for marbled murrelet was variable across the habitat plots with no potential platform trees in some areas (Stantec Consulting Ltd. 2014f).

Although marbled murrelet are not expected to breed in the Project footprint, if they did, the potential effect would be restricted to a single nesting pair. Environment Canada (2014b) notes that nesting marbled murrelet occur at densities of one pair per 33 ha to 67 ha of suitable breeding habitat—a median density of one pair per 50 ha of suitable breeding habitat. Based on minimum regional retention targets and median nesting densities, it is estimated that the Northern Mainland Coast (292,651 ha) could support up to 5,853 nesting pairs of marbled murrelet. Using this same median density, the area of critical habitat in the Project footprint has the potential to support one nesting pair. The potential loss of one nesting pair represents less than 0.001% of the potential breeding population in the Northern Mainland Coast. The federal recovery plan for marbled murrelet indicates that for the Northern Mainland Coast the critical threshold amount of suitable breeding habitat is 68% retention of 2002 suitable nesting habitat (Environment Canada 2014b). The estimated amount of suitable nesting habitat in the Northern Mainland Coast for 2002 is 430,369 ha (Environment Canada 2014c). Therefore, the estimated retention target is 292,561 ha in the Northern Mainland Coast (Environment Canada 2014c). This suggests that the regional supply of suitable nesting habitat could be reduced by an additional 137,718 ha over 2002 levels. In this context, the area of critical habitat affected by the Project (61.5 ha) is less than 0.001% of the estimated total in 2002 and less than 0.001% of the assumed supply target area. Therefore, the Project will not affect the ability to achieve short-term as well as long-term population and distribution objectives for the Northern Mainland Coast population (Environment Canada 2014b).

Pacific Marten

There is a relatively small amount of effective year-round living habitat identified for Pacific marten in the facility LSA (approximately 135 ha; ≤0.003% of facility RSA), which is primarily located within old-growth coniferous forests (Stantec Consulting Ltd. 2014f). Removal of high-suitability old-growth coniferous forest in the facility LSA to construct the LNG facility is the primary effect on Pacific marten year-round living habitat (approximately 50 ha) (Table 5.6-9).

Western Sandpiper

Vegetation clearing for construction of the LNG facility will result in the loss of approximately 20 ha (≤0.003% of RSA) of effective summer and fall foraging habitat for western sandpipers within the facility LSA. Only an estimated 2 ha of highly suitable habitat for western sandpiper will be cleared.

Western Screech Owl

The loss of riparian-associated mature deciduous and old-growth mixedwood forest is the primary contributor to the loss of effective western screech-owl year-round living habitat (approximately 75 ha).

Western Toad

Clearing for construction of the LNG facility will result in the loss of approximately 62 ha of western toad breeding habitat, including known breeding ponds (Stantec Consulting Ltd. 2014f). Mitigation measures, including an amphibian capture and relocation program before clearing and wetland compensation, will manage the loss of western toad habitat. Compensation associated with wetland loss will effectively address residual effects on western toad.

Terrestrial Species Summary

Availability of terrestrial habitat for key species in the facility LSA will be reduced by approximately 265 ha with habitat loss including 40 ha of upland forest, 80 ha of wetland habitats, and 145 ha of floodplain habitat. An additional 21 ha may be subject to tree clearing but will not result in loss of understory vegetation. Grizzly bear require areas for feeding, travel, and seclusion, including sedge meadows and riparian forests that support key forage species. Marbled murrelet, western screech-owl, and Pacific marten require mature and old-growth forests for reproduction and year-round living. Best management practices will be applied to facilitate compliance with SARA and the *Wildlife Act*, and to avoid, where possible, the destruction or disturbance of breeding sites and nests, especially during sensitive wildlife periods such as reproduction (BC MOE 2012; Environment Canada 2014a).

Loss or change in habitat will occur in an area subject to existing anthropogenic and industrial disturbances (e.g., RTA facility, former Methanex facility, former Eurocan Pulp and Paper site); consequently, most local wildlife populations are expected to demonstrate some level of habituation. Considering baseline habitat types and the sensitive nature of the estuary ecology, there will be low to moderate resilience to changes in habitat caused by the Project. Most wildlife species present have secure populations and access to additional suitable habitats in the facility RSA. Habitat loss in most of the Project footprint is assumed to be irreversible following decommissioning and reclamation as the site will be returned to industrial lands standard and will not be re-vegetated. During operations, habitat in some areas (e.g., the LNG loading line) is expected to recover to an early seral plant community within 10

to 15 years and support associated young forest or shrub wildlife communities. The integrity of any remaining patches of vegetation will be retained as much as possible by minimizing intrusion and disturbance.

With the adherence to best management practices and the implementation of mitigation measures loss or change in habitat as a result of the Project is not expected to influence the regional sustainability of other potentially occurring species, including the little brown myotis, Keen's myotis, great blue heron and Canada goose. Most of these species have secure populations (see Table 5.6–4 for a list of species of concern potentially occurring in the facility LSA) and also have access to additional suitable habitats in the facility RSA.

All activities associated with marine shipping are assessed for marine birds (Section 5.6.6).

5.6.5.2.4 Determination of Significance for Loss or Change in Habitat

The loss or change in habitat within most of the Project footprint is considered permanent. The Project footprint will be reclaimed for a land use determined and agreed with the relevant authorities in the preparation of the decommissioning and reclamation plan. In some areas (e.g., the LNG loading line), habitat is expected to recover during operation to an early seral plant community within 10 to 15 years.

There is a high likelihood that there will be residual effects from the Project on the quantity and quality of terrestrial wildlife habitat measured at baseline (based on habitat suitability models); however, there is a low probability that the loss or change in effective key species habitat will affect the sustainability of regional wildlife populations. The facility LSA represents a very small portion of regionally available habitat within the context of the larger facility RSA. Grizzly bear, for example, are known to have large home ranges (Dahle and Swenson 2003; Schwartz et al. 2003) and exhibit average daily movements of up to 1.5 km in search of food (Gibeau et al. 2002). The facility LSA represents 0.007% of the home range size of a typical female grizzly bear (52 km^2: Schwartz et al. 2003).

The Project footprint overlaps with 61.5 ha of marbled murrelet critical habitat as identified by Environment Canada (2014b). However, this area was assessed to be of marginal value based on information provided in the recovery strategy (Environment Canada 2014b,c), supporting reports (e.g., Burger 2002; CMMRT 2003) and recent field surveys (Stantec Consulting Ltd. 2014f). In addition, the area of critical habitat affected by the Project (61.5 ha) is less than 0.001% of the assumed supply target area as defined by Environment Canada (Environment Canada 2014c). Given the marginal value of the habitat, and the small proportion of the habitat supply target affected, it is concluded that the Project will not affect the ability to achieve short-term or long-term population and distribution objectives for the Northern Mainland Coast population (Environment Canada 2014b) and therefore potential effects are assessed as not significant.

The loss or change in effective habitat of 12.7 to 119.9 ha (≤0.003% of facility RSA) is a single occurrence that will have residual effects over the life of the Project. With application of mitigation and environmental protection measures, the loss or change in habitat on key species occurring within the facility LSA is assessed as not significant.

5.6.5.3 Assessment of Risk of Injury or Mortality

5.6.5.3.1 Description of Project Effect Mechanisms for Risk of Injury or Mortality

Terrestrial Wildlife

Project activities might increase the risk of injury or mortality for wildlife resources. These activities include clearing of vegetation, upgrading of roads and increased road traffic in the facility LSA, and human-wildlife interactions. A qualitative approach is used to assess the potential mortality risk for wildlife resources associated with Project activities.

Marine Birds

There is potential for injury or mortality of some marine birds as a result of bird strikes with the marine terminal and related infrastructure because of disorientation caused by nighttime lighting of the structures. Marine birds are visually oriented and are known to become disoriented at night in the presence of artificial light, especially during seasonal migration periods when birds are more abundant (Bruderer et al. 1999; Le Corre et al. 2002).

5.6.5.3.2 Mitigation for Risk of Injury or Mortality

The following mitigation measures will manage the adverse effects on wildlife of injury or mortality as a result of Project activities.

- Design of the LNG loading line corridor will consider and incorporate, where practicable, ways to maintain tidal flow and wildlife passage (Mitigation 5.5-8).
- Clearly delineate (flag) vegetation clearing limits to avoid damage to important wildlife habitat features (e.g., large boulders, nurse logs, raptor nests, mammal dens, ungulate mineral licks) in the facility LSA but outside of the Project footprint or the areas of temporary construction disturbance. Major game trails will be cleared of equipment, brush piles, and felled trees to maintain their use as movement corridors for wildlife, where practicable (Mitigation 5.6-1).
- Construction activities will account for applicable bird breeding periods:
  - end of March to mid-August for migratory birds (Environment Canada 2014b)
  - January 1 through September 5 for raptors (BC MOE 2012)

Clearing activities that need to occur during bird breeding periods will incorporate measures to protect birds and their eggs as per federal and provincial regulations. These measures will be detailed in the Wildlife Management Plan (Mitigation 5.6-5).

- Bear-proof fences will be installed around the workforce accommodation centre(s) and Project site boundary to reduce potential for on-site interactions with wildlife (Mitigation 5.6-6).
- If clearing of open water wetland habitats within the Project footprint occurs during the amphibian breeding period (March 1 to August 15) an amphibian salvage program will be implemented. Details on an amphibian salvage program and measures to protect amphibian species will be detailed in the Wildlife Management Plan (Mitigation 5.6-7).
- Feeding and harassment of wildlife will be strictly prohibited (Mitigation 5.6-8).
- Protocols will be developed and implemented as outlined in a Wildlife Management Plan, including measures such as bear awareness to avoid or mitigate human-wildlife conflicts and injury to humans or wildlife (Mitigation 5.6-9).
- A Wildlife Management Plan will be developed and will include requirements for reporting wildlife sightings, including bat or bird collisions. Reporting will include information such as species, location, and weather conditions (Mitigation 5.6-3).
- Waste will be managed according to an established Waste Management Plan onsite and in the workforce accommodation centre(s) or maintenance areas to reduce the potential to attract wildlife to the facility. Garbage and other waste should be temporarily stored onsite in bear-proof containers and disposed of at an approved facility (Mitigation 5.6-10).
- If clearing of vegetation occurs during the bear denning period (October to March), pre-clearing bear den surveys will be required. Identified bear dens will be protected by a 200 m no-disturbance buffer during the denning period (Linnell et al. 2000) (Mitigation 5.6-11).
- Supervisory staff on berthed vessels will be alerted to the hazards and potentially high-risk periods for bird strikes caused by deck lighting, particularly on nights when visibility is poor. Staff will be informed of the applicable seasonal and daily migratory periods. Facility staff will report bird collisions to a member of the Project environmental team, including information on bird species and weather conditions. Vessel personnel will be provided with information on how to treat and release marine birds that become grounded on vessel decks (Black 2005) (Mitigation 5.6-12).
- During construction, operation, and decommissioning, drivers will maintain slow (specified) speeds on all roads in the Project footprint and be extra diligent during amphibian migration periods, especially when adjacent to wetlands, in order to reduce the potential for collisions with wildlife (Mitigation 5.6-13).

These mitigation measures will be implemented during pre-construction and construction phases, as well as during operation. They are intended to manage the magnitude, extent, and permanency of change in risk of injury or mortality by reducing the potential for injurious interactions between wildlife and Project activities.

5.6.5.3.3 Characterization of Risk of Injury or Mortality

Terrestrial Wildlife

The risk of injury and mortality is expected to be greatest during the vegetation clearing stage of site preparation. At greatest risk is wildlife with limited ability to disperse or that have strong site fidelity. This includes amphibians, small mammals and animals that are nesting or in dens or burrows. Larger mammals such as grizzly bears and ungulates as well as adult birds are less likely to be affected because they are highly mobile and will likely disperse from areas being affected by Project activities. Mortality will be managed by adhering to applicable federal (e.g. MBCA) and provincial legislation and through implementation of mitigation measures. As a result, wildlife mortality during construction will be low to moderate in magnitude (i.e., limited to a small number of individuals) and will be short-term.

Reducing the potential for injury or mortality to species of conservation concern is especially important. Clearing outside of sensitive timing windows and applying no-disturbance buffers to breeding sites will effectively mitigate effects on provincially or federally listed species with local populations and suitable breeding habitat in the facility LSA (e.g., grizzly bear, western toad, western screech-owl).

Risk of mortality from traffic will increase during Project construction. Bears can be attracted to roads because of the presence of rich forage and opportunities for ease of movement (Northrup et al. 2012). The risk of mortality to breeding, dispersing, or migrating western toad will be highest along sections of the road adjacent to suitable breeding habitat (Forman and Alexander 1998). Movement of adult western toad is mostly nocturnal; therefore, traffic, highest during daylight hours, generally will not contribute to adult mortality. During peak migration to breeding sites and dispersal of juveniles from breeding sites, mitigation measures will manage the number of individuals affected.

Human-wildlife conflicts may occur sporadically throughout the life of the Project. The Project will be built in an active industrial area, and, as a result, some wildlife species might already be habituated to human activities. There are regular occurrences of grizzly bear, black bear, and wolves in the facility LSA as noted in the Wildlife TDR (Stantec Consulting Ltd. 2014f) but, with mitigation measures, nuisance wildlife are not expected to be an issue.

Flaring may occur during project commissioning and under emergencies. The potential impact of these events on terrestrial wildlife is described in Accidents and Malfunctions, Section 10.5.4.2.

Risk of injury and mortality to terrestrial wildlife as a result of collisions and human-wildlife interactions will occur over the long-term (e.g. operation phase), be low in magnitude, local in geographic extent and occur sporadically. Vehicle collisions and human-wildlife interactions will be managed to acceptable levels through mitigation measure and standard procedures and practices of Project operation. Recovery of individuals will be approximately the time required for one generation of the local population. Natural recruitment through reproduction and migration is expected to offset the loss of a few individuals within a regional population, which may suffer mortality effects from the Project. The residual effect will be reversible following decommissioning of the Project.

Marine Birds

The residual effect of nighttime lighting on marine birds will be low magnitude (i.e., limited to a small number of individuals) and will occur primarily during construction and operation. The facility and LNG carriers will contribute to increased lighting from current light levels primarily during operation. Resident birds might be acclimated to nighttime lighting, (including from the existing RTA facility); information with regards to bird strikes (i.e., for resident or migratory species) in the local area is unavailable. Baseline information indicates that alcid species (e.g., marbled murrelet, tufted puffin, common murre) are uncommon in the Kitimat River estuary habitats and are unlikely to interact with sources of artificial light at the LNG facility.

Black oystercatchers are unlikely to occur near the marine terminal because it is an artificial structure and provides no suitable nesting or foraging habitat, e.g., islets, reefs, rocky beaches, and sand bars (Campbell et al. 1990b). A variety of shorebirds use the Kitimat River estuary, including dunlin (*Calidris alpina*), short-billed dowitcher (*Limnodromus griseus*), black turnstone (*Arenaria melanocephala*), Pacific golden-plover (*Pluvialis fulva*), spotted sandpiper (*Actitis macularius*), and wandering tattler (*Tringa incana*). Artificial lighting is not expected to cause potential injury or mortality to shorebird species moving past the terminal to reach this site. Although birds might be attracted to areas of poor foraging if lit (Australia Pacific 2011), nighttime lighting has been associated with improved visual foraging for shorebirds.

Double-crested cormorants have been observed using the Kitimat River estuary foreshore, Kitamaat Village, and Minette Bay (Horwood 1992). This species uses artificial marine structures for roosting, such as wharves, log booms, jetties, and pilings in marine environments (Campbell et al. 1990a). Glaucous-winged gulls are highly mobile and use human-made structures opportunistically (Campbell et al. 1990b). Resident individuals of both species are likely to be familiar with structures similar to those of the Project from other urban and industrial sites.

With mitigation, the potential for injury or mortality resulting from collisions with the marine terminal or LNG carriers will be low in magnitude, limited to the shipping RSA, and long-term in duration. With

mitigation, the Project may result in a low number of individual marine bird mortalities for the duration of construction and operation. This residual effect will occur as rare, accidental, irregular events. Based on past evidence, this residual effect will be low and reversible following decommissioning.

5.6.5.3.4 Determination of Significance for Risk of Injury or Mortality

Terrestrial Wildlife

The Project will comply with applicable federal and provincial legislation to protect wildlife from harm. Residual effects will potentially be of moderate magnitude during construction. There is a low to moderate magnitude for risk of mortality during operation. Residual effects will be long-term in duration, but reversible after the life of the Project. With the application of mitigation and environmental protection measures, the risk of injury or mortality will not affect the sustainability of regional terrestrial wildlife populations. The residual effect on terrestrial wildlife in the facility LSA, due to potential risk of injury or mortality, is assessed as not significant.

Marine Birds

With mitigation, the Project will result in a low risk of injury or mortality to marine birds. The residual effect will occur over the long-term, although will be sporadic and rare, and will be more likely to occur during nights of poor visibility at the LNG facility and during peak migratory periods (i.e., spring and fall). The number of individuals affected will be low to negligible in the context of the regional marine bird populations. The magnitude of residual effect is low. The potential risk of injury or mortality to marine birds in the facility RSA is assessed as not significant.

5.6.5.4 Assessment of Sensory Disturbance or Behavioural Alterations

5.6.5.4.1 Description of Project Effect Mechanisms for Sensory Disturbance or Behavioural Alterations

Terrestrial Wildlife

Acoustic emissions, artificial light, and other human and equipment activities might cause sensory disturbance to wildlife primarily during the construction phase and to a lesser degree during the operation phase. A qualitative approach is used to assess potential sensory disturbance associated with Project activities on wildlife resources.

Loud noise from vegetation clearing, tree felling, construction equipment, pile driving, and human activity might result in wildlife avoidance of established habitats. Operation of the LNG facility will introduce an increased level of human and equipment activity, which might continue to disturb some sensitive species. Decommissioning activities might continue to disturb some sensitive species. Although the response to

physical or auditory disruptions varies by species and by individual familiarity, wildlife will tend to avoid moderate- to high-level disturbances (Habib et al. 2007; Bayne et al. 2008; Schaub et al. 2008).

Marine Birds

Sensory disturbance might occur as a result of noise and human activities during construction (e.g. marine terminal construction) and increased activity at the marine terminal. Construction activities will involve pile driving at the terminal and alterations to the existing wharf. Anthropogenic noise sources can displace animals from preferred foraging or breeding habitat, disrupt predator-prey interactions and, in extreme cases, cause hearing loss. Operation and decommissioning activities might continue to disturb some sensitive species.

5.6.5.4.2 Mitigation for Sensory Disturbance or Behavioural Alterations

The following mitigation measures will manage sensory disturbance or behavioural alterations as a result of Project activities:

- Implement industry best practice for mobile construction equipment (i.e., regular maintenance, speed restrictions, correct sizing of equipment, modernizing of fleet, reduce idling, driver behavior, etc.) (Mitigation 5.3-1).
- Develop and implement a Traffic Management Plan (Mitigation 5.4-6).
- Design of the LNG loading line corridor will consider and incorporate, where practicable, ways to maintain tidal flow and wildlife passage (Mitigation 5.5-8).
- Develop and implement a Decommissioning Plan before decommissioning to allow habitat recovery and wildlife movement to proceed as soon as possible (Mitigation 5.6-4).
- During construction, operation, and decommissioning, drivers will maintain slow (specified) speeds on all roads in the Project footprint and be extra diligent during amphibian migration periods, especially when adjacent to wetlands, in order to reduce the potential for collisions with wildlife (Mitigation 5.6-13).

These mitigation measures will be implemented during pre-construction and construction phases, as well as during operation and decommissioning. They are intended to manage the magnitude, extent, and permanency of sensory disturbance or behavioural alterations.

5.6.5.4.3 Characterization of Sensory Disturbance or Behavioural Alterations

Terrestrial Wildlife

Disruption to wildlife movement as a result of noise disturbance and activity will be higher in the south and east portions of the facility LSA where habitat is currently less disturbed. North and west sections of the Project footprint are adjacent to existing industrial disturbed areas. Noise, including from vehicle and rail traffic, during construction and operation of the Project will primarily be limited to the facility LSA. Sensory

disturbance will be lower during Project operation than during construction; and, the disturbance events will be regular and predictable. Wildlife may habituate to a disturbance event when it is regular with low intensity over a long period of time, lessening the extent of avoidance behaviour (Archibald et al. 1987; Herrero et al. 2005; Klopper et al. 2005; Stankowich 2008).

Site clearing activities, such as tree felling, can impede movement by blocking previously established movement corridors with equipment, organic debris, and workers, and preventing access to important resources (e.g., breeding and foraging habitat). Similarly, Project infrastructure, such as berms, fences, and buildings, can force the movement of a host of species, including bears, moose, deer, small predator species, and amphibians, into other areas. For each species group, this is more important during particular seasons. Some individual animals are expected to navigate around the LNG facility; however, avoidance requires additional energy expenditure and might consequently adversely affect seasonal energy budgets. This avoidance results in the functional loss of habitat adjacent to the LNG facility, along the LNG loading line, and upgraded roads.

Fencing and berms installed during onshore construction around the LNG processing and storage site and LNG loading line could alter behaviour and movement patterns. Mitigation measures include ways to facilitate wildlife movement along the LNG loading line.

For species that exhibit sensitivity to edge habitat, forest clearing for the Project footprint might expose interior nesting species (e.g., western screech-owl) to sensory disturbances such as facility noise and activity, predation, or increased competition by edge nesting species. Species with small home ranges or limited dispersal abilities, such as small mammals, are expected to maintain movement patterns in localized portions of undisturbed habitat in the facility LSA; however, small animals with larger dispersal distances (e.g., western toad) will be less able to navigate around features. There is potential for the upgrade to the existing haul road to disrupt dispersal and migration of western toad as they move between terrestrial habitats and aquatic breeding wetlands along the existing road.

Marine Birds

Sensory disturbance and subsequent avoidance of adjacent habitat will be restricted to the portion of the facility LSA near the marine terminal. The duration of sensory disturbance from the marine terminal will occur over the construction and operational life of the Project, with a continuous frequency because the marine terminal will operate 24 hours per day. The residual effects will be reversible after marine terminal decommissioning.

Marine activity around the wharf will increase during construction. Residual effects from on-land and in-water construction will be caused by acoustic emissions (e.g., construction equipment and pile driving), and increased human and equipment activity. Several species of marine birds (e.g., marbled murrelet,

common goldeneye, great blue heron, western sandpiper) forage in intertidal and nearshore marine habitats around the marine terminal. Marine in-water construction and related activities might cause distress, flushing behaviour, and behavioural alterations that include less effective foraging or avoidance of preferred feeding habitats. This is of particular concern during peak migratory periods (i.e., when relatively high densities of species are on the ocean surface in spring and fall). Staging marine birds foraging in the intertidal areas adjacent to the marine terminal might leave the area during the term of marine terminal construction activities. The harm from, or avoidance of, sensory disturbance events could adversely affect feeding effectiveness and the energetics critical to staging and migration periods.

There is potential for sensory disturbance or behavioural alterations due to attraction to or disorientation caused by artificial nighttime lighting of structures. Artificial lighting is known to affect foraging, migration, orientation, daily timing of behaviour and potentially influences seasonal timing and stress physiology (Gil and Brumm 2014). Brightly lit structures within dark environments can disrupt orientation in night-migrating birds and lead to behavioural alterations including changes in migratory pathways.

During operation, between 170 and 350 LNG carrier visits are estimated per year, depending on the size of the carrier, which is equivalent to approximately one per day to one every two days. Given the context of industrial activity and marine traffic in Kitimat Arm, marine birds might habituate to operational and low-level construction noise, and other types of sensory disturbances that are predictable and not associated with negative consequences (Ward and Stehn 1989; Steidl and Anthony 2000; Grubb et al. 2002). Project operation is less likely to have residual effects on marine birds considering the context of high vessel activity and adjacent industry in their current habitats.

Double-crested cormorants use coastal features such as rocks, pilings, and trees for daytime resting places (Hatch and Weseloh 1999). Construction-related noises, human presence, and light might cause temporary avoidance of the marine terminal area; however, use of the marine terminal area to forage and perch is expected to continue during operation (Foley and Batcheller 1988; Eadie et al. 1995). Common goldeneye is expected to avoid the marine terminal area when seasonal presence of this species overlaps with construction and operation activities. Glaucous-winged gulls are a resident species readily adapted to coastal urban and industrial development (Hayward and Verbeek 2008). Although glaucous-winged gulls might be temporarily displaced by high-level sound and activity disturbances during construction (e.g., tree clearing, pile driving), this species will continue to use the marine terminal and surrounding area for resting, roosting, and foraging during construction and operation.

With the application of mitigation, the potential for sensory disturbance or behavioural alterations will be low during construction and operation of the facility and limited to the facility LSA. Construction will be short to medium term in duration; however, sensory disturbance from operation will be long-term.

5.6.5.4.4 Determination of Significance for Sensory Disturbance or Behavioural Alterations

Terrestrial Wildlife

Project disturbances to wildlife movement from site preparation and construction of the LNG facility, including marine terminal, operation of construction equipment, and installation of fencing along the LNG loading line corridor will present a moderate magnitude residual effect that is long-term. Changes to movement patterns will generally affect species whose range is restricted. Disturbance will affect a wildlife community with low resilience because of other existing and ongoing disturbances in the local area and the sensitivity and importance of the estuary ecosystems. The residual effects will occur intermittently throughout the construction and operation phases of the Project, but will be reversible following decommissioning. Terrestrial wildlife are currently exposed to a moderate degree of disturbance and displacement from existing projects and activities; species are expected to exhibit a moderate response during construction, when disturbance is assumed to be more pronounced and be less responsive to similar sensory disturbances created by the Project during operation. There is a low probability that the loss or change in effective key species habitat will affect the sustainability of regional wildlife populations. The potential for sensory disturbance or behavioural alterations of terrestrial wildlife in the facility LSA is assessed as not significant.

Marine Birds

Sensory disturbance or behavioural alterations of marine birds from marine terminal and in-water construction activities and artificial lighting will be restricted to the facility LSA and will be a short- to medium-term event, occurring irregularly. Berthing of LNG carriers and associated increased marine activity during operation will be regularly occurring, and individual birds are expected to gradually become habituated during daily or seasonal movements and habitat use. There is a reasonable expectation that marine birds will habituate to the increased marine activity created by Project operation.

A moderate magnitude residual effect will occur during construction of the marine terminal and associated infrastructure, and residual effects will be managed during operation. The probability is low that sensory disturbance or behavioural alterations will affect the sustainability of regional wildlife populations. With application of the mitigation and environmental protection measures, the risk of sensory disturbance or behavioural alterations of marine birds in the facility LSA is assessed as not significant.

5.6.5.5 Summary of Project Residual Effects from the LNG Facility

Table 5.6-10 summarizes the loss or change in habitat, risk of injury or mortality, and sensory disturbance or behavioural alterations on wildlife and wildlife habitat. Overall, the residual effects will be local and affect only a small proportion of regional wildlife populations (estimated to be a few individual animals). The populations of most wildlife species with potential to be affected by the Project are regionally secure.

There is the potential for loss of important habitats that provide suitable fall and spring feeding habitat for provincially blue-listed grizzly bear, known to regularly use the areas around the LNG facility site when accessing the Kitimat River estuary. Fencing of the LNG loading line corridor will interrupt wildlife passage and use of established movement corridors for grizzly bear and other small to large wildlife species, including western toad and is a disturbance effect.

Overall, loss of mature and old-growth patches of forest has potential to more prominently affect grizzly bear, Pacific marten, western screech-owl, and western toad.

The number of individuals potentially affected in the facility LSA and shipping LSA will be low and will not affect the regional populations of any of the key species or other wildlife species. Regional terrestrial and marine areas provide alternate habitat for use by most species. LNG Canada will comply with applicable federal and provincial regulations and will establish effective mitigation plans to manage potential effects. Several plans that will be established, such as the Wetland Habitat Compensation Plan, Fish Habitat Offsetting Plan, Wildlife Management Plan, Traffic Management Plan, Marine Activities Plan, and the Decommissioning Plan, among others, will manage Project effects on wildlife. Residual effects from the Project in the facility LSA and shipping LSA will be low to moderate in magnitude, except during the construction phase where the residual effect is high for some species. The likelihood of habitat loss is high, sensory disturbance is moderate to high, and mortality risk is low. The combined residual effects from the Project are assessed as not significant, given identified thresholds and negligible effects on regional populations. The loss of some high suitability habitat for specific species is a concern; however, this loss should be mitigated by restricting clearing to approved areas and developing management plans as noted above.

Given the quality of data available, habitat modelling, the effectiveness of mitigation measures, and the professional judgment and experience of the assessment team, the prediction confidence is high.

5.6.6 Assessment of Residual Effects from Shipping

5.6.6.1 Analytical Methods

5.6.6.1.1 Analytical Assessment Techniques

For information on analytical assessment techniques, see Section 5.6.5.1, which also applies here.

5.6.6.1.2 Assumptions and the Conservative Approach

For information on assumptions and the conservative approach used see Section 5.6.5.1.

5.6.6.2 Assessment of Risk of Injury or Mortality

There is no pathway of effect attributable to marine shipping for terrestrial wildlife (see Section 5.6.2); consequently, this section presents information only related to the assessment of the potential for injury or mortality on marine birds resulting from shipping.

5.6.6.2.1 Description of Project Effect Mechanisms for Risk of Injury or Mortality

A risk of injury or mortality occurs as a result of marine bird interactions with Project marine activities, primarily during shipping for construction, operation and decommissioning. While migrating, bird strikes or collisions can result in physical injury or mortality; as documented in shipping areas throughout the world (Black 2005; Montevecchi 2006; Merkel and Johansen 2011).

5.6.6.2.2 Mitigation for Risk of Injury or Mortality

The following mitigation measure will manage injury or mortality as a result of activities associated with shipping.

- Supervisory staff on berthed vessels will be alerted to the hazards and potentially high-risk periods for bird strikes caused by deck lighting, particularly on nights when visibility is poor. Staff will be informed of the applicable seasonal and daily migratory periods. Facility staff will report bird collisions to a member of the Project environmental team, including information on bird species and weather conditions. Vessel personnel will be provided with information on how to treat and release marine birds that become grounded on vessel decks (Black 2005) (Mitigation 5.6-12).

This mitigation measure will be implemented during construction, operation, and decommissioning phases to help manage the magnitude, extent, and permanency of risk of injury or mortality.

5.6.6.2.3 Characterization of Risk of Injury or Mortality

There is potential for injury or mortality of some marine bird species as a result of bird strikes with the marine terminal and related infrastructure because of disorientation caused by nighttime lighting of the structures. Marine birds are visually oriented and are known to become disoriented at night in the presence of artificial light, especially during seasonal migration periods when birds are more abundant (Bruderer et al. 1999; Le Corre et al. 2002). While migrating, bird strikes or collisions can result in physical injury or mortality, occurrences which have been documented in shipping areas throughout the world (Black 2005; Montevecchi 2006; Merkel and Johansen 2011). Mortality events will occur irregularly and rarely, but might increase under certain weather conditions (i.e., fog or precipitation) or during seasonal migratory periods when numbers of marine birds and species increase dramatically. The number of injuries or events of mortality are estimated to be low and affect only a few individuals. For secure populations, natural recruitment will offset the potential loss of those few individual birds within a regional population.

Considering the relatively low numbers of current large vessel traffic in the shipping LSA, the increase in large vessel traffic introduced by the Project will have long-term effects on individuals and small groups; however, it is unlikely that these residual effects will be detectable in the regional population. Accidental bird strikes will be uncommon and sporadic. Residual effects will occur for the lifetime of the Project, but are reversible following decommissioning.

5.6.6.2.4 Determination of Significance for Risk of Injury or Mortality

The Project will result in a low probability of accidental injury or mortality of marine birds. The potential risk of injury or mortality will occur primarily during the operation phase for the life of the Project, but will be rare and sporadic in frequency. It is unlikely that adverse effects will be detectable within the relatively large regional populations of marine birds, considering the context of low marine traffic in the shipping LSA; the magnitude of residual effect is low. With adherence to mitigation and protection measures, the risk of injury or mortality to marine birds is assessed as not significant.

5.6.6.3 Assessment of Sensory Disturbance or Behavioural Alterations

There is no pathway of effect from shipping on terrestrial wildlife (see Section 5.6.4); consequently, this section presents information related only to the assessment of the potential for sensory disturbance by the Project on marine birds for each of the five key species.

5.6.6.3.1 Description of Project Effect Mechanisms for Sensory Disturbance or Behavioural Alterations

During operation, up to 350 LNG carriers per year will be added to current marine activity within the marine access route. Interactions between marine birds and increased marine traffic resulting from the Project are associated primarily with operational activities, and to a lesser degree with marine shipping activities during construction and decommissioning. These interactions might include in-air acoustic emissions, the physical presence of LNG carriers in the marine access route, LNG carrier lighting, and the risk of mortality, particularly at night or in conditions of low visibility. Seabirds are highly visually oriented and can become disoriented at night in the presence of artificial light (Bruderer et al. 1999; Le Corre et al. 2002) such as when LNG carriers navigate during darkness (Merkel and Johansen 2011).

5.6.6.3.2 Mitigation for Sensory Disturbance or Behavioural Alterations

The following mitigation measure will manage sensory disturbance or behaviour alterations as a result of activities associated with shipping.

- Supervisory staff on berthed vessels will be alerted to the hazards and potentially high-risk periods for bird strikes caused by deck lighting, particularly on nights when visibility is poor. Staff will be informed of the applicable seasonal and daily migratory periods. Facility staff will report bird collisions to a member of the Project environmental team, including information on bird species and weather conditions. Vessel personnel will be provided with information on how to treat and release marine birds that become grounded on vessel decks (Black 2005) (Mitigation 5.6-12).

This mitigation measure will be implemented during the construction, operation, and decommissioning phases to help manage the magnitude, extent, and permanency of sensory disturbance or behavioural alterations to marine birds.

5.6.6.3.3 Characterization of Sensory Disturbance or Behavioural Alterations

The potential effects of shipping on marine birds include sensory disturbance or behavioural alterations attributable to in-air acoustic emissions and the physical presence of ships. Sensory disturbance and consequent behavioural alterations will have the greatest potential to occur during peak migratory periods (i.e., when relatively high densities of species are present, some in very large groups).

For marine birds to become habituated to (i.e., tolerant of) shipping-related disturbances, the activity must be predictable and not result in a negative experience. For example, Schwemmer et al. (2011) found diving birds (e.g., white-winged scoter) located within shipping lanes demonstrated shorter flushing distances than individuals outside of shipping lanes. The presence of marbled murrelet has been shown to be negatively correlated with increased boat traffic (Kuletz 1996; Hamer and Thompson 1997).

Bellefleur et al. (2008) indicated that marbled murrelet do not flush while foraging if the boat traffic is greater than 100 m away; in general, slower traffic reduces flushing behaviour.

Nest provisioning at regional breeding colonies often occurs during crepuscular peaks (i.e., sunrise and sunset) indicating these marine bird species might not be disturbed by the nighttime lighting of vessels because foraging effort mainly occurs during some degree of daylight (e.g. dawn and dusk).

Double-crested cormorants appear to habituate to the presence of vessels. For example, two mainland breeding colonies (i.e., near the Port Mann Bridge in Burrard Harbour, BC, and Chemainus, Washington) are based in industrial areas with routine vessel traffic (Campbell et al. 1990a). Consequently, double-crested cormorants are likely to habituate to the presence of vessels and are unlikely to be affected by Project LNG carriers.

Diving ducks, such as common goldeneye and common loon, might be more susceptible to vessel disturbance than surface feeders (e.g., herring gull and glaucous-winged gull) because of the amount of time spent on the water (Schoen et al. 2012). Common goldeneye is unlikely to be disturbed by Project LNG carriers because this species tends to occupy shallower coastal waters.

Glaucous-winged gulls, similar to other species in the surface-feeder guild (e.g., gulls and terns), are generally less susceptible to vessel disturbance than diving birds (e.g., loons and alcids) as they typically spend proportionally more time in the air than on water (Schoen et al. 2012). For example, a surface feeder, the Aleutian tern (*Onychoprion aleuticus*), was seldom observed on the ocean, where direct disturbance attributable to transiting vessels would likely occur (Schoen et al. 2012).

Although passing vessels could disturb breeding colonies of glaucous-winged gulls, Project shipping will occur several kilometres from known colonies (e.g., South Estevan Sound is more than 15 km from the marine access route). Although it is possible glaucous-winged gulls, black oystercatchers, and other marine birds might nest on relatively small rocky islands near Project marine shipping, behavioural alterations from the distant marine access route are not expected to occur.

Currently, there are abundant populations of marine birds using habitats that overlap areas of high shipping activity, such as Kitimat Arm, Douglas Channel, Principe Channel, and Browning Entrance. Although there is variation among species (e.g., species-specific disturbance thresholds, scale of displacement, recovery times or resilience) and differing conditions, birds may habituate to low disturbance levels that are continuous or predictable (Gladwin et al. 1988). Vessel traffic near seabird colonies in the region is not an uncommon occurrence; therefore, Project marine shipping will not present a new effect in the region. Individual encounters will be relatively brief and will not be detrimental to the overall well-being of the diverse populations of marine birds. Although marine traffic will increase as a

result of the Project, with adherence to mitigation, the potential for sensory disturbance from shipping will be low, limited to the shipping LSA, and long-term in duration.

5.6.6.3.4 Determination of Significance for Sensory Disturbance or Behavioural Alterations

There will be a low degree of marine bird displacement along the marine access route during construction and operation. Residual effects are considered in the context of a moderate level of resilience with relatively higher quality conditions and lower levels of disturbance than the upper reaches of Kitimat Arm. Because most of the marine access route is confined, LNG carrier speeds will be moderated relative to ocean speeds, which will further decrease as LNG carriers approach the wharf at the marine terminal. Consequently, disturbance events, such as LNG carrier noise and on-board activity, as a result of transiting vessels, will be temporary. Although the degree of sensitivity varies by species, birds will generally be expected to recover relatively quickly as their distance from the disturbance increases (Schwemmer et al. 2011). In addition, with consideration for the context of shipping activity in the marine access route, some individual birds may habituate to the regular passing of Project LNG carriers (Kaiser et al. 2006).

With adherence to mitigation, there is a high level of prediction confidence that the Project will cause a low magnitude change for sensory disturbance to marine birds. Sensory disturbance will have the greatest potential to occur during peak migratory periods (i.e., when relatively high densities of species are present). The residual effect of LNG carrier traffic will not adversely affect the sustainability of any regional population of marine birds. Residual effects will be restricted to the shipping LSA along the marine access route. Risk of mortality events will be reversible following decommissioning. Sensory disturbance to marine birds is assessed as not significant.

5.6.6.4 Summary

With application of the mitigation measures, the potential for sensory disturbances and the risk of injury or mortality will be reduced for marine birds. Providing information to crews working on LNG carriers related to managing night lighting required for navigation and operation will help to manage the potential risk of mortality of marine birds. Accidental bird strikes are expected to be uncommon and sporadic. Although the potential for these residual effects to occur will be long-term, the number of injuries or events of mortality are estimated to be low and affect only a few individuals. These residual effects will be limited to the shipping LSA. Residual effects on local populations will recover through natural recruitment (breeding and immigration); therefore, the sustainability of regional populations will not be adversely affected. Consequently, the potential for sensory disturbance or behavioural alterations, and risk of injury or mortality, are assessed as not significant. The combined residual effects of shipping during all Project phases are assessed as not significant.

5.6.7 Summary of Project Residual Effects

Table 5.6-10 summarizes residual effects on the loss or change in habitat, risk of injury or mortality, and sensory disturbance or behavioural alterations on wildlife (terrestrial wildlife and marine birds). Overall, the residual effects will potentially affect only a small proportion of regional wildlife populations (i.e., estimated at only a few individual animals). With adherence to mitigation measures, in combination with the development of the Wildlife Management Plan, Waste Management Plan, Wetland Habitat Compensation Plan, Fish Habitat Offsetting Plan, Traffic Management Plan, Marine Activities Plan and the Decommissioning Environmental Management Program (Section 12), the Project is assessed to have a not significant residual effect on the sustainability of any terrestrial wildlife or marine bird species.

Project residual effects on Schedule 1 SARA listed species from the LNG facility and shipping are summarized in Table 5.6-11. Section 79 of SARA requires assessment of the adverse effects of a proposed project on any species listed in Schedule 1, and for measures to be taken to avoid or lessen those effects, and to monitor them. Identified measures must be consistent with any recovery strategies or action plans in place for the species. In all cases, with the application of mitigation measures, the residual effects of the Project are predicted to be not significant. Two of the SARA listed species have recovery strategies in place, the marbled murrelet and pink footed shearwater. The proposed mitigation measures, as well as strategies provided in Section 10, are consistent with information provided in these strategies.

The combined residual effects of the Project on wildlife (terrestrial wildlife and marine birds) are assessed as not significant.

Table 5.6-10: Summary of Project Residual Effects: Wildlife Resources

Project Phase	Mitigation Measures	Residual Effects Rating Criteria						Likelihood of Residual Effects	Significance	Prediction Confidence	Follow-up and Monitoring
		Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context				
Facility Works and Activities											
Loss or Change in Habitat											
Construction	Mitigation 5.5-11 Mitigation 5.6-1 Mitigation 5.6-2 Mitigation 5.6-3 Mitigation 5.6-4	≤0.01%	LSA	LT	S	R	L	H	N	H	No follow-up programs are proposed for wildlife resources.
Operation			LSA	LT	S	R	L	H	N	H	
Decommissioning			LSA	MT	S	R	L	H	N	H	
Residual effects for all phases			LSA	LT	S	R	L	H	N	H	
Sensory Disturbance or Behavioural Alterations											
Construction	Mitigation 5.3-1 Mitigation 5.4-6 Mitigation 5.5-8 Mitigation 5.6-4 Mitigation 5.6-13	M	LSA	MT	MI	R	L	H	N	H	No follow-up programs are proposed for wildlife resources.
Operation		L	LSA	LT	MR	R	L	M	N	H	
Decommissioning		L	LSA	MT	MI	R	L	M	N	H	
Residual effects for all phases		L	LSA	LT	MI	R	L	M	N	H	
Risk of Injury or Mortality											
Construction	Mitigation 5.5-8 Mitigation 5.6-1 Mitigation 5.6-3 Mitigation 5.6-4 Mitigation 5.6-5 Mitigation 5.6-6 Mitigation 5.6-7 Mitigation 5.6-8	M	LSA	MT	S	R	L	M	N	H	No follow-up programs are proposed for wildlife resources.
Operation		L	LSA	LT	S	R	L	L	N	H	
Decommissioning		L	LSA	MT	S	R	L	L	N	H	
Residual effects for all phases		L	LSA	LT	S	R	L	L	N	H	

Project Phase	Mitigation Measures	Residual Effects Rating Criteria						Likelihood of Residual Effects	Significance	Prediction Confidence	Follow-up and Monitoring
		Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context				
	Mitigation 5.6-9 Mitigation 5.6-11 mitigation 5.6-12 Mitigation 5.6-13										
Shipping Activities											
Sensory Disturbance or Behavioural Alterations											
Construction	Mitigation 5.6-12	L	LSA	MT	MI	R	M	M	N	H	No follow-up programs are proposed for wildlife resources.
Operation		L	LSA	LT	MI	R	M	H	N	H	
Decommissioning		L	LSA	MT	MI	R	M	H	N	H	
Combined residual Project effect for all phases		L	LSA	LT	MI	R	M	H	N	H	
Risk of Injury or Mortality											
Construction	Mitigation 5.6-12	L	LSA	MT	MI	R	M	L	N	H	No follow-up programs are proposed for wildlife resources.
Operation		L	LSA	LT	MI	R	M	L	N	H	
Decommissioning		L	LSA	MT	MI	R	M	L	N	H	
Residual effects for all phases		L	LSA	LT	MI	R	M	L	N	H	

KEY
MAGNITUDE:

For loss or change in habitat:

Loss of effective habitat in hectares.

[1]Refer to Section 5.6.5.2.3 for key species specific values.

L = Low—loss or change in habitat is well below identified threshold (<5%) and will not threaten the long-term sustainability of an identified regional wildlife or marine bird population

M = Moderate—loss or change in habitat is below the identified threshold (≥5 to <20%) and will not threaten the long-term sustainability of an identified regional wildlife or marine bird population

H = High—loss or change in habitat is above identified thresholds (≥20%) and may threaten the long-term sustainability of an identified regional wildlife or marine bird population

For risk of injury or mortality:

L = Low—Residual effect is negligible and will not affect sustainability of regional population

M = Moderate—Residual effect is moderate but unlikely to affect sustainability of regional population

H = High—Residual effect is high and might affect sustainability of local population

For sensory disturbance or behavioural alterations:

L = Low—Effect presents a permeable barrier and will not affect sustainability of regional population

M = Moderate—Effect presents a semi-permeable barrier, but unlikely to affect sustainability of regional population

H = High—Effect presents an impermeable barrier and might affect sustainability of regional population

GEOGRAPHIC EXTENT:

PF = Project Footprint—effects are restricted to the Project Footprint

LSA—effects occur within the facility LSA and or shipping LSA – both of which encompass the Project footprint

RSA—effects extend beyond the facility LSA and or shipping LSA into the facility RSA or shipping RSA

DURATION:

ST = Short-term—effect occurs for less than one breeding season or generation (e.g., less than one year)

MT = Medium-term—effect occurs for several breeding seasons or generations, or a Project phase (e.g., one to five years, or the Project construction phase)

LT = Long-term—effect is occurs across multiple breeding seasons or generations, or multiple Project phases (e.g., 6 to 30 years, or the lifetime of the Project)

P = Permanent—effect occurs across multiple breeding seasons or generations and is unlikely to recover following Project decommissioning and reclamation

FREQUENCY:

S = Single event—effect occurs once

MI = Multiple irregular events (no set schedule)—occurs sporadically at irregular intervals through construction, operation, or decommissioning phases

MR = Multiple regular events—occurs on a regular basis and at regular intervals through construction, operation, or decommissioning phases

C = Continuous—occurs continuously throughout the life of the Project

REVERSIBILITY:

R = Reversible—effect will cease after Project decommissioning and reclamation

I = Irreversible—effect will persist beyond the life of the Project

CONTEXT:

L = Low resilience—occurs in a fragile ecosystem or the level of baseline disturbance can be a contributing factor to reduced sustainability of a local or regional wildlife population

M = Moderate resilience—occurs in a stable ecosystem or the level of baseline disturbance is not likely to contribute to reduced sustainability of a local or regional wildlife population

H = High resilience—occurs in a viable ecosystem or the level of baseline disturbance does not contribute to reduced sustainability of a local or regional wildlife population

PREDICTION CONFIDENCE:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation, and assumptions made.

L = Low level of confidence

M = Moderate level of confidence

H = High level of confidence

LIKELIHOOD OF RESIDUAL EFFECT OCCURRING:

Based on professional judgment

L = Low probability of occurrence

M = Medium probability of occurrence

H = High probability of occurrence

SIGNIFICANCE:

S = Significant

N = Not Significant

Table 5.6-11: Schedule 1 Listed Species Potentially Occurring in the Facility LSA or Shipping LSA

Common Name	SARA - Schedule 1 Status	Species Habitat Requirements[a]	Potential Seasonal Occurrence[a]	Habitat Present in Facility LSA[B]	Habitat Present in Shipping LSA[B]	Habitat Present in Project Footprint	Potential Project Effects			Mitigation Measures	Significance of Residual Effects	Accordance with Recovery Strategy and/or Action Plan
							Loss or Change in Habitat	Risk of Injury	Sensory Disturbance or Behavioural Alterations			
Coastal tailed frog	special concern	Moderately steep, cold, unsilted streams, and nearby adjacent terrestrial habitat.	Year round	Yes (B,F, O)	No	No	Yes	Yes	No	Mitigation 5.6-1 Mitigation 5.6-3 Mitigation 5.6-4 Mitigation 5.6-8	N	No Recovery Strategy or Action Plan exists for this species. As such, see Mitigation Measures column.
Western toad	special concern	Occurs in a variety of habitats from sea level to 3,600 m. Breeds in calm, open water of wetlands, stream edges, roadside ditches, or shallow margins of lakes.	Year round	Yes (B,F,O)	No	Yes	Yes	Yes	No	Mitigation 5.6-1 Mitigation 5.6-3 Mitigation 5.6-4 Mitigation 5.6-7 Mitigation 5.6-8 Mitigation 5.6-9 Mitigation 5.6-13 Mitigation 5.6-14	N	No Recovery Strategy or Action Plan exists for this species. As such, see Mitigation Measures column.
Band-tailed pigeon	special concern	Usually found below 1,000 m in a variety of forest types, especially pine-oak, spruce, fir, Douglas-fir, redwood (*Sequoia sempervirens*), cedar (*Thuja* spp.), hemlock (*Tsuga* spp.) and alder (*Alnus* spp.).	Spring, summer	Yes (B,F)	No	Yes	Yes	Yes	Yes	Mitigation 5.6-1 Mitigation 5.6-2 Mitigation 5.6-3 Mitigation 5.6-4 Mitigation 5.6-5 Mitigation 5.6-8 Mitigation 5.6-9	N	No Recovery Strategy or Action Plan exists for this species. As such, see Mitigation Measures column.
Common nighthawk	threatened	Habitats include mountains and plains in open and semi-open areas: open coniferous forests, savanna, grasslands, fields, near cities and towns. Nesting occurs on the ground on a bare site in an open area.	Summer	Yes (B,F)	No	Yes	No	Yes	Yes	Mitigation 5.6-1 Mitigation 5.6-2 Mitigation 5.6-3 Mitigation 5.6-4 Mitigation 5.6-5 Mitigation 5.6-8 Mitigation 5.6-9	N	No Recovery Strategy or Action Plan exists for this species. As such, see Mitigation Measures column.
Great blue heron	special concern	Freshwater and brackish marshes, along lakes, rivers, bays, ocean beaches, fields, and meadows.	Year round	Yes (F)	Yes	Yes	Yes	Yes	Yes	Mitigation 5.6-1 Mitigation 5.6-2 Mitigation 5.6-3 Mitigation 5.6-4 Mitigation 5.6-5 Mitigation 5.6-8 Mitigation 5.6-9 Mitigation 5.6-12	N	No Recovery Strategy or Action Plan exists for this species. As such, see Mitigation Measures column.

Common Name	SARA - Schedule 1 Status	Species Habitat Requirements[a]	Potential Seasonal Occurrence[a]	Habitat Present in Facility LSA[B]	Habitat Present in Shipping LSA[B]	Habitat Present in Project Footprint	Potential Project Effects			Mitigation Measures	Significance of Residual Effects	Accordance with Recovery Strategy and/or Action Plan
							Loss or Change in Habitat	Risk of Injury	Sensory Disturbance or Behavioural Alterations			
Marbled murrelet	threatened	Exposed coastal waters, bays, inlets, lagoons, harbours, coves, inlet mouths, and shallow banks	Year round	Yes (B)	Yes (F)	Yes	Yes	Yes	Yes	Mitigation 5.6-1 Mitigation 5.6-3 Mitigation 5.6-4 Mitigation 5.6-5 Mitigation 5.6-8 Mitigation 5.6-9 Mitigation 5.6-12	N	No Action Plan exists for this species. Mitigation measures are consistent with the recovery strategy(Environment Canada 2014b)
Northern goshawk	threatened	Typically nests in mature or old-growth forests	Year round	Yes (B,F)	No	Yes	Yes	Yes	Yes	Mitigation 5.6-1 Mitigation 5.6-3 Mitigation 5.6-5 Mitigation 5.6-8 Mitigation 5.6-9 Mitigation 5.6-13	N	No Recovery Strategy or Action Plan exists for this species. As such, see Mitigation Measures column.
Olive-sided flycatcher	threatened	Breed in various forest and woodland habitats: taiga, subalpine coniferous forest, mixed coniferous-deciduous forest, burned-over forest, spruce or tamarack bogs and other forested wetlands, and along the forested edges of lakes, ponds, and streams	Spring, summer, fall	Yes (B,F)	No	Yes	Yes	Yes	Yes	Mitigation 5.6-1 Mitigation 5.6-3 Mitigation 5.6-4 Mitigation 5.6-5 Mitigation 5.6-8 Mitigation 5.6-9 Mitigation 5.6-13	N	No Recovery Strategy or Action Plan exists for this species. As such, see Mitigation Measures column.
Peregrine falcon	special concern	Various open situations from tundra, moorlands, steppe, and seacoasts, especially where there are suitable nesting cliffs.	Spring, fall, winter	Yes (F)	No	Yes	Yes	Yes	Yes	Mitigation 5.6-1 Mitigation 5.6-2 Mitigation 5.6-3 Mitigation 5.6-4 Mitigation 5.6-5 Mitigation 5.6-8 Mitigation 5.6-9 Mitigation 5.6-12 Mitigation 5.6-13	N	No Recovery Strategy or Action Plan exists for this species. As such, see Mitigation Measures column.
Pink-footed shearwater	threatened	Pelagic	Summer	No	Yes (F)	No	No	Yes	Yes	Mitigation 5.6-3 Mitigation 5.6-8 Mitigation 5.6-9 Mitigation 5.6-12	N	No Action Plan exists. Mitigation measures are consistent with measures identified in the recovery strategy (Environment Canada 2008).

Common Name	SARA - Schedule 1 Status	Species Habitat Requirements[a]	Potential Seasonal Occurrence[a]	Habitat Present in Facility LSA[B]	Habitat Present in Shipping LSA[B]	Habitat Present in Project Footprint	Potential Project Effects			Mitigation Measures	Significance of Residual Effects	Accordance with Recovery Strategy and/or Action Plan
							Loss or Change in Habitat	Risk of Injury	Sensory Disturbance or Behavioural Alterations			
Rusty blackbird	special concern	Breeding habitat includes moist woodland (primarily coniferous), bushy bogs and fens, and wooded edges of watercourses and beaver ponds.	Summer, fall, winter	Yes (B,F)	No	Yes	Yes	Yes	Yes	Mitigation 5.6-1 Mitigation 5.6-3 Mitigation 5.6-4 Mitigation 5.6-5 Mitigation 5.6-8 Mitigation 5.6-9	N	No Recovery Strategy or Action Plan exists for this species. As such, see Mitigation Measures column.
Red knot	threatened	Primarily seacoasts on tidal flats and beaches, less frequently in marshes and flooded fields.	Transient	Yes (F)	Yes	Yes	Yes	Yes	Yes	Mitigation 5.6-3 Mitigation 5.6-4 Mitigation 5.6-5 Mitigation 5.6-8 Mitigation 5.6-9 Mitigation 5.6-12 Mitigation 5.6-14	N	No Recovery Strategy or Action Plan exists for this species. As such, see Mitigation Measures column.
Western screech-owl	special concern	Prefers broadleaf and riparian woodland. Also moist coniferous forest and woodland.	Summer, fall, winter	Yes (B,F)	No	Yes	Yes	Yes	Yes	Mitigation 5.6-1 Mitigation 5.6-2 Mitigation 5.6-3 Mitigation 5.6-4 Mitigation 5.6-5 Mitigation 5.6-8 Mitigation 5.6-9 Mitigation 5.6-10	N	No Recovery Strategy or Action Plan exists for this species. As such, see Mitigation Measures column.

NOTES:

[a] Campbell et al. 1990a, 1990b; CDC (2014)
[b] B = breeding, F = foraging, O = overwintering

SIGNIFICANCE:
S: Significant **N:** Not Significant

5.6.8 Assessment of Cumulative Effects

Cumulative effects are considered for each Project residual effect. Three stages are involved: (1) establishing context by providing an overview of the cumulative effects of other projects and activities on the VC; (2) determining the potential for Project residual effects to interact with the effects of other projects and activities; and, (3) if the Project does interact cumulatively with other projects and activities, assessing the significance of the resulting overall cumulative effect, and characterizing the Project's contribution to the change in cumulative effects.

5.6.8.1 Stage 1, Cumulative Effects Context

5.6.8.1.1 Terrestrial Wildlife

The facility RSA includes several small towns and communities, including Aboriginal communities, with much of the existing disturbance concentrated around these locations. Forest harvesting is common within most watersheds in the facility RSA and is a dominant disturbance. A GIS analysis of spatial data is used to assess potential cumulative effects of reasonably foreseeable disturbances on wildlife resources in the facility RSA based on the Project Inclusion List in Section 4.5. The footprint of reasonably foreseeable projects and activities is determined by combining provincial datasets covering the facility RSA with spatial data from publicly available data sources (i.e., CanVec, TRIM). Table 5.6-12 presents the projected disturbance in the facility RSA resulting from these reasonably foreseeable future projects and activities. At baseline, approximately 2,518,207 ha (81.1%) of the facility RSA is in undisturbed habitat. Reasonably foreseeable projects and activities might lead to the loss of an additional 3,333 ha (less than 0.01% of the facility RSA) of vegetation in the facility RSA (Table 5.6-12). The spatial extent of disturbance in the facility RSA is estimated to increase by 0.1% to 12.5% of the facility RSA (386,841 ha). Each of these projects will also contribute to an increase in linear density through the construction of roads, placement of pipe, or clearing of vegetation. These features can also contribute to sensory disturbance or behavioral alterations for key species.

Table 5.6-12: Existing and Foreseeable Future Disturbance in the Facility RSA

Land Use/Disturbance Type/Ecological Community	Current Conditions (ha)	Reasonably Foreseeable Future Disturbances (ha)	Total Cumulative Disturbance (ha)[b]
Undisturbed habitat	2,518,207	2,518,207	0
Water	199,894	199,894	0
Buildings and Infrastructure	2,836	2,950	114
Agriculture	81,892	81,892	0
Recreation	28,353	28,353	0
Secondary Road	10,183	10,182	-1
Cutblock and Cutline	244,120	244,112	-8
Hydrographic	100	99	-1
Major Road	1,999	1,999	0
Mining Sites	49	49	0
Oil and Gas[a]	4,344	7,575	3,231
Other Industries	249	248	-1
Powerlines	566	565	-1
Railway	502	502	0
Tertiary/Access Road	8,236	8,237	-1
Total Area	**3,101,530**	**3,104,863**	**3,334**

NOTES:

[a] includes pipeline ROWs, access and development roads, well surface sites

[b] Where total cumulative extent (ha) by disturbance type decreases, this indicates that some of the area is disturbed because of a second source (e.g., road is a greater level disturbance type than cutblock). Such overlapping disturbances are not counted twice, and area is assigned only to one category for the total cumulative disturbance.

5.6.8.1.2 Marine Birds

Existing marine traffic in the shipping RSA is approximately 126 vessels per year (0.7 transits per day). Table 5.6-13 presents the past, present and reasonably foreseeable future projects and activities with the potential to act cumulatively with Project residual effects. Reasonably foreseeable projects and activities include those that have been publicly announced and where detailed project information is publicly available (BC EAO 2006; Enbridge Northern Gateway Project 2010a, 2010b; BC Ferries 2013; Cruise Line International Association 2013; Arthon Industries Ltd 2014; DCEP 2014; RTA 2014). The marine traffic associated with these projects has the potential to interact with marine birds through changes in risk of mortality.

Table 5.6-13: Projects and Activities Identified as Having Potential Cumulative Effects on Wildlife Resources

Project or Activity	Status	Construction Phase (approximate)	Operation Phase (approximate)	Ships Per Year (estimated maximum)
Douglas Channel LNG Terminal (also known as BC LNG)	Proposed	NA	NA	12
Enbridge Northern Gateway Project	Proposed	2015 to 2018	2018 to 2048	250
Former Methanex/Cenovus Terminal	Ongoing	Ongoing	Ongoing	8
Former Moon Bay Marina (footprint only)	Decommissioned	NA	NA	NA
Kitimat Clean	Proposed	NA	NA	NA
Kitimat LNG Terminal Project	Proposed	2012 to 2016	2016 to 2041	90
Pacific Northern Gas Pipeline (includes proposed looping)	Proposed	2015 to 2016	2016-	NA
Pacific Trail Pipelines Project	Proposed	2013 to 2018	2018	NA
Rio Tinto Alcan Facility and Kitimat Modernization Project (KMP)	Ongoing	KMP: 2011 to 2015	Ongoing KMP: 2015 to 2055	80
BC Ferries	Ongoing	Ongoing	Ongoing	225
Cruise Ships	Ongoing	Ongoing	Ongoing	35
Forestry Activities	Ongoing	Ongoing	Ongoing	NA

NOTE:
NA – data not available

5.6.8.2 Stage 2, Determination of Potential Cumulative Interactions

The determination of whether Project residual effects have the potential to interact with the effects of other projects and activities proceeds with an analysis of whether the following two conditions are met:

- The Project results in a demonstrable or measurable residual effect on wildlife
- Project residual effects on wildlife do, or are likely to, act in a cumulative fashion with the effects on wildlife from other past, existing, or future projects and activities in the regional area.

The Project does result in demonstrable and measurable residual effects on wildlife resources, as summarized in Section 5.6.7, so the first condition is met. As described above, other projects and activities, both current and reasonably foreseeable, in the area also affect wildlife resources in the RSAs, so the second condition is also met. Given that both conditions are met, further assessment of cumulative effects is warranted.

Table 5.6-14 indicates the projects and activities with the potential to act cumulatively with Project residual effects.

Table 5.6-14: Potential for Cumulative Effects on Wildlife Resources

Other Projects and Activities with Potential for Cumulative Effects	Potential Cumulative Effects				
	Terrestrial Wildlife			Marine Birds	
	Loss or change in habitat for species of interest	Sensory disturbance or behavioural alterations	Risk of injury or mortality	Sensory disturbance or behavioural alterations	Risk of injury or mortality
Kitimat Area Project/Facility					
Coastal GasLink Pipeline Project	✓	✓	✓		
Douglas Channel LNG Terminal (also known as BC LNG)	✓	✓	✓	✓	✓
Enbridge Northern Gateway Project	✓	✓	✓	✓	✓
Former Eurocan Pulp and Paper Co. Site	✓	✓	✓		
Former Methanex/Cenovus Terminal	✓	✓		✓	✓
Former Moon Bay Marina (footprint only)	✓				
Kitimat Clean	✓	✓	✓		
Kitimat LNG Terminal Project	✓	✓	✓	✓	✓
MK Bay Marina				✓	✓
Pacific Northern Gas Pipeline (includes proposed looping)	✓	✓	✓		
Pacific Trail Pipelines Project	✓	✓	✓		
Rio Tinto Alcan Facility and Kitimat Modernization Project	✓	✓	✓	✓	✓
Sandhill Materials – Aggregate Processing	✓	✓	✓		
Activity					
BC Ferries				✓	✓
Cruise Ships				✓	✓
Forestry Activities	✓	✓	✓		
Fisheries and Aquaculture				✓	✓

NOTE:
✓= those 'other projects and activities' whose effects have potential to interact cumulatively with the Project's residual effects.

5.6.8.2.1 Terrestrial Wildlife

Reasonably foreseeable projects might contribute to the loss or change in habitat and risk of injury or mortality for grizzly bear, in particular, those projects that will lead to further vegetation clearing in the facility RSA or increases in linear feature density. These projects will result in the loss of additional seasonal grizzly bear foraging habitat in the facility RSA. Although information about the distribution of suitable grizzly bear habitat throughout the facility RSA is not available, past, current, and reasonably foreseeable projects are estimated to disturb 3,333 ha (less than 0.1%) of vegetated communities within the facility RSA. The relationship between increased linear feature density, human access, and increased mortality risk for grizzly bear is well defined (Mace et al. 1996; Leblond et al. 2012). Activities associated with the construction and operation phases are the primary effect mechanisms for change in mortality risk for grizzly bear. In particular, road upgrades and increased traffic during construction will increase human access opportunities within the facility RSA for the duration of the construction phase and potentially beyond, depending on factors such as rate of succession and access controls. These activities and associated changes in bear movement might increase human-bear encounter rates, thereby increasing the potential for human-caused grizzly bear mortalities.

Population estimates for grizzly bear within the Bulkley GBPU have increased from 407 in 2004 to 439 in 2012, whereas estimates for the North Coast GBPU have decreased from 214 in 2004 to 190 in 2012 (Hamilton et al. 2004; Hamilton 2008; BC MFLNRO 2012). Both GBPUs are identified as viable, supporting populations of bears greater than 50% of the carrying capacity for these units (MOE 2010). These units also support a grizzly bear hunt. Hunting is permitted in viable GBPUs, except where the population is less than 100 bears or where a special management area exists (MOE 2010). This suggests that existing cumulative effects are below a threshold and are not affecting the sustainability of these GBPUs.

Reasonably foreseeable projects will contribute to the loss or change in habitat for harlequin duck and western sandpiper, in particular, those projects that will lead to the loss of marine foreshore habitat. Harlequin ducks breed along fast flowing inland streams and rivers away from the coast (CDC 2014); as such, there is a low likelihood that harlequin ducks will nest in the facility RSA. Western sandpipers do not nest in the facility RSA—they are known to nest on islands in the Bering Sea, and along coasts of western and northern Alaska and northeastern Siberia (CDC 2014). The loss of marine foreshore or riparian habitat that harlequin duck and western sandpiper use during migratory periods, as well as during overwintering for harlequin duck, is the primary effect mechanism for cumulative effects for these species. Both harlequin duck and western sandpiper have secure populations in BC and have access to additional suitable habitats in the facility RSA; therefore, they are unlikely to be affected by Project activities interacting with other projects and activities.

Marbled murrelet is sensitive to the loss and fragmentation of breeding habitat (Environment Canada 2014b). Reasonably foreseeable projects will contribute to the loss or change in habitat for marbled murrelet, in particular, those projects that will lead to further loss of old-growth habitat. The main terrestrial disturbances facing marbled murrelet include historical, current, and future loss of old-growth nesting habitat, fragmentation of old-growth nesting habitat, predation, and potential disturbances related to the development of energy infrastructure, including collision risks and increased predator concentrations (Environment Canada 2014b). Populations of marbled murrelet will decline in proportion to the loss of suitable nesting habitat (Environment Canada 2014b). The 2014 recovery strategy for marbled murrelet indicates that for the Northern Mainland Coast the critical threshold amount of suitable breeding habitat is 68% retention of 2002 suitable nesting habitat, which suggests that the regional supply of suitable nesting habitat could be reduced by an additional 137,718 ha over 2002 levels. The largest source of future loss of habitat in the facility RSA is oil and gas development (3,231 ha, Table 5.6-12), but only a small portion of this is likely to be within critical habitat. For example, any proposed development greater than 30 km from the ocean will not have an effect on critical habitat (preferred breeding distance of 0.5 to 30 km: Environment Canada 2014b). Further, most of this loss will be from proposed pipeline developments, which are generally located off floodplains where the highest-value marbled murrelet breeding habitat is found. In this context, the contribution of future development to cumulative effects on critical habitat is not significant (i.e., up to 0.02% of the 137,718 ha) and the Project's incremental contribution will be negligible (i.e., less than 0.001% of the 137,718 ha). As indicated in Section 5.6.9, there is uncertainty regarding marbled murrelet critical habitat and, in recognition of this, follow-up surveys were completed to address this uncertainty (Section 5.6.10).

Reasonably foreseeable projects will contribute to the loss or change in habitat and risk of injury or mortality for Pacific marten, in particular, those projects that will lead to further loss of old-growth habitat. Pacific marten depend on access to subnivean habitats for prey items and for denning that are most frequently found in old-growth forest habitat types (Thompson and Harestad 1994). Pacific marten is a secure species in BC and is managed as a furbearing species. The largest change in habitat is associated with oil and gas developments, in particular from the development of linear pipelines, which have a relatively small ROW width (less than 100 m). Given that most of the projected development in the facility RSA is linear development and that Pacific marten populations are secure, it is unlikely that past, present, or reasonably foreseeable projects will contribute to loss or change in habitat for Pacific marten. In addition, it is unlikely that sensory disturbance or behavioural alterations will result from any of these projects.

Reasonably foreseeable projects will contribute to the loss or change in habitat for western screech-owl, in particular, those projects that will lead to further loss of riparian or low-elevation forests. Western screech-owl declines have been documented across BC but are most prevalent in the Fraser Lowlands

and southern Vancouver Island (COSEWIC 2012b). It is unlikely that past, present, or reasonably foreseeable projects will contribute to loss or change in habitat for western screech-owl. In addition, it is unlikely that sensory disturbance or behavioral alterations will result from any of these projects.

Habitat loss, particularly the loss of breeding habitat, has been identified as a component of western toad declines (COSEWIC 2002b). Western toads breed in calm, open waters of ponds, stream edges, and roadside ditches (COSEWIC 2002b). Reasonably foreseeable projects will contribute to the loss or change in habitat for western toad, in particular, those projects that will lead to further loss of breeding habitat.

5.6.8.2.2 Marine Birds

Current annual marine traffic includes 126 shipping traffic vessels (0.7 transits per day), 225 ferries, and 60 cruise ships. Even with this current level of marine traffic, there is an abundant and diverse marine bird community (Section 5.6.3). Reasonably foreseeable other projects and activities are estimated to add an additional 440 vessels to marine traffic, resulting in an increase to 566 vessels (3.1 transits per day). The Project LNG carriers will contribute an additional 350 vessels (1.9 transits per day), for a total of 916 vessels, equivalent to 5.0 transits per day. This is an increase in shipping traffic of 7.8 times over current levels. This increase in marine traffic has the potential to affect marine birds in the shipping RSA through an increase in mortality risk as well as through sensory disturbance or behavioural alterations.

5.6.8.3 Stage 3, Determining Significance of Cumulative Effects

The Project will result in measurable and demonstrable residual effects on terrestrial wildlife and marine birds. These Project residual effects will act cumulatively with other projects and activities in the RSAs. However, there is no reasonable expectation that the contribution (i.e., addition) of the Project's residual effects will cause a change in the cumulative effects that could affect the quality or sustainability of terrestrial wildlife and marine birds.

5.6.8.3.1 Terrestrial Wildlife

Loss or change in habitat, risk of injury or mortality, and sensory disturbance or behavioural alterations will spatially and temporally overlap with past, present, and reasonably foreseeable future projects and activities in the facility RSA. However, following the application of appropriate mitigation, the Project's contribution to cumulative risk of mortality will not reduce the sustainability of regional populations. Consequently, the Project's contribution to cumulative effects related to loss or change in habitat, increased risk of injury or mortality, and sensory disturbance or behavioural alterations is assessed as not significant.

Other reasonably foreseeable projects may also contribute to the loss of critical nesting habitat for marbled murrelet; in particular, projects that occur close to the ocean and overlap with old-growth forests. Data are unavailable to quantify these effects, any effects will be negligible. Based on projections in the federal recovery strategy for marbled murrelet (Environment Canada 2014b), the Project might reduce available critical nesting habitat by less than 0.001% of the estimated total of available habitat in 2002, and less than 0.001% of the assumed supply target area (see Section 5.6.5.2). Also, the critical habitat identified in the Project footprint appears to be marginal based on information provided in the recovery strategy (Environment Canada 2014b) and supporting reports (e.g., Burger 2002; CMMRT 2003) because it is located relatively close to the ocean and is contained within small forest patches with elongated and convoluted boundaries (CMMRT 2003). The overall loss of critical habitat, relative to available habitat, as well as the marginal nesting habitat, contributes the conclusion that cumulative effects are not significant.

5.6.8.3.2 Marine Birds

Past, present, and reasonably foreseeable projects and activities will contribute to an increase in vessel traffic in the shipping RSA. Sensory disturbance or behavioural alterations will act cumulatively with sensory disturbance or displacement caused by past, present, and reasonably foreseeable future marine traffic. A low to moderate sensory disturbance or behavioural alterations will occur for marine birds, given the expectation that individual birds will adjust daily or seasonal movement patterns in response to increased vessel traffic in the shipping RSA (Kaiser et al. 2006). Project marine traffic will have a residual effect on marine bird movements because there is an expectation of spatial and temporal interaction with past, present, and reasonably foreseeable marine traffic. Declines in the sustainability of marine bird populations have not been directly associated with effects from alteration of movement. Accordingly, the Project's contribution to cumulative effects on marine bird populations from sensory disturbance or behavioural alterations will not influence the sustainability of regional populations.

The potential for marine bird mortality will be the highest during Project operation when facility structures will be regularly lit, although incrementally smaller mortality events might occur during construction and decommissioning activities. Attraction to lighting associated with the LNG facility as well as LNG carrier traffic might, in combination with other past, present, and reasonably foreseeable projects, contribute to an increase in mortality events. Consequently the Project's contribution to cumulative effects related to risk of mortality is assessed as not significant.

5.6.8.4 Summary of Cumulative Effects

The Project's contribution to cumulative effects related to loss or change in habitat, risk of injury or mortality, and sensory disturbance or behavioural alterations for terrestrial wildlife and marine birds will be primarily local and affect a few individual animals of the regional populations (Table 5.6-15). Consequently, the Project's contribution to cumulative effects will not affect the long-term sustainability of key species or local or regional wildlife populations. Accordingly, the Project's contribution to cumulative effects is assessed as not significant.

Cumulative effects on terrestrial wildlife and marine birds from all past, current and foreseeable future project, including the Project's contribution, from loss or change in habitat, increased risk of mortality, and sensory disturbance or behavioural alterations are not anticipated to adversely affect the long-term viability of populations of terrestrial wildlife or marine birds and therefore are assessed as not significant.

Table 5.6-15: Summary of Cumulative Effects on Wildlife Resources

		Cumulative Effects Characterization					
Effect	**Other Projects, Activities, and Actions**	**Magnitude**	**Geographic Extent**	**Duration**	**Frequency**	**Reversibility**	**Context**
Facility Works and Activities							
Cumulative Loss or Change in Habitat							
Cumulative effect with the Project and other projects, activities, and actions ▪ Past, current, and reasonably foreseeable projects will disturb 3,334 ha (less than 0.1%) of vegetated communities within the facility RSA.	▪ Coastal GasLink Pipeline Project ▪ Douglas Channel LNG Terminal (also known as BC LNG) ▪ Enbridge Northern Gateway Project ▪ Former Eurocan Pulp and Paper Co. Site ▪ Former Methanex/Cenovus Terminal	3,333 ha	RSA	P	MI	IR	H
Contribution from the Project to the overall cumulative effect ▪ The Project will result in the loss or change of 265 ha of habitat contributing to the overall cumulative effect.	▪ Former Moon Bay Marina (footprint only) ▪ Kitimat Clean ▪ Kitimat LNG Terminal Project ▪ Pacific Northern Gas Pipeline (includes proposed looping) ▪ Pacific Trail Pipelines Project ▪ Rio Tinto Alcan Facility and Kitimat Modernization Project ▪ Sandhill Materials – Aggregate Processing ▪ Forestry Activities	≤0.003%	LSA	P	S	IR	L

		Cumulative Effects Characterization					
Effect	**Other Projects, Activities, and Actions**	**Magnitude**	**Geographic Extent**	**Duration**	**Frequency**	**Reversibility**	**Context**
Cumulative Sensory Disturbance or Behavioural Alterations							
Cumulative effect with the Project and other projects, activities, and actions ▪ Past, current, and reasonably foreseeable projects will contribute to an increase in sensory disturbance or behavioural alterations.	▪ Coastal GasLink Pipeline Project ▪ Douglas Channel LNG Terminal (also known as BC LNG) ▪ Enbridge Northern Gateway Project ▪ Former Eurocan Pulp and Paper Co. Site ▪ Former Methanex/Cenovus Terminal	L	RSA	LT	MI	R	H
Contribution from the Project to the cumulative effect ▪ The Project will contribute locally to an increase in sensory disturbance or behavioural alterations.	▪ Kitimat Clean ▪ Kitimat LNG Terminal Project ▪ Pacific Northern Gas Pipeline (includes proposed looping) ▪ Pacific Trail Pipelines Project ▪ Rio Tinto Alcan Facility and Kitimat Modernization Project ▪ Sandhill Materials – Aggregate Processing ▪ Forestry Activities	L	LSA	LT	MI	R	L

		Cumulative Effects Characterization					
Effect	**Other Projects, Activities, and Actions**	**Magnitude**	**Geographic Extent**	**Duration**	**Frequency**	**Reversibility**	**Context**
Cumulative Risk of Injury or Mortality							
Cumulative effect with the Project and other projects, activities, and actions ▪ Past, current, and reasonably foreseeable projects will contribute to an increase in risk of injury or mortality.	▪ Coastal GasLink Pipeline Project ▪ Douglas Channel LNG Terminal (also known as BC LNG) ▪ Enbridge Northern Gateway Project ▪ Former Eurocan Pulp and Paper Co. Site ▪ Kitimat Clean	L	RSA	LT	I MI	R	H
Contribution from the Project to the cumulative effect ▪ The Project will contribute locally to an increase in risk of injury or mortality through vegetation clearing and other activities.	▪ Kitimat LNG Terminal Project ▪ Pacific Northern Gas Pipeline (includes proposed looping) ▪ Pacific Trail Pipelines Project ▪ Rio Tinto Alcan Facility and Kitimat Modernization Project ▪ Sandhill Materials – Aggregate Processing ▪ Forestry Activities	L	LSA	LT	MI	R	L
Shipping Activities							
Cumulative Sensory Disturbance or Behavioural Alterations							
Cumulative effect with the Project and other projects, activities, and actions ▪ Shipping from past, present, and reasonably foreseeable projects and activities contribute to sensory disturbance or behavioural alterations within the shipping RSA	▪ Douglas Channel LNG Terminal (also known as BC LNG) ▪ Enbridge Northern Gateway Project ▪ Former Methanex/Cenovus Terminal ▪ Kitimat LNG Terminal Project ▪ MK Bay Marina ▪ Rio Tinto Alcan Facility and Kitimat Modernization Project ▪ BC Ferries ▪ Cruise Ships ▪ Fisheries and Aquaculture	M	RSA	LT	MI	R	H
Contribution from the Project to the cumulative effect ▪ Project shipping will contribute to sensory disturbance or behavioural alterations within the shipping RSA		L	LSA	LT	MI	R	M

		Cumulative Effects Characterization					
Effect	**Other Projects, Activities, and Actions**	**Magnitude**	**Geographic Extent**	**Duration**	**Frequency**	**Reversibility**	**Context**
Cumulative Risk of Injury or Mortality							
Cumulative effect with the Project and other projects, activities, and actions ▪ Shipping from past, present, and reasonably foreseeable projects and activities contributes to risk of injury or mortality in the shipping RSA	▪ Douglas Channel LNG Terminal (also known as BC LNG) ▪ Enbridge Northern Gateway Project ▪ Former Methanex/Cenovus Terminal ▪ Kitimat LNG Terminal Project ▪ MK Bay Marina	M	RSA	L	MI	R	H
Contribution from the Project to the cumulative effect ▪ Project shipping will contribute to risk of injury or mortality in the shipping RSA	▪ Rio Tinto Alcan Facility and Kitimat Modernization Project ▪ BC Ferries ▪ Cruise Ships ▪ Fisheries and Aquaculture	L	LSA	L	MI	R	M

KEY

MAGNITUDE:

For loss or change in habitat:

Percent loss of effective habitat in the facility RSA.

1 Refer to Section 5.6.5.2.3 for key species specific values.

L = Low—loss or change in habitat is well below identified threshold (<5%) and will not threaten the long-term sustainability of an identified regional wildlife or marine bird population

M = Moderate—loss or change in habitat is below the identified threshold (≥5 to <20%) and will not threaten the long-term sustainability of an identified regional wildlife or marine bird population

H = High—loss or change in habitat is above identified thresholds (≥20%) and may threaten the long-term sustainability of an identified regional wildlife or marine bird population

For risk of injury or mortality:

L = Low—Residual effect is negligible and will not affect sustainability of regional population

M = Moderate—Residual effect is moderate but unlikely to affect sustainability of regional population

H = High—Residual effect is high and might affect sustainability of local population

For sensory disturbance or behavioural alterations:

L = Low—Effect presents a permeable barrier and will not affect sustainability of regional population

M = Moderate—Effect presents a semi-permeable barrier, but unlikely to affect sustainability of regional population

H = High—Effect presents an impermeable barrier and might affect sustainability of regional population

GEOGRAPHIC EXTENT:

PF = Project Footprint—effects are restricted to the Project Footprint

LSA—effects occur within the facility LSA and or shipping LSA – both of which encompass the Project footprint

RSA—effects extend beyond the facility LSA and or shipping LSA into the facility RSA or shipping RSA

DURATION:

ST = Short-term—effect occurs for less than one breeding season or generation (e.g., less than one year)

MT = Medium-term—effect occurs for several breeding seasons or generations, or a Project phase (e.g., one to five years, or the Project construction phase)

LT = Long-term—effect is occurs across multiple breeding seasons or generations, or multiple Project phases (e.g., 6 to 30 years, or the lifetime of the Project)

P = Permanent—effect occurs across multiple breeding seasons or generations and is unlikely to recover following Project decommissioning and reclamation

FREQUENCY:

S = Single event—effect occurs once

MI = Multiple irregular events (no set schedule)—occurs sporadically at irregular intervals through construction, operation, or decommissioning phases

MR = Multiple regular events—occurs on a regular basis and at regular intervals through construction, operation, or decommissioning phases

C = Continuous—occurs continuously throughout the life of the Project

REVERSIBILITY:

R = Reversible—effect will cease after Project decommissioning and reclamation

I = Irreversible—effect will persist beyond the life of the Project

CONTEXT:

L = Low resilience—occurs in a fragile ecosystem or the level of baseline disturbance can be a contributing factor to reduced sustainability of a local or regional wildlife population

M = Moderate resilience—occurs in a stable ecosystem or the level of baseline disturbance is not likely to contribute to reduced sustainability of a local or regional wildlife population

H = High resilience—occurs in a viable ecosystem or the level of baseline disturbance does not contribute to reduced sustainability of a local or regional wildlife population

PREDICTION CONFIDENCE:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation, and assumptions made.

L = Low level of confidence

M = Moderate level of confidence

H = High level of confidence

LIKELIHOOD OF RESIDUAL EFFECT OCCURRING:

Based on professional judgment

L = Low probability of occurrence

M = Medium probability of occurrence

H = High probability of occurrence

SIGNIFICANCE:

S = Significant

N = Not Significant

5.6.9 Prediction Confidence and Risk

The prediction confidence regarding residual effects is based on:

- scientific certainty relative to quantifying or estimating the effect, the quality and quantity of data, and an understanding of the effect mechanisms
- certainty relative to the effectiveness of the mitigation measures, and
- professional judgment from prior experience, including standard mitigation measures or BMPs.

Higher prediction confidence in all three variables produces greater confidence in the conclusions, assessment of significance, and the selection of mitigation measures.

The potential pathways of effect, and the extent to which the key species use habitats in the facility RSA and shipping RSA, are well understood. The availability and quality of information from existing data sources and field surveys, and the comprehensive analyses of habitat suitability modelling provide a moderate to high degree of certainty in the results of the assessment of loss or change in wildlife habitat and potential barriers to movement and dispersal in the facility RSA. Previous professional experience with similar projects associated with marine terminals and resource shipping in the shipping RSA contributed to the assessment of effects on marine birds. These reasons, combined with a certainty in the effectiveness of mitigation measures and the professional experience and judgment of the assessment team, permits a high level of prediction confidence.

Information on the design and position within the regulatory process for a number of reasonably foreseeable future projects is preliminary; therefore, the prediction confidence regarding cumulative effects is moderate.

There is also uncertainty regarding conclusions related to marbled murrelet and the existing delineation of critical habitat (Environment Canada 2014b). As a result, a Wildlife Management Plan will be developed to address this uncertainty.

5.6.10 Follow-up Program and Compliance Monitoring

No follow-up programs are proposed for wildlife resources.

5.6.11 Summary of Mitigation Measures

5.6.11.1 Facility

To manage loss or change in habitat, risk of injury or mortality, and potential sensory disturbance or behavioural alterations to terrestrial wildlife and marine birds, the following mitigation measures will be implemented:

- Manage vehicle and equipment emissions by conducting regular maintenance on all machinery and equipment (Mitigation 5.2-1).
- Implement industry best practice for mobile construction equipment (i.e., regular maintenance, speed restrictions, correct sizing of equipment, modernizing of fleet, reduce idling, driver behavior, etc.) (Mitigation 5.3-1).
- Develop and implement a Traffic Management Plan (Mitigation 5.4-6).
- Develop and implement a Wetland Compensation Plan to address loss of wetland habitat function for breeding and foraging terrestrial mammals, amphibians, and birds (Mitigation 5.5-10).
- Design of the LNG loading line corridor will consider and incorporate, where practicable, ways to maintain tidal flow and wildlife passage (Mitigation 5.5-8).
- Construction activities will account for applicable bird breeding periods:
  - end of March to mid-August for migratory birds (Environment Canada 2014b)
  - January 1 through September 5 for raptors (BC MOE 2012)

  Clearing activities that need to occur during bird breeding periods will incorporate measures to protect birds and their eggs as per federal and provincial regulations. These measures will be detailed in the Wildlife Management Plan. Clearly delineate (flag) vegetation clearing limits to avoid damage to important wildlife habitat features (e.g., large boulders, nurse logs, raptor nests, mammal dens, ungulate mineral licks) in the facility LSA, but outside of the Project footprint or areas of temporary construction disturbance. Major game trails will be cleared of equipment, brush piles, and felled trees to maintain their use as movement corridors for wildlife, where practicable (Mitigation 5.6-1).
- Develop and implement an approved raptor management plan (Mitigation 5.6-2).
- Bear-proof fences will be installed around the workforce accommodation centre(s) and Project site boundary to reduce potential for on-site interactions with wildlife (Mitigation 5.6-6).
- Clearing of open water wetland habitats within the Project footprint occurs during the amphibian breeding period (March 1 to August 15) an amphibian salvage program will be implemented. Details on an amphibian salvage program and measures to protect amphibian species will be detailed in the Wildlife Management Plan (Mitigation 5.6-7).

- Wildlife movement through the estuary will be maintained during construction and operation of the LNG loading line, where practicable (Mitigation 5.6-14).
- Feeding and harassment of wildlife will be strictly prohibited (Mitigation 5.6-8).
- Protocols will be developed and implemented as outlined in a Wildlife Management Plan, including measures such as bear awareness to avoid or mitigate human-wildlife conflicts and injury to humans or wildlife (Mitigation 5.6-9).
- A Wildlife Management Plan will be developed and will include requirements for reporting wildlife sightings, including bat or bird collisions. Reporting will include information such as species, location, and weather conditions (Mitigation 5.6-3).
- Waste will be managed according to an established Waste Management Plan onsite and in the workforce accommodation centre(s) or maintenance areas to reduce the potential to attract wildlife to the facility. Garbage and other waste should be temporarily stored onsite in bear-proof containers and disposed of at an approved facility (Mitigation 5.6-10).
- Develop and implement a Decommissioning Plan before decommissioning to allow habitat recovery and wildlife movement to proceed as soon as possible (Mitigation 5.6-4).
- If clearing of vegetation occurs during the bear denning period (October to March), pre-clearing bear den surveys will be required. Identified bear dens will be protected by a 200 m no-disturbance buffer during the denning period (Linnell et al. 2000) (Mitigation 5.6-11).
- During construction, operation, and decommissioning, drivers will maintain slow (specified) speeds on all roads in the Project footprint and be extra diligent during amphibian migration periods, especially when adjacent to wetlands, in order to reduce the potential for collisions with wildlife (Mitigation 5.6-13).

5.6.11.2 Shipping

To manage sensory disturbance and alteration of behaviour, or the risk of injury or mortality to marine birds, the following mitigation measures will be implemented:

- Supervisory staff on berthed vessels will be alerted to the hazards and potentially high-risk periods for bird strikes caused by deck lighting, particularly on nights when visibility is poor. Staff will be informed of the applicable seasonal and daily migratory periods. Facility staff will report bird collisions to a member of the Project environmental team, including information on bird species and weather conditions. Vessel personnel will be provided with information on how to treat and release marine birds that become grounded on vessel decks (Black 2005) (Mitigation 5.6-12).

5.6.12 Conclusion

5.6.12.1 Facility

Project residual effects on terrestrial wildlife and marine birds will be local in extent and are assessed as not significant. With adherence to mitigation measures, the Project will potentially affect only a small number of individual animals in regional wildlife populations.

Section 79 of SARA contains specific requirements for when project reviews are being undertaken under CEAA 2012. It requires assessment of the adverse effects of a proposed project on any species listed in Schedule 1, and for measures to be taken to avoid or lessen those effects, and to monitor them. All measures must be consistent with any recovery strategies or action plans in place for the species. The section 79 requirement is met by the assessment of wildlife resources for the Project through identification of effects (Section 5.6.2.4), Project interactions (Section 5.6.4), and potential residual effects and proposed mitigations (Sections 5.6.5 and 5.6.6).

By adhering to mitigation measures and the wildlife management plan for the protection of wildlife, including species at risk and their required habitats, the Project will comply with federal and provincial regulations. Consequently, the effects from Project activities will not adversely affect the sustainability of regional populations. Prediction confidence is high because the potential for residual effects from facility construction and operation, and the extent to which the indicator species use habitats in the facility RSA, is generally understood. The Project will not contribute to cumulative effects in the facility RSA.

5.6.12.2 Shipping

Project residual effects on marine birds will be local in extent and are assessed as not significant. By adhering to mitigation measures, the Project will potentially affect only a small number of individuals in regional marine bird populations. Also, by adhering to mitigation measures and the wildlife management plan for the protection of marine birds, including species at risk and their required habitats, LNG Canada will comply with federal and provincial regulations. Consequently, the residual effects from Project activities will not adversely affect the sustainability of regional populations. Prediction confidence is high because the potential for effects of shipping and the extent to which the indicator species use habitats in the shipping RSA is generally understood. The Project will not contribute to cumulative effects in the shipping RSA.